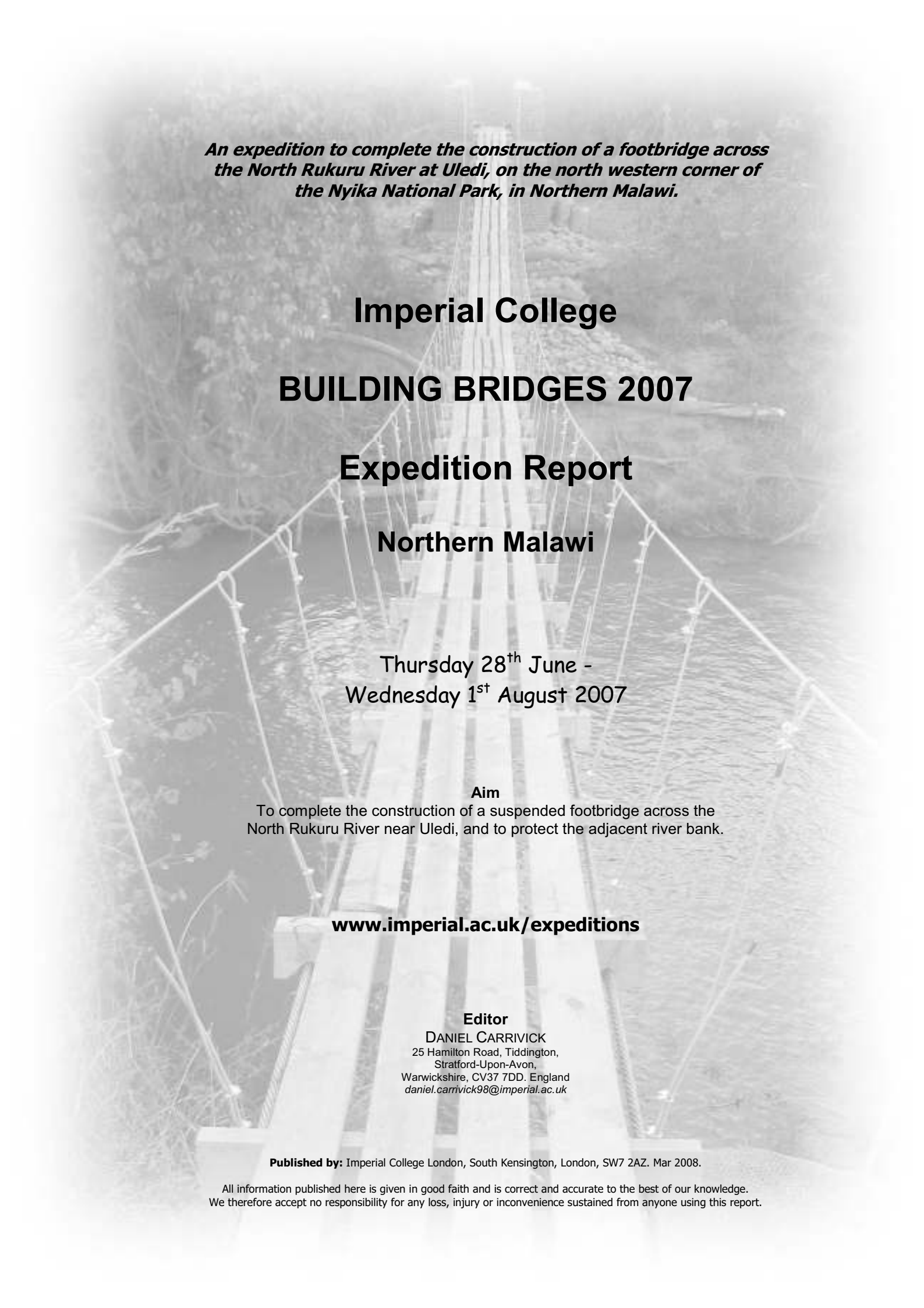


An expedition to complete the construction of a footbridge across the North Rukuru River at Uledi, on the north western corner of the Nyika National Park, in Northern Malawi.

Imperial College

BUILDING BRIDGES 2007

Expedition Report

Northern Malawi

Thursday 28th June -
Wednesday 1st August 2007

Aim

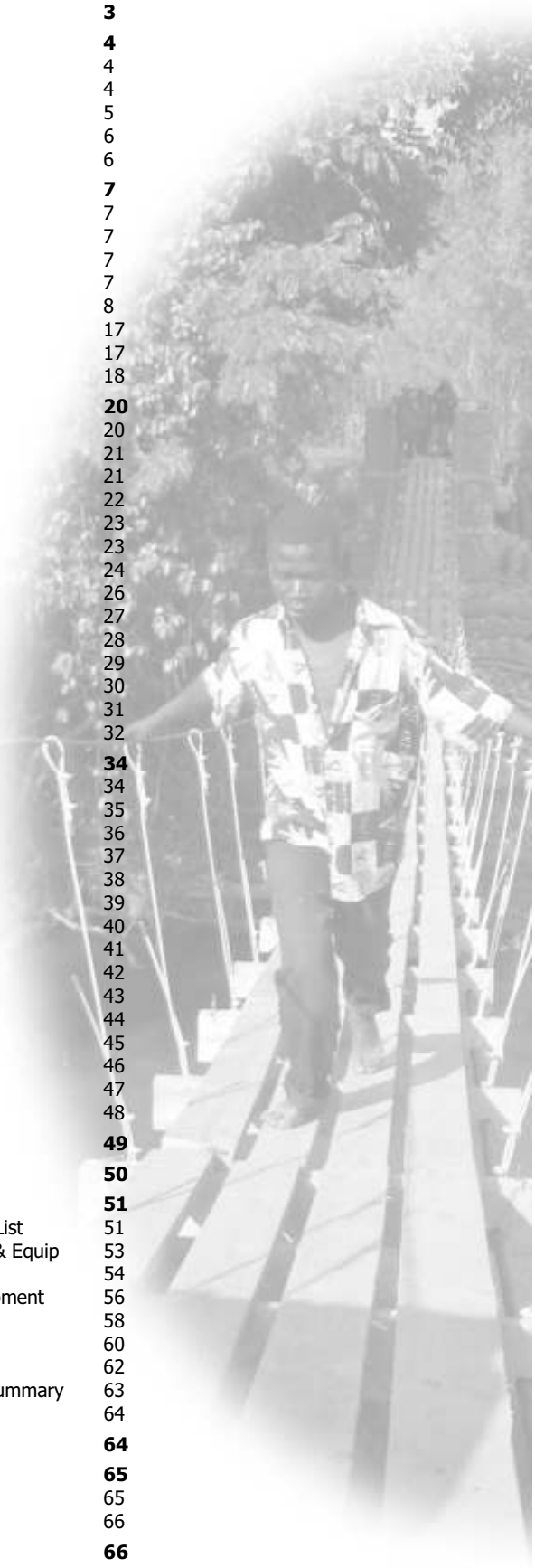
To complete the construction of a suspended footbridge across the North Rukuru River near Uledi, and to protect the adjacent river bank.

www.imperial.ac.uk/expeditions

Editor
DANIEL CARRIVICK
25 Hamilton Road, Tiddington,
Stratford-Upon-Avon,
Warwickshire, CV37 7DD. England
daniel.carrivick98@imperial.ac.uk

Published by: Imperial College London, South Kensington, London, SW7 2AZ. Mar 2008.

Contents



Below – Harriet walks the next piece of decking out to be laid.
Inset – Naomi slides the suspender cables into position.

SUMMARY

By Daniel Carrivick

OUTCOME

This team of five students from Imperial College, London travelled to Malawi to complete the construction of a footbridge across the North Rukuru River at Uledi, on the north western corner of Nyika National Park. This work followed on from the previous expedition in 2006, which surveyed the site, laid down the foundations, and constructed the towers and anchorage for a thirty-seven metre span suspended bridge. The team achieved their aim, much to the appreciation and delight of the community and the national park, who now use the bridge daily to cross the river to collect firewood and patrol against poachers.

EXPEDITION SUMMARY

This expedition was organised by Naomi Bessey and Daniel Carrivick who were part of the team that travelled to Malawi in the summer of 2006. They were joined by Harriet Kirk, who acted as chief site engineer having helped with the design the previous year, and two other civil engineering undergraduates: Li-Teck Lau and Jumana Al-Zubaidi.

The first week was spent in Lilongwe collecting food and equipment supplies while clearing the import duty on the cables, which had been flown out the previous year by airfreight. After several visits to the Malawi Revenue Authority (MRA) and with the help of senior officials from the Department of National Parks & Wildlife (DNPW), the team finally got the permission they required and the import duty was subsequently waived. Having collected the half tonne shipment of cables and accessories from the airport, the team travelled north, stopping overnight at Mzuzu to collect perishable foods, and again at Chelinda to meet park officials, pick up their scout and collect wood from the sawmill.

To the teams' relief the site was in much a similar state as to how it was left ten months previously - just a lot more overgrown. The wet season had brought more rain than normal, but the river had stayed within its banks and did not flood the surrounding area. Work soon began on clearing the site and unearthing the access pits, which had been filled in for safety.

Within a few days of arriving in Uledi, one member of the team became ill with a high temperature and feverish symptoms. No improvement was seen over the next few days so the individual was sent to Mzuzu to see a doctor who diagnosed Malaria. A course of drugs were taken and the patient recovered fully within a week. However further tests done back home suggest this person never contracted Malaria.

Some thirty people were employed from the community to assist with the completion of the bridge. A new minimum daily wage was adhered to which saw workers pay increase by 23% (real terms) from the previous year. The working day remained the same, from 7:30 am to 4:30 pm with a break for lunch between 11:30 am and 1 pm, over the hottest part of the day. Temperatures often reached the low to mid twenties centigrade and the strong sun was made bearable by the cool river and sometimes strong winds. Daylight hours were from 6 am to 6 pm so it was often dark by the time the team ate in the evening, once all the equipment had been removed from the site, the fire lit and the food cooked.

The workers were mainly given the task of collecting materials. Vast quantities of earth were moved to build embankments on the approach to each tower. A soft engineering approach was used to build retaining walls for this earth. This involved filling woven sacks with earth and staking them with metal rods into the ground. Meanwhile sand and gravel were gathered for concreting and boulders were used for armouring the bank and towers.

The whole workforce helped to unroll the cables and carry them across difficult terrain to the site. A great deal of manpower was again required to haul the cables across the river. The cables were then fastened once they had been raised into place using a sequence of pulleys and grips. Members of the expedition team used specialist high ropes equipment to fasten adjoining cables and lay the decking. The bridge was left to settle under its own weight before the final adjustments were made and the cables concreted into place.

With the bridge out of bounds while the concrete set, work concentrated on clearing the river channel from low branches, protecting the river bank in front of the towers and building up the earth embankments behind the towers. The large felled branches were sectioned and manhandled upstream where they were held in place on the east bank by stakes. The area behind each log was then backfilled with large boulders. These were covered with a steel mesh to hold everything in place forming a new tiered riverbank. Meanwhile the west bank was covered with steel mesh, which was weighed down with some left-over lengths of railway track and pinned against the river cliff with twenty inch long metal stakes driven into the earth. The mesh was designed to hold loose blocks of rock in place to prevent collapse and further erosion of the bank.

A last minute rush ensured all the finishing touches were applied to the bridge before the opening ceremony held at 2 pm on Wednesday 25th July. The chief of Uledi and the senior national park officer from Chelinda both spoke to a large crowd that had assembled, before jointly declaring the bridge open. Officials then crossed the bridge one at a time, followed by the local workers and the rest of the community. Useful tools and leftover materials were then handed over to the chiefs for the community to use in the future. That evening a meal was enjoyed by all and the celebrations went on long after darkness.

Having successfully completed the bridge the team headed down to the Lake Malawi via Vwasa Marsh Nature Reserve for a few days of well earned rest and relaxation before returning safely home to England.

INTRODUCTION

By Naomi Bessey

The North Rukuru River divides the community of Uledi, a remote farming community in Northern Malawi, situated on the north western corner of Nyika National Park *(maps A & B)*. Biosearch Expeditions, who visited the area in 2004, discovered that it was not possible to cross the river during the rainy season. The community was therefore effectively split in two for up to six months every year when the rains came. A bridge would allow the National Park scouts stationed in Uledi to patrol against poachers in the park all year round; villagers would also be able to gain year-round access to the school and markets. In addition, scientific surveys on the National Park's flora and fauna could be carried out at different times of the year providing more complete data, than at present.

In the summer of 2006, a five person expedition team, led by Daniel Carrivick and Naomi Bessey, set out to construct a footbridge across the North Rukuru. The footbridge was only partially constructed on this six week expedition, necessitating a return the following year; thus the 2007 Imperial College Building Bridges Expedition was born.

This report documents the 2007 expedition, with the aim of providing accurate, detailed information on the logistical, engineering, social, and financial aspects of this expedition. As well as a document where those interested can discover more about the expedition, this report is intended to be used in conjunction with the Imperial College Building Bridges 2006 Expedition Report as a source of information for people planning similar construction projects or visiting Northern Malawi.

Above & inset – Workers carry the walkway cable down over difficult terrain to the site on their shoulders.
Right – Map of Malawi showing main roads, towns and cities

EXPEDITION MEMBERS

Compiled by Daniel Carrivick

Above & inset – Teck basking in the sun at a rocky pool on one of the North Rukuru's tributaries near the bridge site, a favourite spot where the team could chill out.

Naomi Bessey

23 years old

EXPEDITION ROLE

As Expedition Leader, Naomi was in overall charge of the safety and success of the expedition. She worked closely with Dan and Harriet to ensure that the team was functioning smoothly. Naomi co-ordinated a large part of the initial fundraising as well as pre-expedition liaison with the team's contacts in Malawi which included arranging the truck hire and organising the teams accommodation.

While on site Naomi was often the team's sole point of contact with the local Chiefs and the National Park scouts. Due to Dan's illness at Uledi, Naomi also acted as site manager for a large proportion of the expedition. This involved delegating tasks to the team, often giving them hand-picked workforces. In liaison with Harriet, Naomi set up and supervised most of the mechanical moving tasks, such as placing, tensioning and loading the cables. Naomi was in charge of those team members working at height. She ensured they were familiar with the high rope access techniques used and that they followed the correct operating procedures to ensure a high level of safety was maintained. Naomi also administered most of the first aid on the expedition; though Dan and Harriet were also First Aid trained.

ACADEMIC STATUS

- 2006-2007 - PGCE in Science.
- 2002-2006 - MSci Physics, Imperial College London.

EXPEDITION EXPERIENCE

- 2006 - Helped lead a team of Imperial College civil engineering students in Malawi during which construction began on a 37m span suspended footbridge across the North Rukuru River at Uledi.
- 2005 - Arranged guides, transport and border crossings from Nepal as the logistics officer for Imperial College Shar Kangsum Expedition to Tibet. First ascents and new routes on three 6000m peaks.
- 2005 - Wilderness Medical Training 2-day course successfully completed (Royal Geographical Society).
- 2004 - Thirty day tour of Scandinavia, including three weeks wild camping and exploring Lofoten Islands above the Arctic Circle.
- 2004 - One month trip to central and northern Sudan. Experienced extreme desert conditions and worked with Sudanese doctors surveying houses for sanitary, schooling and medical needs in refugee camps outside Khartoum. Taught English classes in a community centre in the capital.
- 2003 - Five week sailing Expedition from England to St Petersburg in 30ft yacht, position of first mate / acting captain. North sea crossing and Baltic traverse. Planning, logistics and navigation in varied weather conditions; multiple practical tasks to keep boat afloat, often in situations of extreme stress.
- 2002 - Four week sailing trip through Holland and Germany, crossing into the Baltic Sea. Demanding storm experiences in 21ft river yacht.

OTHER INTERESTS & ACHIEVEMENTS

- Enjoys being in remote areas and in the mountains; keen walker and mountaineer in all weather.
- Likes teaching people things, travelling abroad, visiting places off the beaten track and reading.
- Has made a pledge to try every water-sport going, kite-surfing is next!

Daniel Carrivick

27 years old

EXPEDITION ROLE

As finance officer, Dan looked after the expedition finances. This involved compiling the expedition budget and organising sufficient fund raising for the expedition. Dan also ensured grants and donations were paid into the expeditions account promptly thus ensuring sufficient funds were always available so as to not impede expedition preparations. Dan kept a close eye on the accounts in the months leading up to departure to ensure actual expenditure was kept in line with the budget. He organised and purchased most of the new equipment needed for the expedition. This included ensuring sufficient equipment was taken to adhere to relevant health and safety standards.

While on the expedition Dan shared the driving of the teams' three tonne truck. Having a second person who could drive the truck proved useful especially when in and around town. Dan was also responsible for all monetary issues. Changing the right amount of money was quite a challenge. Too much Malawian Kwacha was bulky and difficult to look after safely, while not enough could result in a special journey to the nearest bank – a two day round trip from the bridge site. Dan recorded everything that was spent in Malawi. This included keeping track of who was employed and making sure they were paid accordingly.

Dan organised the expedition food. This involved him planning the type of foods required and ensuring that sufficient quantities of these were bought to last the duration of the expedition. Dan also led communications with the Department of National Parks and Wildlife (DNPW) both prior to and at the start of the expedition to get the import duty on the shipment of cables waived. After much perseverance and several visits to the Malawi Revenue Authority (MRA) Dan succeeded in getting the consignment released duty free.

Below & inset – Jumana walking back through Lilongwe with some of the equipment purchased from the market.

ACADEMIC STATUS

- 2002-to date - PhD student in Structural Geology, Imperial College London.
- 1998-2002 - MSci Geological Sciences, Imperial College London.

EXPEDITION EXPERIENCE

- 2006 - In charge of a team of civil engineering students from Imperial College who began construction on a 37m span suspended footbridge across the North Rukuru River at Uledi, in northern Malawi.
- 2006 - Attended an African pre-expedition bush training course
- 2005 - Led an expedition from Imperial College to the Shar Kangsum mountain range in Tibet. First ascents of at least two 6000m peaks and new route on a 6600m peak.
- 2005 - Wilderness Medical Training 2-day course successfully completed (Royal Geographical Society).
- 2004 - Led a team of four students who ski-traversed over 550km, unsupported, across Greenland's icecap in 29 days collecting a multitude of hydrological, meteorological and physiological data on the way as part of the Imperial College Trans Greenland 2004 Expedition.
- 2003 - Co-led an Arctic training expedition to cross pressure ridges on the west coast of Greenland.
- 2002 - Field assistant for exploration into the small scale reservoir properties of trangressive sandstone bodies bisected by marine ravinement surfaces in New Mexico's canyon lands.
- 2002 - Member of the Imperial College Apolobamba 2002 Expedition. Ascent of three peaks up to 5700m, two of which were previously unclimbed. Ascent of Illimani (6462m) in the Cordillera Real.
- 2001 - Equipment Officer for the Imperial College Tagne 2001 Expedition. First ascent of two previously unclimbed 6000m peaks.
- 2001 - Wilderness Expedition First Aid two-day course successfully completed.
- 2000 - Six week geological mapping and wild camping in remote area on the Isle of Skye

OTHER INTERESTS & ACHIEVEMENTS

- 1st in the 2006 and 2nd in the 2007 Quest adventure race series (Southern England). Finished 5th in both the 2004 & 2005 British adventure ACE race two day series (male solo category).
- Annual summer alpine mountaineering trips to the French and Swiss Alps since 1997, including summiting Mont Blanc (4808m) at the age of 18. Led novice groups up to AD grade on mixed terrain.
- Competent skier, learnt to ski in 1993, have skied more or less annually since 1998 across North America, Europe & Scandinavia.
- Keen participant in other outdoor activities including mountain biking, canoeing, rock and ice climbing, scrambling and caving. Competed in many marathons, with a sub-three hour personal best.

Harriet Kirk

25 years old

EXPEDITION ROLE

Harriet led the engineering side of this year's expedition. She had been involved in the design process prior to the 2006 expedition, and received a full handover of all information from Andras before leaving for Malawi. She also liaised with engineering firms and staff from Imperial College Civil & Environmental Engineering department.

Onsite, Harriet was responsible for finalising elements of the design, particularly the earth embankments and retaining structures. She assisted with supervising the workforce and closely monitored the quality of the work done. In addition, Harriet was responsible for contacting UK engineering firms to obtain sponsorship for the project, and for applying for funding from City & Guilds College Union.

ACADEMIC STATUS

- 2005-to date - MEng Civil & Environmental Engineering, Imperial College London.

EXPEDITION EXPERIENCE

- 2006- Involved in design process for Imperial College Building Bridges Expedition, including visits to design companies.
- 2005- Worked onsite in Liverpool with Habitat For Humanity, a charity dedicated to building homes for low-income families.
- 2004- 3 months' independent travel through Central America, visiting 5 countries and learning Spanish.
- 2004- 3 month expedition to Costa Rica and Nicaragua with Raleigh International. Included a 250km trek, working to build a hostel for schoolchildren in a small town, and living and working in a cloudforest reserve.

OTHER INTERESTS & ACHIEVEMENTS

- Member of Engineers Without Borders, Imperial College, since 2005
- Keen runner, especially off-road, and has competed for Imperial at BUSA Cross-Country Championships. Imperial College Cross-Country and Athletics Club Women's Captain in 2006/07. Enjoys other sports such as martial arts, and most outdoor activities.
- Likes indie, punk and classical music. Plays cello, guitar and bass guitar.

Below – Jumana playing Bao by Lake Malawi.
Inset – Teck (R) has his go while enjoying a cool drink.
Bottom right – The team, from left to right; Jumana, Teck, Harriet, Dan and Naomi, in front of the finished bridge

Jumana Al-Zubaidi

20 years old

EXPEDITION ROLE

Jumana joined the project this year. She was involved in the design process, which involved researching the context of the bridge and its requirements while over-viewing last years design to see if any improvements needed to be made. A few problems arose from the construction of the towers and anchor blocks in 2006, so the team had to assess the various solutions to these problems while bearing in mind restrictions imposed by the environment and, the tools and manpower available. Jumana was responsible for finding the best possible solutions to these problems so the bridge could be completed smoothly, without any further problems arising. She was also involved in an effort to raise funds for this expedition by contacting construction companies and trust funds. Once in Malawi Jumana was involved in material requisition, organisation, and the actual construction phase of the bridge. As a site engineer, Jumana spent most of the time on site concentrating on the structural aspect of the bridge. This particularly involved the hoisting and installation of cables, and the laying of the decking.

ACADEMIC STATUS

- 2005-to date - MEng Civil & Environmental Engineering, Imperial College London.

EXPEDITION EXPERIENCE

- 2000 – 5 day canoeing in the Ardeche River, France. Involved camping.
- Camping on holidays with family and friends in various locations in UK

OTHER INTERESTS & ACHIEVEMENTS

- Played Lacrosse for Reading Women's team
- Enjoys learning about other cultures and people's way of life
- Loves travelling

Li-Teck Lau

20 years old

EXPEDITION ROLE

As one of the three engineering students on the expedition, Li-Teck contributed to overcoming the technical challenges that were posed during the initial planning stage and which arose on site. Such challenges included the embankment design, laying the cables and the protection of the river bank. Li-Teck also acted as site supervisor, coordinating and overseeing the work carried out by groups of local workers, who were employed. The expedition gave Li-Teck the opportunity to pursue his hobby of photography, and he very much enjoyed visually documenting the five weeks he spent in Malawi. Finally, as central to any foreign and educational trip, Li-Teck made special effort to get to know members of the work force and local community for whom the bridge was for. Li-Teck also makes one mean tinned sausage-rice combo!

ACADEMIC STATUS

- 2005-to date - MEng Civil & Environmental Engineering, Imperial College London.

EXPEDITION EXPERIENCE

- 2006 – Three week backpacking trip across Morocco.
- Travelled extensively and experience of living in foreign countries.

OTHER INTERESTS & ACHIEVEMENTS

- Writer for the politics section of Imperial College's student newspaper 'Felix'.
- President of Imperial College society 'Model United Nations'.
- Keen traveller with great interest in international development, foreign culture and politics.

Below & inset – A worker removes the earth from the three metre deep access pit behind the eastern anchor. The pit was infilled for safety at the end of the 2006 expedition.

ENGINEERING REPORT

By Harriet Kirk, Jumana Al-Zubaidi & Daniel Carrivick

Summary

This expedition completed the construction of the footbridge, which began in 2006. The main task involved the installation and attachment of the cables and decking for the walkway. Engineering work was also undertaken to protect the river banks and to provide a suitable approach to the bridge.

Mission Statement

To work with the local natives to build a permanent footbridge across the North Rukuru River near Uledi and in doing so provide the community with construction skills, techniques and tools which they will be able to use and pass on long after the bridge is complete.

Background

Quincy Connell, an expedition leader with Biosearch Expeditions identified the need for a bridge across the North Rukuru River in Nyika National Park, Northern Malawi. During the dry season people waded across the steady flowing river. However, in the rainy season the river rises to such a level that crossing was impossible. Nyika National Park scouts faced the problem of being unable to get across the river and into the park to protect wildlife when water levels rose. As a result, many animals were lost to poachers during wet season. The rains also cut the local community in half as Uledi residents live on both sides of the river. Quincy's suggestion of building a foot-bridge across the river, making the North Rukuru crossable throughout the year, was enthusiastically received by both the community of Uledi and Nyika National Park.

This expedition was a continuation of the building bridges project which began in 2006 when a team from Imperial College surveyed potential bridge sites and constructed the two towers and anchor blocks (see bridge plans sheet 2 & 3). Appendix H gives a summary of the work done in 2006. Unfortunately the bridge could not be completed in 2006 because the cables, which were being shipped from Europe, were significantly delayed. The site was therefore cleared and left ready for when a team could return to finish the bridge.

Upon arrival, this expedition first assessed the condition of the site and the infrastructure to see if there was any damage or weathering caused by the wet season, i.e. both by the rain fall and by high river levels. Construction then continued with the cables being installed and the walkway decking being laid. Appropriate bank protection was also constructed based on the information gathered from the initial site and infrastructure assessment. Lessons were learnt from the 2006 expedition, which made this expedition more prepared for the environment and the conditions that would be faced. The team was also more aware of the community's culture, and thus how to work best with the unskilled workforce, which consisted of rural village farmers.

Aim

The main aim of this expedition was to complete the construction of a footbridge, which was started in 2006, across the North Rukuru River on the north western edge of Nyika National Park, near Uledi in Northern Malawi *(maps A, B, C & D)*. The team aimed to leave the community of Uledi with a fully functional bridge, complete with sufficient protection to ensure the structure remained in a safe and usable condition for several years to come. The idea was to involve local labourers in the construction process as much as possible so they would take ownership of the bridge and thus care for the finished structure as well as having sufficient knowledge and enthusiasm to maintain the bridge. Once again an eye was kept open for any other potential future projects in the region.

Planning & Preparation

The planning for this expedition started in October 2006, when it became apparent that some of the 2006 expedition team members would not be able to go back in 2007 to complete the bridge. New team members were recruited and the handover of information from last year's expedition team began in the autumn term. Dan and Naomi provided continuity during this transition period by being the only two members from the 2006 expedition team who could commit to the 2007 expedition but their roles were mainly logistical as they were not civil engineers. The engineers for this expedition were therefore all new to the project. They received a great deal of support and information from Andras Szollar, who co-ordinated the design process and was chief site engineer in 2006.

The engineers joined the team with varying degrees of knowledge about the project. Everything was new to Jumana and Teck while Harriet already knew a lot about the bridge having been part of the UK design team with Andras prior to the 2006 expedition. The first step was to bring everyone up to the same knowledge base. Each engineering team member read the Helvetas "Bridges for Prosperity" design guide, which formed the basis of the original design. Meanwhile Andras produced a detailed document containing all the relevant information that he had gathered in 2006 on the site, the design, and the construction techniques used. This included a site map (map D), design drawings (see bridge plans), details on the area's geology and information regarding materials and concrete mixes.

Members of the engineering team had regular meetings from April 2007 onwards to plan and prepare for this years expedition. Meetings were regularly arranged with Andras, to discuss potential problems and

Below & inset – Marking site levels; Harriet and Jumana hold either end of the hose pipe while Teck measures and marks the levels.

clear up any misunderstandings over the design. While Andras' information proved invaluable, the engineers found it difficult to fully grasp certain aspects of the project before they actually arrived in Uledi and saw the site for themselves. Dan and Naomi often attended these meetings so they could pass on their first-hand knowledge and experience. Various construction issues were typically discussed, such as the various different methods for installing the cables and decking units.

The major issue in terms of engineering design for this year's expedition was the nature of the embankments to be built between each tower and anchor. These embankments had a dual purpose to provide both an approach ramp to the bridge and act as a dead weight for the anchorage. Some form of retaining structure was needed to form the walls of the embankment, and thus various designs were explored for this. Different methods for protecting the river banks were also investigated to ensure the lifespan of the bridge was not shortened by riverbank erosion. The east and west river banks were very different in both their ground properties and slope profile, thus protection for each river bank was designed individually.

The team made a visit to Whitbybird to discuss these issues with engineers from their Geotechnical department. They gave us advice on embankment construction methods and ideas for how best to build sustainable and environmentally responsible retaining walls. Information regarding the construction of gabions to protect the river banks was also gained; although this ultimately proved beyond the scope of this project. Some of the team also met up with members of staff in the Department of Civil & Environmental Engineering at Imperial College. Advice was sought on performing tests and calculations in the field as well as how best to compact the earth for the embankment.

Considerable time was also spent selecting equipment to be taken out from the UK, including cable grips, wire cutters, and various tools such as spanners, wrenches and sockets (see appendix D for a complete list). The team took a variety of textbooks and field guides out to Malawi, details of which are given in the bibliography at the end of the engineering report *(p18)*. Lecture notes from relevant courses were also taken.

Before leaving for Malawi, the team produced a preliminary time plan detailing the main tasks to be undertaken. This time plan included information about what each task entailed, the equipment needed, any preparation required, and the order in which the tasks were to be carried out.

Methods

SITE CLEARING & PREPARATION

When the team arrived in Uledi, the site was overgrown with long grass up to eight feet high on the west bank *(fig. 1)* and thick dense bush vegetation on the east bank. The site had been cleared of all vegetation the previous year and so the re-establishment of plants was an encouraging sign, as it showed the flora quickly re-colonised the area. This would help protect the river banks and the embankment once construction was complete. However, it did mean the site had to be cleared again before any work could begin, which was not an easy task.

Fig. 1 – The site cleared in 2006 (L) and overgrown upon arrival in 2007 (R)

Four local men were employed on the first day to clear the ground around the towers using pangas (machetes) and hoes. They then cut back and cleared the vegetation on both sides of the narrow paths which led from the camp to the bridge site and to the river. On the west grassy side the work was fairly easy. However, on the east side the workers had to do battle with "buffalo beans", a seed pod that hangs from bushes and is covered in small spines which are released when touched or knocked and cause severe skin irritation. Areas were also cleared on both sides of the river for storing construction materials; namely sand and gravel for concrete, and large stones for bulk fill. The access pit behind the anchor block on the east bank was unearthed and the corrugated steel shuttering which had been left in place the previous year was removed.

Once the site had been cleared, a visual check confirmed that the earth slopes built around the towers in 2006 were present, in good condition, and did not appear to have suffered much from the annual flooding during the rainy season. The towers also showed no obvious cause for concern, with the mortar and brickwork intact and no cracks visible. When the corrugated sheeting was removed from the back of the anchor block on the east side, some steel reinforcement was found to be exposed. This did not appear to have corroded and was simply noted for correction when concreting later on.

An inspection of the riverbanks revealed no major erosion or deposition had occurred since members of the team were last on site, some eleven months previously. In particular, the washout caused by a tributary joining the main river upstream had not been enlarged or migrated downstream at all, which was encouraging. The river was notably deeper than the previous summer, when it was knee deep and just

Above & inset – Removing the walkway cable (26mm) from the reel by rotating the reel on a pallet on the back of the truck.

about possible to cross and keep the bottom of your shorts dry. This year water levels came up to peoples thighs when they waded across at the shallowest point. These higher river levels did not have any major effect on construction and wading across was still safe. The deeper water did though make it notably harder to keep clothing dry, source and transport river materials and generally move backwards and forwards across the river.

The team carried out a survey of the bridge centre line, beginning at the back of the anchor block on the west side. A clear hosepipe filled with river water was used for levelling, once it had been checked for air bubbles. The centre line was marked out using short wooden stakes cut from tree branches. Particular care was taken in finding the position of each tower's tier. The results of the survey were plotted onto graph paper, and compared with the same survey carried out in 2006. This showed that the towers were in the same position as expected. The height difference between the two towers was calculated and this was very similar to that derived previously. These figures were then used to calculate the cables' sag.

CABLE ASSEMBLY & INSTALLATION

An 11 mm handrail cable and a 26 mm walkway cable were used to span the river and form the basis of the suspended footbridge. Both cables were 130 m in length and were transported to Uledi on large wooden reels. A number of different methods for removing the cables from the reels were considered to ensure the cables were not damaged or twisted during this process. The handrail cable was unrolled and installed first due to it being lighter in weight and thus easier to handle. The reel was placed on the back of the truck, which was driven a hundred odd metres up the straightest stretch of road closest to the site. Three workers then dragged and rotated the reel on the back of the truck, while other workers took the end of the cable and walked away from the truck back down the road. Thirty workers were spaced out evenly along the length of the cable, every five metres or so, to spread the weight. Once off the reel, the cable was laid down and measured, and the mid-point was marked with tape. The cable was then carried on the workers' shoulders, and walked across the river. Great care was taken to avoid twisting or scraping the cable on the ground, both of which would have damaged the cable.

The leading half of the handrail cable was installed across the upstream side of the bridge. It was first fed through the anchorage on the east bank *(fig. 2)*, and then taken up over the upstream side of the saddle on top of the east tower before being manhandled down the east river bank and out across the river where a static rope was attached to the cable using bulldog grips. This rope was fed up over the saddle on the west tower, and used to pull the cable into position. Once in place, the rope was used to tie off the cable to the steel loop embedded in the western anchor block. The free end of the cable was then under no tension, and could be fed through the pipe in the anchor block and tied off to itself using bulldog grips. Installation of the other half of the cable took place on the downstream side of the bridge in much the same way. After being fed through the anchor on the east bank, the cable was laid over the east tower before being pulled across the river, the west tower and fastened in place at the western anchor. The handrail cable was left overnight with the static ropes still attached for safety.

Fig. 2 – Access pit behind the eastern anchor block (L) and close up of the cables running through the plastic pipe set in the anchor (R). The red rope was left running through the plastic pipe to prevent it becoming blocked. The orange cord and grips mark the middle section of the walkway and handrail cables respectively.

The 26 mm walkway cable was much heavier and more unwieldy than the 11 mm handrail cable, which made its installation more difficult. Removal of this cable from the reel on the truck occurred in the same way; though this time a team of six men were required to rotate the reel on the back of the truck. Once again, the cable was walked across the river and through the eastern anchor block, and then pulled across the towers using a rope *(fig. 3)*. This time the cable was hauled across the river on a number of pulleys suspended from the 11 mm handrail cable.

Threading the 26 mm walkway cable through the PVC pipe inside the western anchor block proved extremely difficult. The access trench had been kept small so as to minimise the disturbance to the ground in front of the anchor block, but this meant working conditions were cramped and uncomfortable. The pipe opening was at foot level and could only be reached by crouching down and wedging ones' self into the narrow deep trench. The PVC pipe, which was embedded in the concrete anchor block, was bent into a tight curve, around which it was impossible to feed the cable. In order to fit the cable around the bend, individual strands had to be cut away using cable cutters to form a tapered end *(fig. 4)*, which could then be forced through the curved pipe. For future bridges using a similar design, a larger diameter PVC pipe with a more open curve and possibly easier access is recommended. Note these problems would have been avoided if the team had not been restricted by the cables' length which forced them to change the design of the anchorage accordingly.

Once installed, both handrail and walkway cables were tensioned so as to hang at the correct levels. To allow for plastic deformation under load, the cables were over-pulled and left for twenty-four hours,

Below & inset – Installing the handrail cables; workers support the cable as it is fed over the towers.

before being relaxed to their final correct position. This position was calculated using the Helvetas guide, and lines were painted on the west tower to show the final hoisting level. One member of the team was positioned on the opposite bank, and sighted across so that the lowest point of each cable could be lined up with the relevant painted line.

Fig. 3 - Three workers haul the walkway cable (right) over the west tower.

The 26 mm walkway cable was tensioned using two three-way pulley systems *(fig. 4)* used in tandem, each with a safety ratchet which only allowed the rope to be pulled in one direction and prevented it slipping back if let go. In addition a safety rope remained locked off and attached to the cable at all times, thus preventing the cable from falling back to the ground, should the safety ratchet have failed. Once the safety rope and pulley system had been set up, the grips which fastened the cable to its self were undone and six men used the pulley system to raise the cables into position. When the cable was at the correct level, the grips were then tightened. Communication between the observer and the workers pulling the cables was difficult, and the cables were very sensitive, so a certain amount of trial and error was required. The handrail cables were tensioned in a similar way. However, being lighter, not so much man power was required. Two team members carried out the task using just one three-way pulley system.

Fig. 4 – Three way pulley system used to tension the cables. An 11 mm static rope was used in the pulley system and attached to the 26 mm cable using grips. The end of the cable, which was tapered in order to feed it through the anchor block, can be seen in the foreground.

After the cables were left to settle for twenty-four hours, the same system of pulleys and safety ropes were used to relax each cable slightly. The walkway cables were fixed into position, and then the handrail cables were let out to fit the same curve. Each end of the walkway cable was fastened off using five bulldog grips at 180 mm intervals, while the handrail cable used three grips each positioned 90 mm apart. Care was taken to ensure the grips were attached the right way round, with bolts on the "live" end of the cable, and that the grips were tightened to the correct torque.

The design called for suspender cables to transfer some of the load from the walkway cable to the handrail cable. Thirty-eight pairs of suspender cables, each 1.9 m long were required. A combination of 8 mm and 10 mm cable was used for the suspenders. The original plan was to use 8 mm cable for the suspenders. However, because the span of the bridge was much greater than anticipated when the cable was ordered back in May 2006, the team only had enough 8 mm cable for twenty-seven pairs. Additional cable was taken out with the team for the remaining suspenders though it was both thicker (10 mm) and longer (70 m) than necessary so it could also be use to provide an access cable across the river when the walkway and handrail cables were being installed (though was not necessary in the end). Both the 8 mm and 10 mm cable were cut into 1.9 m lengths. Self-amalgamating tape was tightly wrapped around either side of where the cable was to be cut, to prevent the strands unravelling. The cable was then cut using cable cutters.

Below & inset – Installing the decking; Naomi and Harriet manoeuvre another piece of decking into place.

The suspender cables were hung between the handrail and walkway cables from the top of each tower, where they were fastened using two grips at each end, placed 150 mm apart and at least 100 mm from the cable end. The cables were then slid out along the handrail and walkway cables and into position across the river. Trial and error was used to find the right level of tension for the cables, in order to transfer the load effectively. Bending the suspender cables around the main cables proved difficult by hand, especially for the 10 mm suspender cables. Some ad-hoc solutions using karabiners were attempted but none were very successful. For similar future projects, a simple clamp to hold the cable in place while fastening the grips would be very useful. Also if the design allows, use 8 mm cable for the suspenders as it is significantly more flexible than 10 mm cable and this flexibility made attaching the grips much easier.

MATERIALS - COLLECTION & TRANSPORTATION

Concrete was used to protect the buried parts of the cables along with one or two other minor jobs. All concrete was mixed by hand. Bags of cement were bought in Mzuzu, the largest industrial town in northern Malawi. The cement was transported to Uledi, a journey that took about twelve hours, using the teams' three-tonne truck. Aggregate was collected by hand from the riverbed near the site. The riverbed was predominantly composed of sand grade material so finding aggregate in sufficient quantities for collection was difficult. This was made harder by the fact the river level was higher than in 2006 and aggregate grade material removed from the river beds' surface in 2006 did not appear to have been replaced.

Sieves were made round the camp fire one evening by heating steel rods in the fire until they were hot enough to pierce holes in the bottom of plastic bowls. Riverbed deposits were then sieved using these bowls. Material left in the sieve was collected as aggregate while fines were discarded. The use of sieves ensured the material collected would not be too small to use as aggregate. This was a lesson learnt from the 2006 expedition, when the team had to repeatedly explain to the workers what size and shape of aggregate was required, often with little success. The introduction and use of these sieves helped ease this problem.

Sand was shovelled from the riverbed straight into sacks. A human chain was used to pass these sacks up the river bank from where they were carried to the site. The sand was emptied from the sacks into a pile ready for use. An effort was made to collect sand with a consistent grain size and of a high quality containing no dark organic matter and no clay particles. Water was collected in buckets from the river and carried up the river bank. On site the water was emptied into a large old oil drum where it was stored until needed.

All the aggregate, sand and water was transported to assembly points on each bank, so that when the time came for concreting all the materials were close by and to hand. Sand and aggregate were laid out on tarpaulins to keep them separate from the dusty ground and to allow them to dry out in the sun *(fig. 5)*. The water drum was covered to prevent evaporation when not in use. And the cement was kept in a cool dry storeroom and only carried down to the site on the day when it was to be used.

Fig. 5 – A worker empties his sack of aggregate onto the stockpile on site

Rocks were used to protect the river bank in front of the east tower and the base of both the east and west towers. Large boulders were collected from dry braided river beds next to the main channel. These boulder collection points were a fair distance up and downstream of the bridge site (see map D). The rocks were transported in a number of stages, across or down the river and along the river bank. Where rocks were moved short distances such as up river banks, the workers formed a chain and the boulders were passed from one man to the next. Boulders to be placed around the foot of the towers were collected in a pile on site adjacent to where they were to be laid so they did not have to be moved far again. Boulders to protect the eastern river bank were stacked in the river at the foot of the bank.

A vast quantity of earth was required for the embankments. This earth was sourced from behind and downstream of each anchor block (see map D) so as not to weaken the stability of the ground around the bridge. The pits from where this earth was dug were strategically located to make transportation as easy as possible, by making them close to the site and using natural gradients where possible. Different ground properties on either side of the river meant that sandy earth was collected on the east bank while clay was collected on the west bank. Teams of five or six men were given the task of digging the earth and

Below & inset – Laying another piece of decking; Harriet lowers the decking unit while Naomi gets ready to catch it.

transporting it to a stock pile which was created on site adjacent to the anchor blocks. The men within these teams were given different tasks. Often two men would use picks to loosen large chunks of earth, two men would shovel the earth into wheelbarrows, and one or two men would transport the material in the wheelbarrows to the site. Sourcing the material was much more time consuming compared to the actual construction of the embankments so earth was accumulated on site in large mounds long before it was required. Setting a team of men on just the collection and transportation of earth meant that these men soon became quick and efficient at their jobs, providing a constant source of earth which was in high demand at later stages of construction. However, these tasks were physically draining when done for a sustained period of time, so rotation systems were used where workers alternated between the different tasks. Rests were introduced whereby one worker at a time would take a turn to have a rest while the others kept working.

DECKING PLACEMENT

The wooden decking units were constructed in 2006 and kept in a locked storeroom until this expedition arrived. Each unit weighed ~ 30 kg and consisted of four 2 m long planks nailed to the top of three 2" x 6" cross pieces; one at each end and one in the middle (see bridge plans sheet 4). A slot for the walkway cable was cut into each side of the cross pieces. Each decking unit was inspected before being placed to make sure the wood had not rotted or split. The units were generally in a good condition, although some had warped to such an extent that they would not lie flat on the cables.

Each decking unit was lifted on to the top of the west tower by three workers. Then two team members, who wore safety harnesses and used high ropes access equipment, manoeuvred each decking unit into place before laying it. The walkway was constructed from west to east across the river, with the suspender cables being put slid into their final position as each decking unit was placed. A sling, which was looped around the handrail cable, was attached to the front of the decking unit to be laid. This sling took most of unit's weight, and prevented it falling off the bridge. With one team member positioned at either end, the decking unit was then slid out along the handrail cable. The decking unit was guided into position so the slots in the decking aligned with the walkway cable before the sling was released and the unit manually lowered the final few inches into place on the cables. Subsequent units were fitted in the same way, having first been carried to the end of the decking that had already been laid. Near the towers the cables sloped downwards towards the centre of the bridge. Thus the first decking unit laid was tied to the west tower using a safety rope to prevent it from slipping down towards the centre of the bridge. Each unit was then tied to the one laid previously to keep them close together and stop them from moving as other units were carried over them.

The warped units did not sit firmly on the walkway cables which meant they wobbled from side to side as they were trod on. In order to prevent these units lifting off, they were tied by wrapping wire around the walkway cable and nails hammered into the wood above each slot. This was done to all decking units and had the advantage of making the whole structure more secure. It also made the decking more difficult for locals to walk off with, while still being relatively easy to replace when damaged.

EMBANKMENT & RETAINING WALLS

An embankment was constructed between the tower and anchor on both sides of the river to provide an approach to each side of the bridge and dead weight to both east and west anchors (see map D). Retaining walls were built along the sides of each embankment to keep the earth fill in place and to reduce the amount of earth required.

Fig. 6 – Construction of the retaining walls on either side of the west tower. Note the vertical offset in height between the front and back row of sacks in each wall.

First the foundations for the retaining walls were dug. Trenches 1 m wide and 50 cm deep were dug from behind each side of the tower back as far as the anchor, in order to remove the topsoil. In these trenches local woven plastic 50 kg sugar sacks were filled with earth. Two rows of filled sacks were placed in each trench *(fig. 6)* with the sacks in the front row offset compared to those at the back. This lateral offset helped the rows of sacks interlock thus maximising the wall's stability and the protection it offered. The front row of sacks in each trench was two-thirds filled with earth while the back row was only one-third filled. Additional layers of sacks all filled two-thirds full of earth were placed on top and offset inwards towards the embankment to build up the height of the retaining wall and give it an inclination angle of

Below & inset – Earth being dumped on the embankment, ready to be compacted, from a nearby stock pile.

about 60°. The offset created between the front and back row of sacks in each layer *(fig. 6)* gave the retaining wall strength. Finally 8 mm reinforced steel was cut into 1 m long stakes and hammered through the sacks at an angle to hold them together and to stop the wall peeling away from the embankment.

The area between the two retaining walls on either side of each tower was filled in with earth, in between each layer of sacks which were added to the top of the retaining wall. This earth was ferried in from the neighbouring stockpile by whatever means possible i.e. in wheelbarrows, shovelling it directly and carrying it in sacks *(fig. 7)*. The earth was spread out evenly until it formed a 20-30 cm thick unconsolidated layer, which was sprinkled with water. The workers then repeatedly danced, jumped and trod all over the moist earth to compact it *(fig. 7)*. Another compaction method used involved repeatedly hitting the damp earth with the backs of shovels. Although crude, these compaction methods were relatively good given that using a mechanical device was not possible. Once the laid earth was compact, more earth was ferried in and the same process repeated until the earth fill reached the height of the sacks. The embankment was built up against the back of each tower and landscaped so it sloped down to ground level behind each anchor. When the final layer was placed the embankment had been built up to a height of 1.5 m adjacent to the tower.

Fig. 7 – Building the embankment. Earth brought from stockpile (right) by wheelbarrow and sacks was spread out with hoes and compacted by hitting with shovel or jumping up and down on it (man to the right of wheelbarrow).

Shuttering was built up around the parts of the cables within the embankment in order to keep the earth fill out of the trenches in which the cables lay. This shuttering was made out of spare timber and the left over corrugated steel sheeting *(fig. 8)*. A lack of appropriate timber meant the shuttering was not as effective as it should have been. Once the back fill was complete the shuttering was removed, and the trenches dug out and cleared of loose earth where needed. The trenches were then filled with concrete to set the cables in place. First concrete was fed in to the plastic tubing in which the cables lay inside the anchor block. Then the trenches were filled with small rocks and concrete; with the rocks providing bulk in the trenches and the concrete being used to cover the cables and hold the rocks together *(fig. 9)*. The parts of these cables which fed around the back of the eastern anchor block *(fig. 2)* were also covered with concrete, as were any exposed bits of rebar in the anchor block. The concrete was left to cure for three days and the bridge was not touched during this time to avoid compromising the concrete's strength.

Fig. 8 – The shuttering placed around the cable trenches to keep earth out while building the embankment. Plastic pipes were also placed around the cables themselves to protect them.

When the concrete around the cables was set, the earth around the concreted areas was compacted and the access pit behind the anchor on the east side was backfilled and simultaneously compacted. The top of the embankments were landscaped and rocks were placed on top to form an approach pathway up to the bridge. Stepped ladders made (in 2006) from timber were cut to appropriate lengths to provide access to the bridge. Each ladder led from the top of the embankment up the side of the tower to the saddle and walkway. The ladders were attached to concrete blocks in the top of the embankment using large bolts. This was better than putting the ladder feet directly into the ground or into concrete which would inevitably result in the wood rotting quickly.

Below – A worker transporting a rock up to the site to be used to protect the eastern river bank.
Inset – Workers carrying rocks across the river to the stock pile

Fig. 9 – Setting the cables in concrete. Boulders were placed down the sides of each trench to reduce the volume of concrete required.

RIVER BANK PROTECTION

Both east and west river banks were protected in front, and a little way upstream, of the two towers. Protection of the eastern river bank was to prevent the sandy soil from being eroded by the river during the rainy season. Upstream of the bridge site the east bank had been washed out where the Miwanga River joins the North Rukuru. Protection was therefore important in ensuring this washout did not migrate further downstream and affect the stability of the ground around the tower.

The eastern river bank was approximately four and a half metres high and sloped upwards from the water with a number of natural inclined shelves (see bridge plans sheet 1, transect C). Originally, gabions were considered as a protection method. These could have been easily constructed from wire mesh, placed in front of the existing bank and filled with large boulders. However, building enough gabions would have been an enormous task, and the team was uncertain about whether the gabions would restrict the water flow during high river levels. There was concern that the problem might just be transferred elsewhere, causing erosion at another location. Thus the decision was taken not to use gabions but to place protection on the bank itself and thus try to maintain the original shape of the river bank as much as possible.

While travelling to Uledi the team saw gabions protecting a handful of other rivers and dry stream channels. All looked relatively new with no significant weathering to the wire cages but all had been bypassed, undermined, toppled and/or broken. This may have been due to poor construction or improper use of the gabions, or because of the power with which the water flows during the rainy season.

Fig. 10 – The eastern river bank protection. The idea came from natural protection offered by fallen trees and large roots behind which river deposits had accumulated. One such root naturally protecting the bank can be seen running across the lower bank in the foreground.

Several large branches overhung the river channel on the downstream side of the bridge. Flood debris on these branches clearly indicated that the river submerged them during the rainy season. There was concern that these branches had the potential to partially block the river which could cause a build up of water and flood debris that would affect the bridge. Thus these branches were cut down and the river channel was cleared of all overhanging vegetation. Vines which clung to nearby trees and overhung the bridge were also cut back or chopped down where possible.

Logs >30 cm in diameter and up to 10 m in length were cut from the largest branches by using an axe to trim off the smaller branches. The first log was floated up river and positioned near the edge of the first shelf on the eastern bank. Wooden stakes cut from the smaller branches were hammered into the sandy soil below the log to hold it in place. The area of river bank behind the log was then covered with boulders which were built up until they reached the height of the log *(fig. 10)*. These boulders were packed tightly

Above & inset – Man handling the huge tree branches into place to protect the eastern river bank.

so that they did not move around. They were then covered with wire mesh to stop them being lifted up. This process of laying a large log, filling the area behind with rocks and covering it all with wire mesh was repeated up slope by taking advantage of the natural shelves in the river bank where possible *(fig. 11)*. Each subsequent log was placed on the wire mesh that covered the rocks below so as to secure the mesh in place. The protection was built right up to the foot of the east tower where the wire mesh was held down by placing a load of large boulders on it around the base of the tower. Finally the front of each wire mesh was bent and nailed around the front of the logs before being trimmed (see bridge plans sheet 4).

Fig. 11 – River bank protection on the east side. Logs were staked along the bank, rocks placed behind them and wire mesh used to cover them.

The western riverbank was characterised by a steep rocky ~5 m high cliff consisting of clay layers sandwiched between thin cemented sandstones. The sandstone beds jutted out from the river bank where the clay above and below had been preferentially eroded. There was a danger of some sandstone slabs breaking off as they had been substantially undermined. Thus some protection was needed to hold the sandstones in place even when they could no longer be supported by the underlying clays, as this would significantly reduce the rate of river bank erosion.

A roll of heavy duty wire mesh was cut into four 10 m long strips. These were laid side by side next to the west tower and fastened together by threading wire through a small overlap in each adjoining piece. Meanwhile the vegetation on the river bank and in front of the tower was chopped right back. Getting the large mat of wire mesh off the west bank and down to cover the face of the river cliff was not that easy because the mesh kept getting caught on the vegetation stalks. Ropes were attached to the mesh and it was pulled off the bank by people standing in the river while other people picked up the edges of the mesh and tried to walk it off the river bank. On occasions people had to crawl under the large mesh and free it from any vegetation that it got caught on.

Fig. 12 – Wire mesh placed over the west bank to hold loose blocks in situ, thus protecting the bank from erosion.

Once in position the mesh extended from the river bed up the river bank to the foot of the west tower *(fig. 12)*. Steel rods 8 mm thick were cut into one metre lengths and bent into U-shapes. These metal pins were hammered into the ground around the tower and into the riverbank to hold the mesh both in place and against the river bank. Boulders were also placed on top of the mesh around the foot of the tower, to weigh down the mesh and protect the base of the tower from flood waters.

Finally the mesh needed to be weighed down in order to prevent the mesh from being lifted up from the bottom of the river bank by the river. If this happened the base of the river bank would be vulnerable to erosion which would counteract any protection offered by the mesh. Two sections of railway track, each approximately 3 m long, were leftover from constructing the bridges' anchors and were ideal for this purpose. Each track section was very heavy requiring three or four workers to carry one piece of track down to the river. The sections of track were laid on the mesh at the foot of the river bank. Surplus mesh which lay on the river bed was then bent up and around the railway track, and fastened to itself using tying

wire to secure the railway track in place. The railway track sat on the river bed and kept the mesh taught (see bridge plans sheet 4). Before long, vegetation would quickly grow back up through the mesh thus helping to hold the mesh in place against the river bank.

SITE MANAGEMENT

The site management was a key aspect of the project for the expedition team. A considerable amount of manual work needed to be done in a short amount of time in order to complete the bridge. Some thirty odd workers were needed to lift and install the largest cable, thus the number of people employed on a daily basis was kept constant at around thirty until all work was complete. Having a stable workforce was much easier to manage than in 2006 when the number of workers constantly fluctuated. This also made it much easier to work out their wages as most people had earned the same amount. Those employed were kept under a reasonable tight rein to ensure deadlines were met. Progress was reviewed throughout each day to ensure the workforce was suitably distributed and tasks were progressing at a reasonable pace.

Throughout the construction process there was a need to manage the different procedures taking place on site. The site was spread over quite large areas on both sides of the river as well as up and downstream (see map D), i.e. rock and sand collection from the river, digging from pits behind the anchors, concreting at anchor sites, cable work on the bridge's span and anchors, and deck installation on the bridge. The team was therefore required to split up with each team member supervising or managing a different area.

Some activities required initial supervision to make sure the workers knew what they were doing and how to do it. During this time the supervisor answered any questions the workers had and solved any problems that arose. The team member who was supervising could then move on to manage another part of the site as long as this was relatively close by so they could keep an eye on both groups of workers. An example of this was the collection of rocks from the river. A team member was required to split the workers into groups to ferry rocks up the river. If one group had too many people then that group might move the rocks too quickly thus running out of rocks to move, and breaking the chain. In such instances the workers did not take the initiative and redistribute themselves amongst groups, they just did what they were told and once done they stopped working. Thus a team member was required to check up on proceedings and redistribute people as necessary. This system of one team member managing several different tasks worked well, especially for the simpler jobs such as rock, sand and aggregate collection.

Some ongoing processes, such as the construction of the embankments and retaining walls, required a team member to supervise them continually on a daily basis. Although these tasks were essentially the same e.g. moving earth from one place to another, constant supervision was necessary because subtle things kept changing such as where the earth was being dumped and knowing when to compact the earth that had been dumped. Due to the nature of these tasks and a limited number of tools, the supervising team member often found it difficult to get involved with the work that was being undertaken. They were also rarely called upon to do any engineering but could not leave the site otherwise the job would not be done correctly. Thus the individual looking after such groups had nothing to do but watch and supervise as necessary. This was a little frustrating for those who did it, but essential nonetheless.

One team member was responsible for the general site management. This person did not supervise any specific tasks but rather kept an eye on all the tasks taking place to ensure everything came together at the right time. A few workmen did make the tasks their own. They understood what was required of the task, and were able to think for themselves to overcome any problems. The team were mindful of this when allocating workers to tasks, as those who could be left alone to get on with their job obviously relieved the pressure on team members, who could then get on with assisting construction rather than supervising the workforce.

Some problems were experienced on very busy days, such as when concreting or when the cables were installed. All team members were often needed on site where these activities were occurring, leaving other parts of the site unsupervised. On these days, workers not needed for the main task were largely left alone to continue with ongoing tasks such as digging or rock collection. Thus if these workers had a problem with anything or needed a different tool they would often have to trek a fair distance to the site and then search both river banks in order to consult a team member. This was a waste of time for the workers, especially if the problem was big enough to cause work to grind to a halt. Most workers did not speak any English so a team member often had to go back and see the problem for themselves. This wasted time especially if a team member could not leave what they were doing at the drop of a hat.

The team made an effort not to be purely seen as supervisors, but to also get involved with the work and help progress in a directly practical way where possible. This increased community morale and helped the team build strong relationships with community members. There was a fine balance to strike though between getting involved in the practical work and maintaining a well functioning site, and this often proved to be one of the more difficult aspects of the work.

Another aspect of site management which the team focused on was looking after the tools and materials; ensuring they were cared for and returned to the store room (national park building) at then end of each session. What made this discipline particularly important was the time and difficulty involved in procuring new tools or materials, should any have been lost or damaged.

Above & inset – Building the embankment; shovelling earth into a wheelbarrow ready for it to be deposited on the embankment.

Above & inset – Wellington crosses the bridge with caution for the first time, after the bridge is officially opened.

Results & Future Work

All work on the bridge was finished. The cables were installed, the decking laid and the embankments completed marking an end to the bridge's construction. In addition to completing the bridge, the river banks in front of each tower were protected using light engineering methods which maximised protection while at the same time minimised the environmental impact, by using local materials as much as possible and using a non-intrusive design. The bridge was officially opened on Wednesday 25th July 2007 by the chief of Uledi and the senior National Park officer based at Chelinda.

Now that the bridge has been constructed the community is no longer separated by the river during the rainy season. Also the park scouts can now enter the north western part of Nyika National Park all year round and are therefore no longer restricted to patrolling this area of the park in only the summer. This, it is hoped, will help reduce the poaching that has severely depleted the number of animals in the park.

Before the team left, a committee for the bridge was set up. Created from some of the better workers (i.e. local villagers) this committee were entrusted with looking after and maintaining the bridge alongside the resident head scout based at Uledi camp. Many of the workers wanted to be on the committee which shows that the locals are both proud of the bridge and see it as an asset to the community. This was an encouraging sign as it suggests the village will look after and use the bridge properly long after the team left, thus making the whole project worthwhile. The fact the community have adopted the bridge as their own will also help to ensure that the bridge's life span is as long as possible. A maintenance instruction manual with simple easy-to-follow basic safety checks and repair guidelines was left with the committee to help them do their job. Copies were also left with the National Park, and were given to the head scout resident in Uledi and to the senior officer from Chelinda.

One month after the team left, the Biosearch 2007 Expedition team visited Uledi. Quincy Connell, one of the leaders of this expedition and the person whose idea it was to build the bridge, found that the community were very happy with the bridge. Feedback from Quincy shows that the community are already thinking of things they can do to make the bridge better and are beginning to take an active role in making these improvements. Since the team left, the community have cut and cleared new paths on the east bank leading from the bridge to the mud huts where the locals live about a kilometre or so downriver. The bridge committee were also thinking about putting up some sort of netting between the walkway and the handrail cables so that the bridge is safer for local children. The team had considered installing wire mesh down the sides of the bridge to do this job. However, with limited time and resources the team felt it was best to use the wire mesh to protect the river banks and let the community install side netting on the bridge; for this was something they could do easily by weaving a fence from local grasses as they traditionally do for their homes and gardens.

Discussion

HANDOVER & PLANNNING

In general, the handover process between the 2006 expedition and this expedition worked very well. This was largely thanks to Andras who oversaw the transition period and continued to support the engineers on this expedition long after the handover. Andras produced a very comprehensive document containing every little detail about the bridges' design. This proved invaluable when planning and designing the work undertaken on this expedition, as it meant any information needed could easily be found, indicating just how important it is to keep accurate records of what is done on site. The team were apprehensive about visiting the Whitbybird design office because no one from the 2006 expedition team was able to join them. However the visit went well and if anything this helped the new engineering team get a grip of the project and know what they were really talking about!

EMBANKMENT & RETAINING WALLS

The team were pleasantly surprised by how well the workers were able to compact the earth for the embankment using only their feet. Both embankments appeared strong and kept their shape well. The retaining wall structure made from earth filled sugar sacks worked very well on the east side, where the soil was quite sandy. The fill consistency seemed to allow the sacks to fit together easily, without gaps, to create one coherent structure – a bit like a wall of sandbags. This added greatly to the structural integrity of the embankment as a whole. On the west side, the soil was a stickier, more clayey consistency. The clay formed hard blocks and clumps which made the compaction of earth in sacks difficult. It also meant the filled sacks were irregular shaped and therefore did not interlock as well as on the east bank. In an ideal world, the sandy soil would have been used to fill sacks on both sides of the river. However, this would have involved transporting ~50 m^3 of soil across the river by hand; a difficult and time-consuming task.

MATERIAL COLLECTION

This was the most labour-intensive and time-consuming task undertaken. It was therefore also the task in which the management of the site and the workforce was most crucial. On some occasions, for example when tensioning the cables, the team were all involved in a task at one location, while workers were spread around the site collecting earth and rocks. This meant that at times it was not possible for the team to supervise the workers and ensure productivity was maintained. Wellington, the teams' Malawian truck driver, was useful as he acted as a foreman. This was a role that he was not hired for, but which he willingly and ably took on. His enthusiasm for the project and desire to help build the bridge made him a valuable asset both on site and around camp. Having a native person on the team like Wellington who gave local knowledge and advice proved invaluable. And this saved the team both time and money especially when it came to haggling for goods. If a driver such as Wellington had not joined the expedition, the outcome could have been so very different, for he knew his truck better than anyone and whenever there was a problem he was able to fix it or get it fixed – something the team would have not been able to do so efficiently.

Inset – Jumana and Teck working alongside workers to concrete the cables below the ground.
Above – Who's that pouring concrete on Teck's head?
Right – Harriet and Naomi supervise the workers as they move a large tree branch into position to help protect the east bank.

DESIGN & CONSTRUCTION

The construction process ran extremely smoothly this year. However, there were a couple of small things, which could have been done differently to prevent difficulties arising. The first was to do with where the concrete was mixed during the 2006 expedition. Due to the varying ground properties, the anchor block on the east side was three metres deep and two metres wide while that on the west bank was two metres deep and three metres wide *(see bridge plans)*. This meant the cables went a lot deeper underground and into the anchor on the east side than on the west side, something that was possibly overlooked when the trenches for the cables were dug. In 2006 concreting was mixed by hand on the ground between the tower and the trench on the east side. When this expedition installed the cables, the trenches were found to be too short and thus further excavation was required. Extending the trenches was extremely difficult because the ground was covered with a crust of concrete which had been left behind from when concrete was mixed there during the 2006 expedition. It took several hours' hard labour with a pick axe in order to remove it, something which could have been avoided if the concrete had not been mixed between the tower and anchor.

The other thing that could have done differently was to make the bend in the plastic pipe, in the western anchor block, more open so the cable would have been easier to feed through (see discussion in methods – cable assembly & installation). This was something that could only be learned from experience, and if the project was repeated, a much larger bend could be built into the pipe. That said there should be no need to introduce such a design because unless you are limited by the length of cable as this expedition was, the cable can go right through the anchor block before looping back (see Helvetas design).

SITE MANAGEMENT

Members new to the expedition team this year had a steep learning curve in how to effectively manage the workforce. They soon discovered which tasks required the most supervision, which men worked well together and where problems were likely to occur. Some of the workers were competitive, for example there was a bit of competitiveness amongst those collecting rocks to see who could find and carry the largest rocks. The team played along with this camaraderie to increase morale and productivity on some of the more tedious tasks. Although the workers were on site to do a job, the team ensured they enjoyed what they were doing as much as possible by allowing them to have a bit of fun but at the same time ensuring this did not compromise anyone's safety. An example of this was when human chains were formed and rocks passed from one person to the next. The workers enjoyed this as it was different and more fun than trudging backwards and forwards across the river carrying rocks. However, one or two got carried away and started throwing rocks to each other rather than passing them. This led to a few rocks being dropped which could easily have injured somebody's foot so the team made it clear that throwing rocks to each other was not permitted.

The team made an effort to work alongside the locals wherever possible, rather than be seen purely as supervisors. Perhaps the most important thing was that the team learned some words of Tambuka, the local language, and spent time talking and laughing with the workers on site (see appendix J for a list of Tambuka words learned). At times it was difficult to build up a relationship with the workers while maintaining site discipline. This was especially so when some men were late for work or were found to be slacking off. When this occurred, those individuals were taken aside and given a formal warning. Following this, one of these men arrived several hours late for work the next day. The team liaised with the park scout responsible for taking the workforce register about this individual's behaviour and after finding no exceptional circumstances both parties agreed the worker in question should be sacked. This was a hard decision to make, and one that no one particularly wanted to do, but it was the right decision as it sent out a clear message to the rest of the workforce. Many workers supported getting rid of those who were not pulling their weight. The decision did not cause any bad feeling and the man returned to celebrate the bridge's opening.

Working in a supervisory role was probably the most challenging and tiring aspect of the expedition, but it was also extremely rewarding.

Below & inset – Excavating a trench for the foundations of one of the retaining walls.
Bottom right – Workers carry rocks from a stock pile up to the site; the source of these rocks can be seen in the distance on the other side of the river.

Bibliography

TECHNICAL GUIDES USED

Helvetas et al (2002) *Short Span Trail Bridge Standard - Suspended Type, Suspension Type, and Accompanying Technical Information* [Online] Available from: http://www.bridgestoprosperity.org/bridgemanuals.htm [Accessed 14th March 2007] (This is the one most of our design was based on)

I.T. Transport Ltd and Department for International Development (2004) *Footbridges - A Manual for Construction at Community and District Level.* [Online] Available from: http://www.ittransport.co.uk/publications.htm [Accessed 14th March 2007]

ILO/ASIST (1998) *Material selection and quality assurance for labour-based unsealed road projects - Technical Brief No.9* : [Online] Available from: http://www.ilo.org/public/english/employment/recon/eiip/publ/reference/general.htm [Accessed 14th March 2007]

MacAlloy (no date) *Cable Linking Systems* [Online] Available from: http://www.macalloy.com [Accessed 14th March 2007]

Tensoteci (no date) Steel Cables [Online] Available from: http://www.redaellitensoteci.com/inglese/siamo/siamo.htm [Accessed 14th March 2007]

BACKGROUND READING

Dennis, R. with I.T. Transport Ltd and Department for International Development (2002) *Footpaths and Tracks - A Field Manual for their Construction and Improvement* [Online] Available from: http://www.ittransport.co.uk/publications.htm [Accessed 14th March 2007]

ILO/ASIST (2000) *Guidelines for the Design and Construction of Suspension Footbridges* [Online] Available from: http://www.ilo.org/public/english/employment/recon/eiip/publ/reference/general.htm [Accessed 14th March 2007]

Outdoor Structures Australia (2001) *Exterior Timber Design Notes* [Online] Available from: http://www.outdoorstructures.com.au/timber_guides.php [Accessed 14th March 2007]

Corus (no date) *Information About Steel Bridges* [Online] Available from: http://www.corusconstruction.com/en/design_and_innovation/bridge [Accessed 14th March 2007]

OTHER INFORMATION

Imperial College et al (2004-6) *Lecture Notes: CE2 Reinforced concrete design, CE1-2 Structural mechanics, CE1-2 Soil mechanics, CE1 Surveying, and Surveying Field Course, CE1 Materials (steel, concrete, timber)* Imperial College, London UK

Carrivick, D. (ed) (2007) *Imperial College Building Bridges 2006 Expedition Report.* Imperial College, London.

Cobb, F (2004) *Structural Engineers Pocket Book*. Butterworth – Heinemann, Oxford UK

Davis, J. Lambert, R (2002) *Engineering In Emergencies – A Practical Guide for Relief Workers*. 2nd Edition, ITDG Publishing, Warwickshire UK

L Turner, A Lakeman (1942) *Concrete Construction Made Easy*. 3rd Edition, Concrete Publications Limited, London UK

ADMINISTRATION & LOGISTICS

Written and compiled by Naomi Bessey & Daniel Carrivick

Training & Preparations

WILDERNESS LIVING

No specific training was undertaking prior to this expedition as Dan and Naomi underwent training prior to the 2006 Imperial College Building Bridges Expedition (see the 2006 expedition report for details) and had experienced living in the African bush during that expedition. Dan and Naomi were therefore able to advise and prepare the rest of the team for what living and working conditions would be like.

FIRST AID

Before the 2006 Imperial College Building Bridges Expedition, Naomi, who was already qualified as an outdoor activity first aider, underwent further wilderness medical training by attending the two-day Far From Help 1 course organised by the Royal Geographical Society on the 11-12th March 2006. Dan attended the same course to renew his wilderness expedition first aid qualification which had lapsed after being gained more than three years previously. No further first aid training was undertaken prior to this expedition as the training received in spring 2006 lasts for three years before a refresher course needs to be taken.

CONSTRUCTION

One of the major logistical problems prior to this expedition was getting the import duty on the cable shipment waived. The amount of tax being charged by customs in Malawi for the release of the cables was quoted to be over £700. Apparently this was because the duty is calculated not just on the cost of the imported goods, which had been donated and thus declared as costing a nominally small amount (about £100), but also on the shipping cost, which totalled almost £1400.

Following the return of the 2006 expedition, Dan liaised with the Department of National Parks and Wildlife (DNPW) in Lilongwe to see if they could assist in getting the tax waived. There was no rush for this to be done immediately as a return to Malawi was not planned for some time but when six months later their was still no progress, a little more pressure was applied to get things moving. Mr Mbota, the teams DPNW contact in 2006 had handed the issue onto his replacement; Brighton Kumchedwa. Mr Kumchedwa had written to the Treasury but they never responded, and representatives from SDV (the company handling the shipment in Malawi) had been several times to the Malawian Revenue Authority (MRA) regional office in Lilongwe to check on progress, but they were unable to get anywhere. The team were subsequently advised to wait until the 1st March 2007 when a change in the Malawian customs procedures regarding the processing of duty free shipments was due to come into force.

Mr Kumchedwa then visited the Treasury, who referred him to the MRA in Lilongwe and they referred him onto the MRA head office in Blantyre. A letter was faxed to the MRA in Blantyre and a reply was expected within a few days. A breakdown in communication ensued and with the expedition fast approaching, there was a real sense of urgency to push things as far as they could, before the team travelled out to Malawi. A week before the team were due to fly out Dan faxed a letter to the MRA in Blantyre explaining that the shipment contained materials which had been donated to the Malawian Government for use on a foot bridge at Uledi. Apparently, in a telephone conversation with Mr Kumchedwa, a senior MRA official did agree that the team should not have to pay tax on the import. However, the problem was that this was not enough to get the cables released and a long drawn out bureaucratic procedure had to be completed before the team could collect the cables.

Once in Lilongwe the team met up with Mr Kumchedwa. Initial telephone conversations with the MRA in Blantyre were not promising, with them saying the tax should just be paid as the cables were required immediately. The news from the MRA seemed to vary depending on who was contacted and on what day, which did not inspire the teams' confidence in being able to get the tax waived. The senior official who had verbally sympathised and agreed that the tax should be waived was difficult to get hold of, which stalled proceedings a bit. However, things started to move forward when contact was once again made.

The team were sent to the MRA in Lilongwe with a wad of papers and a cover note explaining the situation, hoping this would be the end of the saga, but it wasn't enough to satisfy the customs officials. The staff worked in typical Malawian style – only occasionally did they actually do any work and yet they were quite happy to chat amongst themselves while customers waited to be served, and when you did finally get to see someone, help and advice was not forthcoming. After initially being turned away, Dan managed to persuade one reluctant member of staff to phone the head office in Blantyre and speak to the senior official who had granted us permission. Even speaking directly to someone superior was not enough to satisfy the customs official and written confirmation was required. The pace at which things happen in Malawi is quite slow so it was no surprise that the team were told to come back the following day to see if the written authorisation had come through. The team then had to get a DNPW representative to sign to say the cable shipment was for them. Mr Kumchedwa was unable to do this as he was new to the department and had not been added to the MRA's list of authorised signatories, thus the DNPW Deputy Director Mr Jiah was taken to sign the forms at the MRA office in Lilongwe. A small hic-up arose when Mr Jiah didn't have any appropriate ID on him but fortunately someone at the office knew him personally and was able to confirm he was who he said he was.

The MRA then needed the Tax Payer Identification Number (TPIN) for Land and Lake Safaris (to where the shipment had been addressed), so the team got this number and gave it to the SDV (the company handling the shipment in Malawi) who insisted it was wrong because it was a personal TPIN and they needed the company TPIN. In the end the two sides; SDV and Land and Lake Safaris, sorted it out over

Above & inset – The all important piece of paper which released our shipment of cables without us having to pay any import tax.

Below & inset – Just some of the money and documents needed for this expedition.

the phone. It turned out that SDV were wrong and the number Land and Lake had provided was correct! Finally all the paperwork had to be signed off by a representative from SDV. Malawians are quite laid back and don't pay much attention to time so it was no surprise that the chap from SDV turned up an hour or so later than arranged. After signing the forms the team collected the wad of paperwork and headed for the freight terminal at the airport where the cables were picked up without any import tax being paid.

A lot of the problems aforementioned could have been avoided by having the cables sent to a government address. Unfortunately the 2006 team were rushed into arranging the shipment as the cables were donated at the eleventh hour, thus the address used was the only Malawian address the team had, which was for Land and Lake Safaris through whom the expedition truck was hired. This address seemed like a good one to use at the time as Land and Lake Safaris had a large garage in which the heavy and bulky shipment could be stored. With hindsight though it would have been better to have the shipment sent to the DNPW in Lilongwe as this would have made it much easier to get the import duty waived.

Permission & Permits

NATIONAL PARK ENTRY PERMIT

Nyika National Park has an entry fee payable per person per day spent inside the park just like all the other parks and reserves in Malawi. However the team was able to get this charge waived given one of the main reasons for building the bridge was for the parks benefit. Permission to enter the National Parks free of charge can only be granted by the Department of National Parks and Wildlife in Lilongwe. The team therefore sought permission by visiting the National Parks headquarters while gathering supplies in Lilongwe at the start of the expedition. Mr Ramosh M. Jiah (Deputy Director of Education & Extension) wrote us an official letter outlining who we were and what we were doing. This letter was sufficient for repeated free entry and exit to Nyika National Park and it was also accepted for entry at the Vwasa Marsh, where the team received a complimentary tour of the nature reserve. Dan and Naomi were also able to gain free access to Lake Malawi National Park and Liwonde National Park by showing the letter though not everyone was as willing to waive their park entry fees as at Vwasa Marsh.

MALAWIAN VISA

British passport holders do not need a visa to enter Malawi. On arrival, team members were given a free thirty day visa. Extensions to this had to be sought as the team planned on staying longer than 30 days. The process was free and involved one member of our team presenting all our passports to the local government offices in Mzuzu before the initial thirty-day visa had expired. Extensions were valid for a further thirty days. The team had a few slight problems in getting their visa extensions what with not being close to Mzuzu and by the fact the offices were not open at weekends. So if you know you'll need a visa extension, it is best not to leave getting it to the day before your current visa expires. Visa extensions can also be obtained from government offices in other major towns in Malawi such as Blantyre and Lilongwe.

Fund Raising

EXPEDITION COSTS

The fundraising for this expedition was split in two parts; the first of which targeted trust funds to help raise money to get a team out to Malawi, while the second concentrated on securing funds from engineering companies to complete the construction process. Information about various trusts and grant-awarding bodies was found on the Royal Geographical Society's website. A short list of those relevant to this expedition was drawn up, which included deadlines and contact details. An expedition leaflet was put together and a generic letter written which was subsequently tailored to meet each organisations specific requirement. The letter and leaflet were sent out to the trusts together, and where relevant they were accompanied by an official grant application form. A total of £7500 was raised for the expedition from four different grant-awarding bodies. Each team member made a personal contribution of £500 towards the expedition which added another £2500 to this, giving a final total income of £10,000 for the expedition costs (appendix F, table F1).

CONSTRUCTION COSTS

Malawi is a very poor country and the National Parks, which are run by the government, are no exception. Originally the park was going to provide the materials for the bridge. However, prior to the 2006 expedition, it became apparent that the park did not have any money to spend on materials and therefore could only provide those that were naturally available i.e. timber. Timber alone was never going to be sufficient to build a thirty odd metre long foot bridge, especially if its main structure was to be safe from the threat of being burnt by poachers or wild bush fires. Thus the team took it upon themselves to raise the funds necessary to construct the bridge.

Companies and other organisations that supported the team in 2006 were targeted first and this was followed up by approaching those companies who had been unable to support the 2006 expedition for one reason or another but gave the team reason to believe they might consider supporting such a venture in the future. Again tailored letters were sent out to each organisation and these were accompanied with the expedition leaflet. If replies were not forthcoming then the letters were followed up with phone calls and/or emails. A total of £3150 was raised to cover the costs associated with the construction of the bridge; from four different companies and one charitable organisation (appendix F, table F1).

EXPERIENCES

The key thing when raising funds for an expedition is to start as soon as possible, for it is never too early to start applying to trust funds and grant awarding bodies. The principal of "if you don't ask, you won't get" was followed. Hence the letters which were sent out didn't just ask for financial assistance, they

Below & inset – Malawian notes and coins; the local currency is kwacha and tambala; the largest note was MWK 500 (just under £2) which meant large wads of cash were often carried around.

also asked for sponsorship, product discount or technical knowledge as applicable. Team members had a range of fund raising experience from previous expeditions. This had shown that targeting small companies was not very productive as many could not afford to help while responses from large companies were also not very successful due to the number of requests they get coupled with the fact they were often looking for more in return than an expedition like this could offer. Businesses also preferred to support local people and/or initiatives rather than foreign ones. Thus the fundraising for this expedition was targeted at medium sized UK based companies. Some team members had links to companies through their studies and these contacts were used to the team's advantage.

Generally letters proved to be more successful than emails. This is probably because letters are a bit more personal and emails from unknown senders can easily be blocked, ignored, or become lost in full inboxes. The team was successful in enlisting the support of a few companies to help with, and check over, certain design aspects associated with this expedition. Meetings were held with engineers from these companies in the spring of 2007 where issues relating to the design and construction of both the embankment and the protection of the river bank were discussed.

Finances

EXPEDITION ACCOUNT

The Imperial College Exploration Committee's Honorary Treasurer made arrangements with the Imperial College Finance Division to manage this expedition's accounts. In practice, Imperial College acted as the expedition's banker. All income was paid into an expedition bank account held by Imperial College and all expenses claimed back from this account through the college finance system. The expedition's financial position was continuously monitored by the Exploration Committee and all transactions were authorised by the committee's Honorary Treasurer.

OPERATIONS

Most pre-expedition expenses were paid personally by team members, by cheque or card and reclaimed later from the expedition account. Payment for the truck was made by electronic transfer to an English bank account held by Land and Lake Safaris through whom the vehicle was hired. Paying such a large sum of money in advance and in full is not recommended practice. However, the company had been used previously by both Biosearch Expeditions and the 2006 Imperial College Bridge Building expedition so the team knew the company was bona fide.

SUMMARY

Contributions received totalled £13,230; of which £2500 came from the five expedition team members' £500 personal contributions (see appendix F, table F1). A total of £8000 came from various different trust funds, with £6000 raised internally, i.e. from grant awarding bodies within the University of London, and £2000 raised from external sources. The remaining £2730 was donated by several different engineering companies, who we contacted with regards to supporting certain aspects of the expedition, such as funding for materials for construction. It also includes a small personal donation from an individual.

Expedition expenditure totalled £13,168.04 at the time this report was published. Just under half of this, £5,931.65, was spent on travel with the flights and the hire of vehicles accounting for 80% of this expense. The remaining 20% of travel expenses were mainly spent on fuel and other costs associated with the running and maintenance of these vehicles. Some £3,204.97 was spent on construction with the majority of this being spent on materials and equipment. A large part of this (28%) was spent on personal safety equipment. This high ropes access equipment had two purposes; firstly it was used in pulley systems to help haul the cables into place and secondly it was used by team members to protect them when working at height. Double the amount of equipment was taken as was used at any one time, so the team had the ability to rescue a casualty from height in an emergency. The amount spent on labour was not that much accounting for just 13% of the total construction costs. Out of the remaining £4,031.42, 32% was spent on subsistence, 40% on equipment, 9% on health and 19% on miscellaneous items (see appendix F, table F2).

This expedition's subsistence costs were greater than the 2006 expedition's. This was due to a number of reasons; namely team members collectively stayed in Malawi for more days than in 2006 and the team spent longer in Lilongwe at the beginning of the expedition, partly because two team members flew out several days before the rest of the team, and partly because it took a long time to get the import duty on the cables waived. Health costs were approximately half those of the 2006 expedition because a lot of medical supplies could be reused, individuals were already adequately trained and a cheaper source of anti-malarial medication was found.

This expedition raised a similar amount of money as the 2006 expedition, but its costs ended up not being as high. Some costs covered by the 2006 expedition did not have to be paid again (e.g. the shipment of the cables), and some things were purchased cheaper (e.g. the flights). Also, and perhaps most importantly, some costs budgeted for did, in the end, not have to be paid i.e. the tax on importing the cables. All this meant that this expedition's accounts were not as tight as in 2006. Thus the team were able to live and operate a little more comfortably, which saw expenditure in group expedition equipment increase, for example airbeds were purchased so team members could sleep in relative comfort rather than directly on a hard, cold concrete floor, and a UV water sterilisation lamp was bought so the team did not have to put up with the taste of iodinated water. The team were also able to replace lost or damaged equipment that did not belong to the expedition, from both this expedition and the 2006 expedition. More money was also spent on personal clothing and equipment because several of the new team members had to purchase key items which they didn't already possess such as sleeping bags, rucksacks, head torches and appropriate footwear. Hence the total amount spent on expedition equipment was significantly higher for this expedition than in 2006.

Below & inset – The team's truck making its way up onto the Nyika Plateau; this three tonne truck was used by the team while travelling in Malawi.

The current balance shows the expedition account is in credit to the tune of £61.96. This will be used to cover the costs associated with binding and distributing this report and to subsidise team member's travel costs for forthcoming expedition presentations.

Insurance

POLICY

Each expedition member was insured with AIG Lifeline Plus group personal accident and travel insurance. The policy was fully comprehensive and included £5 million personal liability and unlimited emergency medical expenses which covered air-ambulance fees and repatriation. It also covered lost personal property, stolen cash up to £1000, travel disruption and costs associated with being hijacked, kidnapped or ransomed. The insurance entitled holders to travel assistance and benefits while travelling in the form of pre-trip planning advice, concierge services, document protection and security advice. The team did take the precaution of uploading copies of their documents onto the secure document protection service prior to departure, though these did not need to be accessed during the expedition. The cost of such a policy is not known as it was a general policy for all Imperial College staff and students while working abroad.

EXPERIENCES

No dealings with the insurance provider were experienced. A few personal and group items of equipment went missing but it was difficult to say whether these items were lost or stolen. Making a claim for these items was therefore not thought to be worthwhile, especially as they would not have been valued very highly. Thus where it was appropriate, suitable replacements were purchased using expedition funds.

Travel

FLIGHTS

The team flew with Ethiopian Airlines from Heathrow to Lilongwe, via Rome and Lusaka, and with a change of planes at Addis Ababa International airport. The food was reasonable but the choice of in-flight entertainment left a lot to be desired. Each person had a huge 40kg personal baggage allowance which was nice as it meant the team had no problem taking out the extra materials they needed – these included 70m of 10mm steel cable weighing 35kg, several bags of wire rope grips and an 8kg pair of cable cutters. A few foods that could not be bought in Malawi were also taken out from the UK, though in comparison, these did not weigh much.

One team member lost their sleeping bag on the flight out. This was partly due to it being refused on the plane as hand luggage at the last minute and thus it had to be checked in separately on its own (i.e. it couldn't be put inside a rucksack or kit bag). The team member was assured it would arrive on the next flight the following day, but it actually arrived on the flight after that some three days later. Fortunately this happened to be the same day that the rest of the team arrived in Lilongwe and they picked up the sleeping bag, otherwise it would probably still be sitting in a corner of Lilongwe airport now! No other problems were experienced.

On arrival in Lilongwe the team changed some money at the airport. The exchange rates at the airport were more favourable than in the city so this was worth doing. Those team members who arrived first in Lilongwe caught a taxi into the city while the truck and driver that had been hired by the expedition picked up the remaining team members when they arrived a few days later. The journey from the airport to the city centre took just under half an hour.

TO ULEDI

The expedition hired a 3 tonne truck for the whole duration of the expedition, which was paid for by means of an electronic transfer before the team left England. This transport was arranged through Land & Lake Safaris in Lilongwe, who the 2006 expedition team used. For this expedition the team decided to hire a driver with the truck as the team did not feel confident that they would be able to solve any problems with the truck on their own. Thus it was deemed to be in the best interests of a successful expedition that a driver should accompany the team for the duration of the expedition. The truck and driver both turned out to be the same as in 2006. This worked well as it meant the team knew exactly what they were getting and the driver knew exactly what to expect, so everyone got on well together. Wellington, our driver, assisted with construction activities while on site and haggled for us when in town, thus he more than earned his wage.

The team travelled in the truck by road from Lilongwe to Uledi via Mzuzu. The 400 odd kilometre drive from Lilongwe to Mzuzu along the M1 was on relatively good, fast tarmac roads and took approximately five hours (map A). From Mzuzu the tarmac road was taken as far as Rumphi about 65 km away, which took about an hour. This section of road was not so good with many more potholes. The M24 was then taken past Bolero before turning off at Nyika Junction to the park gate at Thazima. This broad two-lane dirt road had deteriorated significantly since the previous year. The 60 odd kilometre journey from Rumphi to Thazima took two to two and a half hours. The road through Nyika National Park was a mountainous single lane dirt track. Its quality varied with some reasonable stretches but there were also some poor sections which required care and skill on the part of the driver. Standard saloon cars were seen travelling along this road but they were not suitable, as shown by the passengers of these vehicles who were often forced to get out and push or walk alongside their vehicle. The journey from Thazima to Chelinda took just over two hours while that from Thazima to Kaperekezi took approximately three hours (map A). Once at the Kaperekezi Gate the M9 turned into a two-lane dirt road, which was taken through Nthalire as far as the turn off to Uledi. The road was undulating in places and fast compared to the dirt road through Nyika. It

Below & inset – The vegetable market in Mzuzu where the team bought some root vegetables for the expedition.

took around an hour to get from the Kaperekezi Gate to Nthalire while from Nthalire to Uledi took another good two hours. The track from the M9 to Uledi had not been travelled along by many vehicles. In 2006 the track was in a pretty bad way but this expedition found that the first part had been maintained; substantially decreasing the amount of time it took to travel along this part of the road. Towards Uledi the road remained potholed and overgrown, but thankfully this was no worse than the previous year and so the truck was still able to reach Uledi.

GETTING AROUND LILONGWE

While in Lilongwe the team mostly used the three tonne truck to get around the city. Using such a big vehicle did not pose any real problems, not even with parking. Someone had to stay with the truck whenever it was parked to guard the contents in the back of the truck as there was no other way of keeping them secure. The roads were often quite busy. In some places it was quicker to walk but this was not possible most of the time due to the equipment and supplies that needed to be carried. On occasion's team members did walk in and around various parts of Lilongwe, though never on their own and never after dark. Care was taken to avoid the known danger areas of the city. Taxis were also used to get around the city when the truck was being used by other team members. Some problems were experienced in finding and getting taxis in certain parts of the city. Taxi fees were arranged in advance to ensure a fair price was charged.

Food

FROM THE UK

A few foods were taken out to Malawi from the UK. Some of these, for example spices, instant sauces and instant deserts, were taken out because those sorts of products could not be purchased in Malawi. Meanwhile other things such as sweets and chocolate were taken out because in Malawi they were either more expensive or not as nice. The weight of foods taken out from the UK was not that much and with a 40kg baggage allowance per person the team had no problem taking this food out with them. Similarly there were no problems getting this food through customs and into Malawi.

LOCAL

Most of the staple food was bought from supermarkets in Lilongwe, at the beginning of the expedition. Enough food was purchased to feed six people (five team members and the truck driver) for thirty days. This food had to be quick and easy to cook over a campfire, and needed to provide the essential nutrition required. Some planning was therefore done beforehand to work out what foods to buy and how much of each was required. Team member's likes and dislikes were also taken into account when planning meals. Some imported fruit and vegetables were bought in Lilongwe. These included root vegetables such as onions, potatoes and carrots which lasted a long time and other fruit and vegetables not available elsewhere in Malawi e.g. oranges, apples and cabbage. Quantities of these items varied according to how often they'd be eaten and how long they would last.

The bulk of the food was purchased in Shoprite (see appendix E for list of foods). Most items were no cheaper to buy in bulk, so the smallest packet sizes were bought for convenience i.e. instead of buying one 5kg bag of rice the team bought ten 500g bags of rice. This meant if one packet split, the amount of food lost was minimised. Also the small packet sizes made it easier to ensure the right amount of each food was cooked for each meal. Shoprite had a good range of own-brand products which were more expensive than English supermarket own-brand products but were on the whole cheaper than other supermarkets in Malawi. Some typical prices of the cheapest brands worked out at 42p for a tin of baked beans, £3.51 for 1kg of cornflakes, 95p for 500g of margarine, £1.05 for one litre of cooking oil, 60p for 500g of pasta, 37p for 1kg of sugar and 95p for a 400g tin of tomatoes (see Appendix E for a full list with prices). The quality of this food was reasonable, with the pasta being better and less starchy than in most developing countries. However, the tinned meats were not up to much.

On the journey to Uledi, locally grown fresh fruit and vegetables were bought from town markets in Mzuzu, Rumphi and Nthalire. These were cheaper than from the supermarkets and often tastier! Transporting these foods was difficult as they were often soft and prone to bruising or crushing. Four tomatoes cost approximately 11p, a large bunch of local greens 2p, three small aubergines 13p and four carrots 10p. Bananas were not as readily available as during the 2006 expedition. This may have been due to the expedition being a month earlier in the summer season. Nevertheless there was still plenty of sugar cane widely available from the road side. Eggs were purchased both locally from inhabitants in Uledi as well as from local markets and cost about 5p each. Several chickens costing £2.30 each were also purchased from local markets, while a goat was bought from a local for about £10. The goat and chickens were slaughtered, cooked and eaten with Nsima and relish as part of the bridge opening ceremony.

TRANSPORTATION

Some fragile foods were put into plastic containers to prevent them getting squashed or damaged. These plastic containers along with all the other food was packed tightly into cardboard boxes so that they would not bounce around and damage each other. The boxes of food were then placed in the back of the truck so as to not move around or take up much space. Fresh fruit and vegetables were carried in large open plastic buckets on top of the food boxes. This set-up protected the cardboard boxes full of food from being damaged by people sitting on them and ensured no one sat on the fresh fruit and vegetables as they could see it. Eggs were kept between two egg trays and carried on a team member's lap. On the rougher sections of the road the tray of eggs were held to cushion the blow of pot holes and thus prevent the eggs from breaking.

Above & inset – Using a UV light to purify a litre of water ready for drinking.

ULEDI

This expedition was not limited by the weight or amount of food that could be taken as there was plenty of room in the three tonne truck for food. The team were however limited by the length of time fresh foods would keep for. New supplies could only be got when the truck went to Mzuzu to collect building materials, which occurred just once during this expedition. The nearest market was at least a three-hour round trip from Uledi and thus it was not practical to make special journeys to get fresh foods from this market, not least because such trips would have left the truck short of diesel, which was only available in Rumphi and Mzuzu (map A). Subsequently the team relied upon a lot of tinned foods and root vegetables.

All cooking was done over an open fire, which gave the team much more freedom when it came to cooking things than if camp stoves had been used. A typical day on site in Uledi consisted of three meals. These meals were cooked by different members of the group, depending on who was not pre-occupied with site or construction activities. The cooking, washing up and fire making were roughly shared out amongst all team members and Wellington, the team's driver, who ate with the team.

Breakfast was a quick cup of tea or coffee with a bowl of porridge or cereal. Bread was also eaten for breakfast when it was available; namely at the beginning of the expedition and when the truck returned from Mzuzu midway through the expedition. A cold snack was eaten for lunch, as often team members were tired after a busy morning on site and lighting a fire required too much time and effort. Also it was often very warm so hot food would not have been ideal. Lunch was therefore a quick, uncooked meal which typically involved making your own sandwiches when bread was available and when not, having crackers or leftovers from the previous evening's main meal and turning them into a rice, pasta or potato salad. Fillings and accompaniments mainly revolved around tinned fish, cheese, spreads and crisps, together with fresh or tinned vegetables (e.g. fresh tomatoes or tinned sweet corn). Biscuits usually followed together with some fruit when available during the first few weeks of the expedition. Eggs, bananas and other local produce were purchased on occasions from workers in Uledi.

The evening meal was the main meal of the day. It was also the biggest social time of the day, when the whole team sat together around the camp fire to discuss how things were progressing on site and to make plans for the next day. Potatoes, rice or pasta were used as staple foods for each main meal and were accompanied by a selection of vegetables and spices to form for example a vegetable curry. Tinned meat or fish were used in meals roughly every other day to add some variety. Powdered sachets of blancmange, jelly, whip and custard were taken out from the UK and regularly eaten as pudding after main meals. Such puddings helped to re-hydrate individuals and keep their energy levels up. At the end of the expedition there was a little food leftover, some of which the team used while travelling back to Lilongwe and the rest of which was given to Wellington (our truck driver) and the scouts at Uledi, who appreciated this kind gesture.

WATER

Bottled water was used for drinking while in town and on route to and from Uledi. One litre bottles of water cost around 70-80 Kwacha (26-30p) depending on where they were bought. Two litre bottles were better value for money at 100 Kwacha each (~35p) but these were not as widely available and could often only be bought in the larger supermarkets. Bottled water was readily available both in Lilongwe and Mzuzu as well as in other towns throughout Malawi such as Rumphi and Nkhata Bay. Water for cooking with at Chelinda was obtained from an outside tap and boiled before use.

The river was the main source of water at Uledi and despite its size, the water quality was good because the river came down off the Nyika plateau and there were no settlements upstream of Uledi. The team typically took the precaution of sterilising the water before use. However, on occasions a few team members did drink straight from the river without treating the water. A UV light was used as the primary method of sterilising water and iodine drops were taken as a back-up measure. A well situated in Uledi near the school also provided clean drinking water. This was not used regularly as a source of water because the river water was much closer and therefore more convenient to collect. Water was collected in plastic buckets and lids placed over them to keep the dust and insects out.

EATING OUT

While in Lilongwe the team preferred to eat out rather than at Mabuya Camp, as the food was both better and cheaper in the city. The choice of budget cafes and takeaways was not that great with the dishes offered by most places being orientated around fast-foods. The fast-food places used by the team were the Hungry Lion, situated next to the entrance of Shoprite and Café Delight, situated next to a Total garage and the seven-eleven supermarket on the Kamuzu Procession Rd about 1 km northwest of Shoprite on the outskirts of Lilongwe. There were other fast food places but these two were used due to their convenience; the Hungry Lion was close to the main shopping area in the old town (Area 4) and Café Delight had plenty of parking large enough for a three tonne truck. The food at the Hungry Lion was reasonably priced and very popular with locals which meant there was often quite a queue at lunch time. At Café Delight the meals were cheap, portion sizes good and the quality of meat reasonable. However, the best thing was their speed of service – at a large proportion of restaurants in Malawi which the team ate at (especially outside of Lilongwe) the food took an unbelievably long time to arrive after ordering (i.e. a minimum of one hour and sometimes closer to two hours, irrespective of how busy the restaurant was).

For something a little different the team got takeaways from Shoprite, the biggest supermarket in Lilongwe (Area 4), which sold hot meals ready to eat. The beef stews were of high quality and very meaty by Malawian standards. They were priced by their weight which made these a little more expensive than other takeaways. There was also a Nando's near Shoprite, which served the traditional peri-peri chicken and chips that the restaurant chain is famous for all over the world. Chicken portions were small and not as meaty as Nando's restaurants in the UK. However, this was typical of chicken portions throughout Malawi.

Inset – An A-frame at Mabuya Camp with the team's expedition supplies outside.
Below – Naomi puts another box of expedition food on the stack ready to be loaded onto the truck.

Complete meals with drinks typically cost around £1.50 per person. Fast food places used frequently by locals were the cheapest with meals working out at about £1.20 per person while dishes at more upmarket restaurants, such as Nando's cost approximately £1.80 per person. The cleanliness of the restaurants visited was reasonable and the team experienced none of the hygiene problems sometimes associated with eating out in developing countries.

The team had their expedition meal at Buchanan's Grill. This restaurant was a bit out of the way but that was more than made up for by its lovely setting in beautifully landscaped gardens. The service was excellent, the food of superior quality and the variety of meat on the menu quite mouth watering after a month of meat deprivation. An equally pleasant restaurant was Don Bironi's Bistro which is perhaps more conveniently located in the Old Town (Area 4), though the setting is not as nice. The food was excellent and the menu offered a more diverse range of meals to include pizza, pasta and fish dishes as well as the typical grilled meats one would expect.

In Mzuzu, the team ate at the Mzoozoozoo hostel where they also stayed. The bar menu was not that extensive but the variety offered met most tourist's needs and included decent dishes such as steak, meatballs, omelette and sausages, not typically found elsewhere in Malawi except in the touristy restaurants in Lilongwe. Portions were large and the quality was excellent. There was sometimes a bit of a wait for food if other people had ordered before you but there was something reassuring about knowing the food was being freshly cooked. The most expensive meal was a mixed grill which cost £2.50 with the cheapest meals about half this amount.

The team sampled the local traditional cuisine at Lucy's Restaurant in Nthalire. The meal, which is typically eaten with hands, consisted of a lot of nsima, a bit of relish and a small piece of chicken with not much meat on the bone. Nsima is the local staple of boiled maize flour while the relish consisted of boiled vegetable leaves and some tomatoes. Everyone found the nsima very filling and a bit bland on its own. Although the dish wasn't that amazing, the team appreciated the experience and at 50p per person it was dirt cheap too.

Accommodation

ULEDI

While in Uledi and on site, the team stayed in one of the empty National Park buildings. The National Park had three buildings in Uledi all set around a central dirt courtyard (map D). Each building was split into two separate three-room apartments. The National Park scouts permanently stationed in Uledi lived in another one of the buildings. The buildings were made of bricks with corrugated roofs and concrete floors on which the team slept. Airbeds were taken to sleep on, as in 2006 camping mats did not do much to soften against the hard floor making it fairly uncomfortable to lie on. Not all the doorways had doors but where present they were wooden and lacked handles and locks. The windows were small, so the rooms were often quite dark but this kept them cool during the day. They contained glass blinds though some slats were missing. Two rooms were used for sleeping in, another two for keeping construction tools and materials in and a fifth for our food.

In 2006 the team had problems with mice eating through rucksacks and kit bags to get at the teams' food and first aid supplies so before arriving in Uledi this expedition prepared fully to prevent the same thing happening again. Measures undertaken included storing bagged foods in sealed plastic containers and constructing shelves to store foods off the floor. Cooking was done over an open fire in the courtyard. Fire wood was collected from just inside the National Park on the other side of the North Rukuru River, usually with the help of locals due to the dangers of going into the bush alone. Two toilet sheds were permanently situated at the back of one of the buildings and these contained concrete floored long drops which the team used.

TOWNS & CITIES

In Lilongwe the team stayed at Mabuya Camp. Typically two people stayed in a chalet or an A-frame ($15 per night) as this gave the team room in which to securely store equipment and supplies, while everyone else stayed in the dormitory or camped as this was cheaper at $5 per person per night. The accommodation was as basic as it gets in Lilongwe but the team preferred to stay there, rather than in the more expensive bronze rooms at Korea Garden Lodge, where the 2006 expedition team stayed, because there was a livelier atmosphere and the owners were friendlier. One drawback of this was that Mabuya is situated further out from the centre of Lilongwe, so while it was feasible to walk to the shops from Korea Garden Lodge, this was not really practical from Mabuya Camp. The camp was always busy with many groups staying there each night. Despite this there were plenty of toilets and showers, so there was never really any queue, and there was also never any shortage of hot water. The campsite bar was situated next to the dormitories which meant it was often quite difficult to get an early night's sleep while staying in a dorm. However, the bar was a good place to spend the evenings with a TV, games, books and lots of other people, all of whom had an interesting story to tell. There were plenty of extra communal seating areas just outside too. Some meals were eaten on site at the restaurant but they only did a set menu in the evening. The food was not that great and was relatively expensive so the team preferred to head into town to have a better, and often cheaper, meal.

In Mzuzu the team stayed in a small friendly hostel called Mzoozoozoo. The accommodation was in wooden bunkhouses and all beds had mosquito nets. The facilities were a bit primitive but they were adequate for what the team wanted and an absolute bargain at less than £2 per person per night for a bed. Camping was also permitted within the grounds of Mzoozoozoo and cost just under £1 per person per night. The hostel was within walking distance of the town centre and had an enclosed yard where it was safe to park vehicles and leave tents. The food was good and cheap, and the on-site bar acted as a local hub for the ex-pat community, as well as a good place to meet other travellers.

Below & inset – Two-way radios were used to communicate between the east and west river banks; here with the upstream handrail cable in place, the downstream side of the cable is being put in place.

CAMPING

Some team members camped once at Chelinda when travelling between Mzuzu and Uledi and again at Nkhata Bay when spending a few days at Lake Malawi at the end of the expedition. At Chelinda, a tent was pitched on the green outside the main park office buildings, with the parks permission. An outside tap provided water and there were toilets round the back of one of the buildings which were used. Getting up in the morning was a chilly experience as overnight the temperature dropped significantly due to the relatively high altitude of the plateau. Wellington (the truck driver) and the other team members slept inside one of the buildings next to a log fire where it was warm, though the drawback of this was the room was quite smoky.

At Nkhata Bay some of the team camped at Butterfly Lodge, while others stayed in a dormitory. The site was picturesque and idyllic, set under the trees on the rocky shoreline of the lake. The total cost for five people (two tents) worked out to be £5.75 per night. Wooden huts on stilts were also available to rent for around twice the price. Facilities were as you would expect with proper toilets and wash rooms. The lodge had some canoes which were essentially hollowed out logs that residents could try and paddle if they wanted to, when they were not being used for business. The team ate at the neighbouring Mayoka Village and also cooked on the beach using a camp stove (which had been taken on the expedition in case of emergencies).

Communications

PRE EXPEDITION

When planning for the 2006 expedition the team experienced difficulties communicating with Malawians over the telephone. This was partly due it being very hard to understand what was being said and that it was often difficult to get through to the right person. Thus during the 2006 expedition the team tried to get emails from all their new contacts so contact could be made via email when planning for this expedition. These email addresses proved invaluable along with those of Land and Lake Safaris and Mike Labuschagne at Nyika National Park, which had been used prior to the 2006 expedition.

The team's accommodation in Lilongwe at the beginning of the expedition was arranged and booked in advance via email. This was important as the team needed to know where to meet up as two team members flew out a few days before the rest of the team. Korea Garden Lodge, where the expedition team stayed in 2006, and Mabuya Lodge, where the team stayed in 2007, both replied within three days of the initial enquiry. This length of time to receive a reply was fairly typical of businesses in Malawi run or owned by foreigners. Businesses that are run by Malawians are less likely to have email and those that do took longer to reply. No money was paid in advance for reserving accommodation.

Dan was in regular email contact with Brighton Kumchedwa (Deputy National Parks and Wildlife) and William Gondwe (SDV) between the 2006 expedition and this expedition, to try and get the import duty waived on the bridge's cables which had been shipped to Malawi from Europe in 2006. Communicating by email meant copies of documents could be provided to the relevant authorities without much delay, or risk of getting lost.

CONTACTING HOME

While in Malawi, team members used the internet to communicate by email with friends and family back home. The internet could only be accessed at major population centres such as Lilongwe and Mzuzu, as well as at tourist hot spots such as Nkhata Bay. Prices varied widely and were most expensive at tourist hot spots where there was typically just one internet place with only one or two computers. An average price worked out at approx £3.00 per hour, which was better value for money than if the team had used the phone to communicate with people back home. Most internet connections were not particularly fast compared to western standards, and this was a little frustrating at times. The connection speed in Mzuzu was faster in some places than others so trying different cafes to find the fastest one is recommended. In Lilongwe, team members used the internet facilities at Mabuya Lodge.

AROUND SITE

Two-way radios – the cheap sort, available from most outdoor shops, with 3-5 km limited range - were taken to be used on site to aid communication. These proved invaluable on the 2006 expedition when it was often necessary to communicate with people on opposite banks of the river. However, these walkie-talkie radios were not used much on this expedition because the nature of the tasks being undertaken meant that there wasn't the need for the same sort of instant communication between the team members. Also once the decking was laid, it was just as easy for team members to walk across the bridge to talk to one another as it was to try and make radio contact. Each radio was taken out to Malawi with fully charged one-cell battery together replacement AA batteries. These AA batteries were not required as the original battery lasted for the duration of the expedition. A small portable solar charger was also taken so the teams AA batteries could be recharged on site as necessary.

IN ULEDI

While in Uledi, the team could have used the national park's radio at the scout base to make contact with the outside world if they had needed to. However, such communications would have been sporadic at best because the radio was not always functional. The radio's battery and some of its parts were regularly used for other things and so communication was only possible once the battery had been solar charged and the radio rebuilt. Then it was a case of persistence as any communication sent could only be received at Chelinda and the radio station there was not permanently manned. Chelinda were in much better radio communication with both the Department of National Parks and Wildlife in Lilongwe and the rest of Nyika National Park including its headquarters at Thazima.

Below & inset – Naomi wearing typical clothes worn on site and using personal protective equipment to stay safe while working at height.

WITH LOCALS

The team made a real effort to learn simple instructions and nouns in Tambuka - the native language (appendix J). This significantly increased direct communication between team members and the workers which led to a more relaxed atmosphere on site. The psychological effects of this were immediately apparent with the workers saying when they didn't quite understand what they had to do. This was in contrast to the previous year when the majority of workers just said 'yes' to everything even when they didn't understand what was being asked of them. The use of Malawian foremen, as well as our truck driver Wellington and two park scouts to disseminate instructions increased this year. This was highly effective as those Malawians picked to be foremen had a better grasp of English and showed they could take the initiative when others were not so sure what to do. Whenever anything was translated, it seemed to take ten times as long to say in Tambuka as it did in English, which was rather disconcerting at first. This meant that the team had to be concise in what they said and communication was often kept to single sentences, or just a few words. Saying something like hurry up often provoked a translated outburst lasting several minutes after which the workers invariably look fairly cowed. But then apparently Malawians shout angrily at each other when they are being happy.

Clothing & Equipment

This section gives a general outline of some of the clothing and equipment used by the team. For a complete list of the things taken along with comments about individual items see appendix A for group equipment, appendix B for personal clothing and equipment, appendix C for first aid equipment and appendix D for construction equipment.

CLOTHING

Each person on the team took two complete changes of clothes together with some extra items of clothing for comfort. One set of clothes was worn while working on site while the other was worn when in towns and cities. Typical clothes worn on site were a pair of durable, hard-wearing trousers and a T-shirt, together with a fleece for the chilly mornings and late evenings. Old clothes, which were already quite worn were taken, so it didn't matter too much how dirty they got or if they got damaged. A good sunhat was also essential when working on the west bank as there was very little shade on that side of the river. Trekking trousers, a long-sleeved shirt or t-shirt and a wind-proof jacket were worn in and around towns and cities, and for travelling in. Brand new clothes were not taken as they would quickly get trashed due to the demands imposed on them by the nature of expeditions together with the dust and dirt associated with living in developing countries. The clothes worn when in town were in a better state of repair than those worn on site so the team did look reasonably respectable but not so that they stood out from what the locals wore.

FOOTWEAR

Most team members wore an old pair of approach shoes on site. They were fine for getting around and the protection offered by ankle boots or steel toe-caps would have been a bit over the top especially when many of the locals went around with bare feet. Approach shoes are also more comfortable and breathable than most site boots. Some of the team chose to take their shoes off every time they crossed the river while others kept them on when wading across. Taking them off had the advantage of having dry shoes but the inconvenience of having to stop, take them off, cross the river, and then put them back on again. The main draw back from leaving them on, apart from getting wet shoes, was sand often got in causing rubbing. Some team members also took sandals and these were worn on days when a large part of the day was spent in or crossing the river.

AIRBEDS

Team members slept on a concrete floor in one of the national park buildings. Airbeds were taken to sleep on because foam camping mats did not really offer enough cushioning. There is always a danger with inflatable mattresses that they could get a puncture and thus be effectively useless. For this reason puncture repair kits for each airbed were taken and each person also took a foam mat as well just in case. A few of the airbeds did go down slowly. The loss of air was not sufficient to warrant trying to find the source of the leak so instead they were just topped up with air daily. This was a bit inconvenient but it was much better than not being able to sleep because the floor was too hard. Some team members also found the single airbeds a bit narrow and kept rolling off in the middle of the night.

CABLE CUTTERS

A pair of Felco C112 steel cable cutters was used to chop the suspender cables with. These were the top of the range professional steel cable cutters which used a force transmission system to provide additional cutting power. They weighed some 3.6 kg and were 73 cm in length. The maximum cutting diameter of the Felco C112 cutters is 12.7 mm (0.5 inches) which meant all but the largest steel cable (the 26 mm walkway cable) could be cut in one go using this tool. This was not a problem though as the bridge design meant that there was no need to cut either the walkway (26 mm) or the handrail (11.3 mm) cable. The walkway cable did have to be tapered in order for it to be fed through the anchor block and this was done by separating the main strands of the cable and chopping these one at a time. The cutters were also used to chop the 8 mm reinforced steel rods used in protecting the west river bank and in the retaining walls.

TOOLS

Team members used a torque wrench to fasten the large wire rope grips (on the 26 mm and 11.3 mm cables), while a normal wrench and spanners were used to attach the small wire rope grips to the suspender cables. Spare sockets and spanners were taken out, many of which weren't used. The team felt justified in taking most of this back-up hard wear, because without the right sized tool the wire rope grips

Below & inset – Malangalanga road in Lilongwe; the busy and congested streets posed a potential risk to team members when walking around so care was required.

couldn't be done up and that would have jeopardised the completion of the bridge. Thus the team had to guard against all eventualities including the possibility of equipment breaking and / or getting lost. In the end one of the wrenches broke on site and at least one socket was lost so taking replacement tools was worthwhile. However, doubling up on both sockets and spanners was probably bit of an over kill; there was probably no need to double up on the spanners especially as these could be easily purchased in Mzuzu. Of course there was always the danger of loosing a kit bag of equipment while flying out to Malawi. To guard against this all the key primary equipment (e.g. torque wrench and socket set) was put in one kit bag and sent out with Teck and Jumana while all the spare secondary equipment (e.g. back-up wrench, sockets and spanners) was taken out by the remainder of the team a few days later. Should the bag of key equipment have got lost then Teck and Jumana would have had time to let the rest of the team know who could then do something about it before they left the UK. Fortunately the only thing which did not arrive was Teck's sleeping bag so the rest of the team took a spare one out for him just in case his didn't turn up.

WATER PURIFICATION

A Steripen was taken to purify the river water with before drinking. Steripen's contain a UV lamp which when switched on and placed into water destroys any waterborne diseases present. Indicator lights on the side of the pen showed when the water had been successfully purified and when purification had failed and needed to be repeated. Using the Steripen was better than using Iodine because Iodine affects the taste of the water and the water has to be left thirty minutes after iodine has been added before it can be drunk. However, the Steripen did have a few drawbacks. Firstly the lamp had to be agitated in the water for a good couple of minutes which often tired the wrist of the person holding it. The Steripen consumed batteries quickly. It took four AA batteries at a time which made it quite heavy. A set of batteries did not last long. This was probably due to a combination of factors including the frequency with which it was used, the length of time it took to purify one bottle of water and the high energy requirements of the lamp. The team took a solar battery charger so the high battery consumption rate wasn't a problem but it would have been had the team not been able to recharge batteries. Iodine was still taken as a back-up method of purifying water and this was just as well as there were one or two occasions when the Steripen wouldn't work – probably because water got into some part it shouldn't have.

Risks

Expedition members faced a range of potential hazards, some of which were to do with the nature of this expedition and others to do with being in Malawi; a third world country in Africa. In general the risks posed by the climate, wildlife, social circumstances and diseases were increased by the remoteness of the area in which the team were operating along with the general nature of the construction activities undertaken. The largest pre-emptive measure taken against these risks was awareness. All risks were thoroughly assessed prior to the expedition and the risk assessment for the 2006 expedition was updated in light of that expedition. All team members were briefed in detail about the risks, given written information about them and reminded of specific risks at certain times during the expedition. A full medical kit was carried, and members of the team were trained to an appropriate level for this remote expedition. Specific hazards, their consequences and how they were managed is detailed in appendix G.

ROADS

Malawi is not a particularly dangerous place for westerners although occasional muggings and car-jackings do occur so taking precautions is recommended. Road safety poses the greatest risk to foreigners with the standard of vehicles and drivers being relatively poor. The volume of traffic outside large towns and cities is generally low, though despite this (or perhaps because of this) Malawi has a large number of road-related injuries and deaths each year. This is primarily due to social reasons, with the majority of the population not being road-aware. Many people walk quite large distances along roads almost on a daily basis to the nearest market or town and some fail to stay on the side of the road. This general lack of awareness results in a large numbers of pedestrian casualties. All members of the team were highly road conscious, and although several members could legally drive in Malawi, the team hired a driver who did the bulk of the driving. No travelling was done after dark (about 6 pm) as this is when the risk of an accident is greatest with lots of people continuing to walk along and down the middle of roads. Lights on Malawian vehicles were poor to non-existent as were road markings. And as if this wasn't bad enough all that remained of the roadside crash barriers were short wooden posts – presumably the locals had removed the corrugated metal barriers for personal use.

CONSTRUCTION

Some of the work undertaken on site during this expedition had the potential to cause a serious or potentially fatal accident; thus strict controls were introduced to ensure such accidents did not occur. The heaviest steel cable, which was manually hauled to a height of six metres by some thirty men, weighed just less than 400 kg. The cables were walked into place, with men spaced at regular intervals ensuring they carried no more than 20 kg per person. In most instances the weight carried by each person was significantly less than this. The risk of injury to workers was also reduced by giving the workers frequent rests. Once the cables weight was supported off the ground, the area underneath the cables was cordoned off using red and white tape taken out to Malawi from the UK for this purpose. The tape was placed across the river both upstream and downstream of the bridge and the area in between was out of bounds. This cordon remained in place until both the handrail and the walkway cables had been hauled into place, adjusted and secured into their final resting position. Workers were threatened with losing their job if they ventured into this out of bounds area, to make them aware of the seriousness of the danger.

Three way pulley systems were rigged onto the loops built into the anchor to pull the cables into the correct hanging position. The forces involved had been calculated prior to the expedition and suitable equipment purchased to withstand these forces. A taut 11 mm dynamic safety rope was used while the

Above & inset – Jumana using high rope access equipment to minimise the risks associated with working at height.

cables were being raised to prevent them dropping back to ground, and this was backed up with a second rope with a bit of slack in it. These safety ropes were attached to the steel cable using the cable grips; this caused the static rope to be permanently deformed and resulted in localised burning of the rope's sheath which was slightly concerning. These burns were caused by Malawians over-tightening the grips so after this was discovered, the grips were all tightened by team members. The static safety ropes were inspected carefully before each use and damaged sections were not used again.

Once the cables had been fixed in place, team members walked out along the cables to affix the suspender cables and lay the decking. Team members who did this were required to use specialist high ropes access equipment which involved wearing a climbing harness and clipping onto the handrail cable using two karabiners on the end of two lanyards attached to each harness. The two lanyards enabled team members to safely pass obstacles on the cable by unclipping one karabiner and re-clipping it past the obstacle, before unclipping the second karabiner and doing the same with this. In this way team members could safely move past suspender cables which linked the handrail and walkway cables, while always being secured to the handrail cable by one karabiner. Helmets and chest harnesses were also provided. Decking units were also attached by slings to the handrail cable while they were being walked into position, so if dropped they would not fall off the bridge. All team members were shown how to use this high ropes access equipment and were initially supervised by Naomi who was competent with these techniques. No more than two team members were allowed on the cables at any one time and where possible the two team members clipped onto different cables to avoid the potential of overloading one particular cable. Four complete sets of high ropes access equipment were taken to Malawi, despite the fact only two people were allowed on the cables at any one time. This was so that if those working got into difficulty there was enough equipment on site for other team members to safely rescue them.

WILDLIFE

Malawi is home to a large number of dangerous snakes, spiders, scorpions and plants. Since one side of the site was in the National Park the risk of encountering snakes was increased. Small scorpions were also seen at least once per week, mostly by the camp fire as they were attracted by the hot rocks and glowing embers. For this reason particular care was taken when re-lighting or stoking up fires; all team members were advised to wear closed shoes, and never to walk about barefoot, although some used sandals while river based.

Team members did not work on site alone, or go out of camp after dark, minimising the risk of encountering dangerous wildlife. A black snake around two metres long with a thick body encroached on the construction site on the east bank when some ten workers and two team members were busy there. The snake behaved aggressively and was eventually driven away by sticks and stones thrown by the workers, after skirting round the edge of the site at great speed. This snake was similar to the one killed the previous year on the same side of the river, which was thought to be a black mamba.

There was little risk from large animals on site. However, when travelling through the National Parks the team saw crocodiles, hippos, elephants, monkeys and various antelope. Advice was followed to avoid dangerous situations arising. This included not leaving the vehicle unless a scout was present, keeping the engine running, and travelling slowly when passing wildlife.

Medical Issues

FIRST AID KITS

Two group first aid kits were taken to Malawi. The main kit, which contained a complete set of expedition first aid supplies including antibiotics, creams, ointments, dressings, instruments and other remedies, was kept on site in Uledi for the whole time that members of the team were there. A second kit was kept in the truck so that when some team members travelled to Mzuzu to collect materials – a three-day round trip – they too had immediate access to first aid supplies. This smaller first aid kit addressed the risks associated with driving in Malawi coupled with the remote location and harsh environment in which the team operated. The kit contained painkillers, antiseptics, basic antibiotics and dressings to deal with a major trauma but not with the day-to-day illnesses and minor injuries of being on site or in camp. In addition to these group first aid kits, every team member carried a personal first aid kit containing emergency first aid and enough painkillers, plasters etc. for their own use throughout the trip. For a complete list of supplies in each of the first aid kits taken see appendix C.

EMERGENCY EVACUATION PLAN

The team's emergency evacuation plan was to use the expedition truck to transport any casualty from Uledi to the nearest airstrip at Chelinda in the heart of Nyika National Park. This would have involved five hours driving over rough dirt tracks. From Chelinda a casualty could be flown direct to a private hospital at Lilongwe. Those left in Uledi would try to make radio contact with the scout camp at Chelinda to ensure a plane was ready and waiting to swiftly transfer the casualty to Lilongwe. However, such radio communication could not be relied upon because the radio stations were not permanently manned. Also the radio at Uledi was rarely in working order because parts were often used for other functions and pieces frequently needed repairing. Should an evacuation not have been possible by plane from Chelinda, say due to fog, then the truck would drive the casualty to Mzuzu (six hours from Chelinda), where the casualty could be flown (less than one hour) or driven (another five hours) to Lilongwe private hospital or admitted to Mzuzu general hospital as necessary.

Evacuation in a medical emergency would have been a difficult procedure without use of a vehicle. The team's contingency evacuation plan in case the truck was not at Uledi or had broken down relied heavily on getting a radio message out to Chelinda. Despite the radio not always being operational and manned, the team was fairly confident that if needed, radio contact with Chelinda could almost certainly be made within twenty fours. Park staff at Chelinda could then assist either by liaising with third parties or by sending a

Below & inset – A barefoot worker transports a load of earth to the stock pile; some workers suffered minor injuries to their feet because they did not have any shoes.

park vehicle to Uledi to evacuate the casualty. If making contact with Chelinda looked unlikely to succeed, say because the radio was known to not be working, then a local person would have been sent to the junction with the main road (the M9, map A), and another person to Nthalire, to try and get assistance from a passing vehicle. Both were about 30 km away from Uledi and would have taken 3-6 hours by bike and on foot. Not many vehicles used the M9. Only one or two vehicles passed along the road every hour, and most of these were large goods trucks. Thus it may have taken some time to find a suitable vehicle that could assist. Some time could be saved by moving the casualty closer to the main road. However, if their condition allowed this then the likelihood is that this would not be undertaken because the casualty's condition was unlikely to be so critical, and thus the small amount of time that would be saved was not worth the huge amount of effort that would be required.

VACCINATIONS & ANTI MALARIALS

Most of the team were already immunised against hepatitis A and B, typhoid, diphtheria, tetanus and polio, though those that required boosters or new vaccinations had them. Team members also received immunisations against rabies as the risk was believed to be significant. Vaccination against yellow fever was not required for Malawi but is required for some neighbouring countries. All team members used Doxycycline anti-malarial tablets which were taken as prescribed for one week prior to the expedition, during the expedition and for four weeks after the expedition. No serious side effects were experienced although one team member was ill on a few occasions in 2006 when the tablet was not washed down with plenty of water. There was concern that team members may suffer from photosensitive skin rashes. As a result, suitable clothing was taken so most parts of the body could be covered-up and protected as necessary. These preventative measures did not need to be implemented as no one developed any photosensitive skin rashes.

MEDICAL REPORT

Members of the team went down with various different illnesses causing logistical problems for those left on site. One team member was incapacitated by their health for the best part of two weeks, and on average one other person was either off or on 'minimal' duties due to illness. This stretched the team tight. On at least three days there were only two functional team members on site. Due to the number of team members who were ill at any one time, it was necessary to make greater use of Malawian 'foremen,' a method which proved highly effective. These 'foremen' were employed by the 2006 expedition team and thanks to their thorough training they were able to lead various tasks themselves.

One member of the team contracted what was thought to be Malaria, despite taking Doxycycline anti-malarial medication daily as prescribed. Symptoms included a high fever (up to 42°C), associated sweating, hot/cold spells, dizziness and tiredness. The patient was monitored by the medical officer once every 2-3 hours and more often when possible. After three days of severe symptoms, with no significant improvement in their condition, they were sent together with another mildly ill member of the team to Mzuzu for prognosis and treatment. The mildly ill team member was suffering from diarrhoea and had experienced other bouts of illness on the expedition prior to this. The team therefore felt it was prudent that both ill persons should leave with the truck as anyone left in Uledi would effectively be stranded until the truck returned three or four days later. And if during this time their medical condition were to worsen then they would have been put at severe risk. As it was, the mildly ill team member's condition improved on the way to Mzuzu and this individual required no further action.

In Mzuzu, a local doctor took a blood sample from the other ill team member using techniques obsolete in the developed world. After analysing the blood on a slide under a microscope he confirmed a certain strain of Malaria was present and prescribed a course of Arinate (Artesunate medication for the curative treatment of Malaria manufactured in Belgium). One course involved taking an initial two 100mg tablets followed by one 100mg tablet per day for four more days. The individual continued to take the standard daily dose of Doxycycline anti-malarial medication throughout the illness and while taking Arinate. Having started the treatment, the team member returned to Uledi with the truck where they made a full recovery once the course of Arinate had been completed. After the expedition the team member had blood tests back in the UK to check the disease had been properly eradicated. The results found no trace of Malaria and showed the individual was highly unlikely to have ever contracted the disease. So what the illness was remains a bit of a mystery.

Two team members were unwell quite frequently, often for several days at a time. This was attributed to their susceptibility to the expedition environment which included their diet, the climate and the nature of the work being carried out. Symptoms included headaches, nausea, dizziness and mild diarrhoea but without fever. Rehydration sachets were prescribed once for a two day bout of mild diarrhoea, and apart from this only non-prescription painkillers were administered.

First aid treatment given to workers was minimal, and included things like antiseptics and plasters/bandages for mild cuts and abrasions. Painkillers were also dealt out sparingly and workers had to complain consistently over a day or two before the team considered whether to give them any. This was necessary in order to assess that their need was genuine as many workers saw painkillers and other medication as some sort of prize or reward. They would not receive the medication ordinarily, so although it may seem a bit harsh to initially refuse treatment, it did mean the team's medication was saved for real emergencies (both within the team and the local community). First aid was always administered within the camp at Uledi. First aid supplies were kept out of sight of everyone except team members, even those being treated, to reduce the risk of causing unwanted problems. Workers who were given drugs had to take them in front of the team member who gave them it. They were not allowed to take them away for consumption later. Similarly dressings and other treatments were never given to people to take off site, as this would open up the potential for these to be misused, stockpiled or used for alternative purposes.

Below & inset – Lizards liked to lie in the sun on the warm bricks of the west tower; here one inspects the cement.

Expedition Impact

ENVIRONMENTAL

One of the expedition's main priorities was to minimise, as much as possible, its environmental impact. The impact of the team and the bridge was assessed prior to the expedition and standard operating procedures were drawn up to minimise any environmental impact. These operating procedures were adhered to, and continuously monitored, throughout the expedition and where necessary refinements were made. The team worked sympathetically with the local workers on site by encouraging them not to damage their environment. This ranged from making sure pollutants didn't enter the river to ensuring the size of the site cleared was kept to a minimum and trees were not cut down unnecessarily.

The British Mountaineering Council's (BMC's) guidelines on waste management were followed throughout the expedition. All burnable rubbish was disposed of daily, on the camp fire. Tins, cans, jars and plastic tubs with lids were all given to the local scouts so they could reuse them. Such items were gratefully received as the people in Uledi lived off the land and therefore they never ate nor could afford the foods that came in this sort of packaging. The National Park camp at Uledi had a 1.5 m deep pit for rubbish and the team placed all their other non-burnable food packaging in this to eventually be buried. Some of this rubbish was also taken back to Mzuzu and Lilongwe, and disposed of in the bins where the team stayed. Toxic waste was minimised by using rechargeable batteries as much as possible and where normal batteries were used, these were brought home to England for proper disposal. At the end of the expedition, the sites on both sides of the river were thoroughly cleared of all left over construction material. Such operating procedures minimised any potential visual, chemical and/or physical impacts. No equipment or non food items were dumped at any time during the expedition.

While in Uledi the team used the toilets at the National Park scout camp to dispose of all human waste. The toilets were made up of two separate deep pits, each covered by a thick concrete slab with a hole in the middle. Small straw huts had been constructed over these semi-permanent long drops to give a bit of privacy. These human waste pits had been dug in clayey ground and were set back, far away from the river and any flowing water.

COMMUNITY

The employment of thirty to forty local people to help construct the footbridge in Uledi brought a short-term economic boost to the community. Without this work, these people would have been unemployed as there was no other paid work in Uledi. These people were mainly subsistence farmers, simply growing enough food for them and their families to survive. Any surplus crops would be taken to market where a small income could be made. Such an economic boost will hopefully enable the community to invest in things that they otherwise wouldn't have been able to afford, for example new materials for their homes or new tools for farming. The workers also learnt how community members can work together to achieve things they wouldn't be able to do on their own. It is hoped the workers will use this knowledge and apply these skills so that in the future the community can work together and undertake its own developments. All local tools purchased for each expedition were left with the village chiefs, thus giving the community the means to do this. These tools should last for between 5-40 years depending on the item and how often it is used. This, together with the short-term boost of disposables like the left over cement, could lead say a temporary mud building being replaced with a more permanent one, or an extension being carried out to an existing building such as the school.

Patrols can be undertaken throughout the year now there is a bridge across the North Rukuru River. Uledi Camp is therefore estimated to triple in size and function, as the bridge will result in more scouts being stationed in Uledi to effectively patrol the park. This will in itself bring other improvements to the infrastructure, for example, the road is likely to be improved if it is used more frequently. When the bridge was officially opened the National Park actively started recruiting locals to become park scouts, and a list was made of the workers who were interested in doing such a job. There is also the possibility that the communities understanding of the English language may improve in the long-term, as scouts learn English as part of their training. With time and the establishment of proper tracks, it is possible Uledi will develop a large enough passing trade to sustain a shop or set of small shops and perhaps even a weekly market.

The other possible long-term impact of the expedition is the outlook of the workers involved in building the bridge. Some of the workers from the 2006 expedition had already left the community for work in more affluent areas, while others had moved to a neighbouring district where they worked in a mine which had recently opened up. Those workers employed during both the 2006 and this expedition will have a wider skill base and possibly more ambition. The community works through a system of hereditary chiefs, and although this system was respected, the 'bridge representative' in the community was elected on merit only. He now heads a bridge committee which will maintain and look after the bridge.

Photography

DIGITAL CAMERAS

Dan, Harriet and Teck took the majority of the photos during the expedition. All were fine for most purposes but none had a wide enough angled lens to capture a good photo of the whole bridge from upstream, once complete. The best that could be done was to take several photos and stitch them together (see panorama E - on map sheet D)

Dan used a Canon PowerShot A85 digital camera with two 1GB and one 512MB memory cards. The camera uses four AA batteries at a time which makes it relatively large and heavy compared to other compact cameras. Picture quality was reasonable with 4.0 effective mega pixels, 3 x optical zoom and a large screen. The camera was fully automatic, very easy to operate and took up to 3 minute long movie clips. Photos were taken on the highest resolution setting giving finely compressed images with dimensions

Below & inset – Most of the natives enjoyed having their photo taken; here Richard Nyirende, a Nyika National Park scout poses for a photo before heading out on a five day patrol along the northern boundary of the Park.
Bottom right – Two workers clear the site by cutting back the long grass.

of 2272x1704 pixels. Short movie clips were also taken on the highest resolution setting, which limited their maximum length to thirty seconds. Movies were recorded at ten frames per second, with dimensions of 640x480 pixels. Dan took over 550 photos and almost 300 video clips, which filled the 2.5GB of memory he took, however this was reduced to about 2GB after editing the last of the movie clips once back home.

Harriet used a Canon PowerShot A460 digital camera with a 1GB memory card. This stored over 350 photographs as well as several short video clips. The camera takes 2 AA batteries, which lasted very well as they only had to be changed once during the expedition. With 5 mega pixels, 4 x optical zoom and a macro mode, the camera was excellent for close-ups and therefore very useful for photographing details of the construction process. The camera was sturdy and easy to operate. Meanwhile Teck took 340 photos and a few long video clips using a Fujifilm FinePix S6500fd digital camera with a 1GB XD memory card. This 6 mega pixel camera had 10 x optical zoom, providing high quality photos.

Digital cameras have numerous benefits in that they remove the need to fiddle around changing films in adverse conditions and unwanted photos can instantly be deleted making space for more photos. However, most digital cameras eat batteries and the Canon PowerShot A85 was no exception. Due to this, rechargeable Ni-MH 2500-2700mAh rapid charge compatible AA batteries were taken for use in most cameras. At least two sets of rechargeable batteries were taken for each camera along with a rapid charger, plug and adapter. In 2006, attempts to recharge batteries from the truck using the cigarette adapter whilst travelling did not work very well as the roads were too bumpy – all the dust and bumping around actually broke the charger. The team also took a small portable solar panel which recharged AA batteries only. This device took about a day (10-12hrs) to fully charge four AA batteries and was used while in Uledi. The solar charger was convenient as it could be put out in the sun at the start of the day and left to recharge while that days work was being undertaken - although an eye had to be kept on the solar panel to ensure no one walked off with it. In towns and cities the solar charger was less convenient as there was nowhere safe to leave it out unattended for a long enough period of time, so the rapid charger was used to recharge batteries from the mains supply. By taking replacement sets of batteries as well as chargers, batteries could be recharged at leisure rather than having to do them immediately. The cameras consumption of batteries was reduced by ensuring camera flashes and LCD screens were switched off at all times unless needed. Viewing of photos was primarily reserved for when batteries could easily be recharged i.e. when in town where there was an electricity supply. Cameras were kept on people at most times, either in pockets or bags, especially while on site. This meant that all those unexpected and interesting moments were captured on camera. Everything worked well and there is nothing extra we would have taken.

PURPOSE

Most of the photos taken are for private use by the photographer and for future personal memories. As well as being used here in the report, some construction photos have been used in newspaper and magazine articles reporting on this expedition's achievements. A selection of the best photos have been put together to form a slide show and this formed the basis of the teams post expedition presentations. Dan put his movie clips together to form a nine minute video which was shown at some of the presentations. This movie captures the day to day work carried out on site and shows the bridge being completed. Use of any image from this expedition requires prior permission from the photographer. Please direct all enquiries to the editor (see inside front cover page for contact information).

Below & inset – Naomi and Harriet waiting to be let into terminal 3 at Heathrow while the building is evacuated due to a terrorist threat; after an hour or so the suspect package was removed and the terminal re-opened.

DIARY

Written by Li-Teck Lau and edited by Daniel Carrivick

Thursday 28th June – Leaving London

Jumana and I headed to Malawi a few days before the rest of the team because our flights had been booked slightly later than theirs, which meant in order to get the cheapest fares we had to travel out before the summer season began on July 1st. Naomi and Dan had packed and sent two huge kit bags full of equipment with us, which we could barely carry. Thankfully Harriet was on hand to help us carry them from University to the underground station just after the evening rush hour.

Friday 29th June – Arrival in Lilongwe

Our flight with Ethiopian Airlines to Malawi was nothing special. The films being shown were not great which did not help pass the time. We stopped briefly in Rome and then had to change planes at Addis Ababa before finally reaching Lilongwe. Jumana and I waited a long time at passport control, and then again at baggage reclaim. I was made to check my sleeping bag in at Heathrow because the new anti-terror measures prohibited me carrying more than one piece of hand luggage. We waited until all the bags had come through but the sleeping bag never turned up. According to the lost luggage man, it must have been left in Addis Ababa and he assures me that it will arrive on the next flight, the following day.

We took a taxi into the city. Our driver taught us some Chichewa like 'hello' and all the rest, but I didn't remember much. Children stood by the road waving the voles they'd caught and roasted on a stick, just in case we wanted a snack. On the edge of the city we passed a new shiny building with a sign that said it was built with EU funding (just in case you were wondering where your taxes are going).

It was mid-afternoon by the time we arrived at Mabuya Camp on the other side of the city, where we were booked in, so Jumana and I decided to explore the area before it got dark. We walked down the dusty roads to the city centre and across the bridge, which spans the Lilongwe River, to the second hand clothes market. The market was similar to a charity shop selling only clothes from the 1980's and thus had little to offer. We asked the price of a couple of things for reference, but had no intention of buying.

Jumana bought some fruit and vegetables from Shoprite whilst I ate an interesting 'Hungry Lion' fried chicken meal. Not very imaginative I know, but there was not much food on offer and we had to get back to Mabuya before it was dark.

Saturday 30th June – Back to the Airport

We lay in quite late, tired from the travelling and from having been unable to get to sleep because of the noise coming from the bar, which was next to our dormitory. We met a guy who was dropping his friend off at the airport, so we hitched a lift to try and retrieve my long lost sleeping bag. We ended up waiting three hours for the plane to arrive and all the bags to come through. My sleeping bag was not amongst them so it was quite a waste of time.

We went back to Mabuya where we read some of the magazines left by other travellers and chatted to other travellers about what they were doing and where they had been. Jumana learnt how to play the local board game Bao by losing repeatedly to an 8 year old, and I got to know some of the locals.

Sunday 1st July – Buying Wheelbarrows

We walked into the city centre in the morning. A few of the locals that hung around Mabuya together with Fiona, an Irish girl who was working in Malawi as a nurse joined us. Malangalanga road was our destination where an Arab market trader sold us three wheel barrows and four shovels, some paint and a paint brush, all for just under what the team paid last year for these items. However, we found out later that we had probably not got a very good deal, for the wheelbarrows were second-hand and a little bit worse for wear, where as the 2006 expedition team had bought these items new from a slightly more reputable shop.

Nevertheless, at the time we thought it was a good day's work. Fiona helped us wheel the wheel barrows back to Mabuya Camp. Luckily we had a chalet for the night, instead of a dorm, which meant that we could safely store all the equipment we had purchased in it.

Lots of groups arrived at Mabuya in the afternoon, many from the UK. I spoke with a Glaswegian, whilst Jumana socialised with some students from Newcastle. Later I played chess with an American guy, which went on for ages and eventually ended in a stalemate - luckily or skilfully by me, depending on the perspective.

Monday 2nd July – Other Team Members Arrive

Jumana and I took the morning easy, waiting for the rest of the team to arrive. I sat on the front terrace of the hostel reading the book that I'd brought with me from England. I was already half way through, which was worrying as it had to last the whole expedition. I only hoped the others had brought books too and I would be able to swap mine with them. Our exam results were released and Jumana and I took it in turn to go online and see them. Safe to say, they were all fine.

Dan, Naomi and Harriet finally turned up around 4 pm in a big blue three tonne truck driven by Wellington – both driver and truck were the same as the team had used in 2006, with the windscreen of

the vehicle still broken from the unfortunate accident that occurred during that expedition. They had been delayed leaving from Heathrow as terminal three was evacuated while they were checking-in due to a terror scare involving a suspect package. On arrival in Malawi they had done one or two things on the way to Mabuya Camp. At the airport they visited SDV (a Malawian handling company) to check the cable shipment was still there but their contact was out. They also called in at the British Embassy (which was closed for the public holiday) to see what time they opened and at the department for National Parks and Wildlife to say hello and put pressure on the Malawian Revenue Authority (MRA) to waive the import tax on the cable shipment. I was eating a burger as a late lunch when they appeared with my sleeping bag, much to my surprise for I had given it up as lost. Apparently they had seen it lying amongst a pile of unclaimed baggage at Lilongwe airport and picked it up.

After catching up on all the news we decided to eat in. Dinner was of an interesting beef stroganoff, which served the purpose but was nothing special. We spent the evening watching the rain-interrupted tennis from Wimbledon until a power cut put paid to this. A discussion was had as to the things that needed to be done and plans were made under candlelight on how best to do these the following day.

Tuesday 3rd July – Shopping in Lilongwe

We were up by 7am having a quick breakfast at Mabuya Camp as we had a full day of collecting supplies ahead of us. Our first stop was Shoprite, southern Africa's answer to Tesco, where we had arranged to meet Wellington at 8am. Dan drove us there, arriving a little late after it took us longer to sort out the stuff that had been left in the back of the truck overnight. Wellington was waiting for us and he took Naomi and Harriet on a separate mission to buy equipment while Jumana, Dan and I raided the supermarket.

Unfortunately, our keenness was hampered by the fact they opened an hour later than normal on Tuesdays, so we loitered around outside counting down the minutes to 9am when the shutters went up and we were let in.

Naomi and Harriet returned at 10:30am as planned. Seeing that we were no where near ready they went to the National Park headquarters to see if they could meet Brighton, the deputy who was assisting us to get the import duty on the cables waived.

We purchased all manner of items, from stacks of tinned sausages to buckets for water carrying, in the end over-filling three trolleys. It was gone midday by the time we had checked out and Shoprite's background music album must have played at least ten times. The total came to 97,000 Malawian Kwacha, paid for with wads of brand new 200 Kwacha notes.

After packing everything into boxes and loading the truck, we collected Naomi and Harriet from the shop where they had bought a hundred metres of 1.5 m wide wire mesh, some nylon rope and an oil drum - I say oil, it had actually been used to hold termite poison.

Lunch was back at camp where we indulged in the spoils of our shopping - cucumber, tomato and cheese sandwiches for some while others had peanut butter on bread. I hadn't eaten peanut butter in eons and it proved a pleasant rediscovery.

That afternoon Naomi, Jumana, Harriet and I got dropped off in Malangalanga road where we bought more equipment. Kalaria Hardware centre, across the road from the central mosque, sold us wire cutters, 10 m of clear hose pipe and 300 hundred used sacks for the retaining wall. Jumana and Harriet went off back to the old market where they purchased three metal buckets while Naomi and I set about trying to hail a taxi; an interesting ordeal considering there were no taxis. According to a police lady we asked, taxis could be spotted by their different coloured number plates. Even so, we couldn't see these, and in the end had to rely again on the police woman to hail us a ride. I'm pretty sure she stopped a random private vehicle and asked whether they could take us back to Mabuya. Anyway, rather than doing a U-turn to pick up Naomi and our purchases, I was taken on a twenty minute tour of the city as the driver fought his way around Lilongwe's congested one way system. Naomi thought I had been kidnapped when we eventually picked her up. We ended up paying 200 kwacha for the privilege.

Meanwhile Dan had gone in the truck to sort out the cable with the tax people. The cable had been imported from Italy ten months previously. Because the shipment wasn't addressed to a government office the Malawian Revenue Authority (MRA) were insisting we paid import duty worth some £700 on it. The cable had been sitting in a warehouse near the airport for the past year, and despite repeated attempts by email to get the tax waived, the issue remained unsolved. Communication between the Department of National Parks and the MRA had begun but the MRA's position changed almost daily. Red tape was everywhere and to cut a long story short, Dan could not get the cable released.

With the shops closing and darkness descending everyone met up again back at Mabuya Camp for dinner at 6:30pm. Jumana closed a deal on the sale of a Bao board. That evening we played cards in candlelight as there was another power cut. Jumana showed a propensity to losing. And speaking of losing, I had a rematch with the American at chess, and lost - twice. They were close games though.

Wednesday 4th July – Import Duty Waived

We all got up early in anticipation of being able to collect the cables and leave for Mzuzu. Unfortunately, our first set back occurred when Wellington turned up forty minutes late. We stopped at the vegetable market and I took some photos, while the others bought fresh produce.

Dan continued his efforts to free the cables from government hands. This started with a visit to the National Park headquarters where numerous telephone calls were made. Brighton managed to persuade the MRA head office in Blantyre to verbally agree that the tax should be waived so we then had to take the

Above & inset – After being officially released, a forklift truck loads the cables onto our truck.

Below & inset – A woman selling local onions at the market in Rumphi; the team bought perishable fruit and veg from Rumphi such as tomatoes.

customs declaration forms to the MRA branch in Lilongwe. There we sat in the back of the truck as the hours passed by while Dan met with the staff there, who were in no particular rush to do anything. After much confusion and a long wait they phoned the MRA in Blantyre to get them to fax through the relevant authorisation documents.

Progress had been made in that it now looked like we wouldn't have to pay the import duty, but our next task was to get Mr Jiah (the director of the national parks) to personally go and sign the forms. We picked Mr Jiah up after having lunch back at Mabuya and drove him back to the MRA in Lilongwe which was bit of an outpost, some twenty minutes drive out of the city down a dirt road. With the documents complete, all was good, although they still needed to be signed off by the senior MRA official. They also needed the tax personal identification number (TPIN) for Land and Lake Safaris to which our shipment was addressed, so we stopped off on the way back to Mabuya to get this. Dan phoned William Gondwe at SDV (our handling agents) to give them the TPIN but they also needed the name it was registered under. So Dan returned to Land and Lake Safaris, who said it was registered under their company name. SDV said they needed the name of the person the TPIN was registered under so Dan ended up handing the phone to McDonald (our contact at Land and Lake Safaris) and he spoke directly to the people at SDV to sort it out.

Chicken and mushroom pasta was eaten for tea in the camp and followed by more card shenanigans. Other accomplishments of the day include cutting out one end of the oil drum with a chisel. A group of Americans sang loudly into the night in celebration of Independence Day, but thankfully we were in one of the separate huts for what we hoped would be our last night in the Malawi capital.

Thursday 5th July – Travelling to Mzuzu

I spent the night on the chalet floor because we were short of a bed. It wasn't that great; I think a mosquito landed in my eyelash just as I was falling asleep.

We had a 9am rendezvous with a representative from SDV at the MRA to hopefully collect the paperwork enabling us to pick up the cables. There we waited. By 9:30am their was still no sign of the SDV representative so Dan phoned him but ran out of credit after only saying as much as hello. Shortly after the rep turned up, sorted out the documents and gave them to us. We drove to the airport, presented the paperwork to SDV who took them to customs to be fast-tracked. Just over an hour later we were given the all clear and could collect the cables. However, our problems didn't end there. The cables still had to be loaded onto the truck. SDV's loading bay was too high for our truck and the cables too heavy to be lifted by hand. A fork lift truck was called from the airport but it was lunchtime, so it was sometime before one finally arrived.

With cables safely on board, we left for Mzuzu just before 1pm. The journey took the best part of five hours, all on tarmac roads. I spent half my time travelling in the back which was novel and the remainder in the relative comfort of the front cabin. This was my first real experience of the Malawi wilderness and also the frequent but friendly police road checks.

We arrived in Mzuzu just before 6pm, as the sun disappeared below the horizon, and checked into the Mzoozoozoo hostel. Our room, I believe, was once a barn and the shower was a tap placed high on an outside wall. I had a sneaky suspicion that the bath I'd had in Lilongwe the previous day was going to be the last warm wash that I'd have for a while. I ate the much talked about Mzoozoozoo steak as we talked about gabions, what we needed to buy in Mzuzu, and read the messages left on the bar wall by last years expedition team.

Friday 6th July – To Nyika National Park

Streaks of yellow sunlight spilled through the gaps between the wooden planks of the hut and woke me up at around 6am. It was still very cold at that hour and we didn't get up for some time - until it had warmed up a bit. By 8:30am we were on the truck heading for central Mzuzu for more construction materials, this time in search of cement and rebar. The team took on their individual missions whilst I guarded our belongings in the back of the truck and explained to Wellington the minimum wage concept.

The shopping soon turned into organised chaos with everyone knowing what everyone else was buying but no one knowing where they were. We struggled to all meet up again with some people taking longer than others. Jumana was waiting to be picked up outside a shop with some plastic tubing that she had purchased and we met up with everyone else on route. Time was getting on and there was still more stuff we needed to buy. Harriet and Naomi went to get the steel while the rest of us dashed round the market for axes, jerry cans, vegetables and beans. The walk through the town's food market was nice; Mzuzu seemed a much nicer place than Lilongwe. It was Malawi's official Independence Day, though we did not see much evidence of it on the streets.

After changing more money, filling up with diesel and buying some bread and water we left at midday and drove an hour down the road to Rumphi. There we stopped briefly to pick up some different vegetables from the local market. Rumphi marked the end of the tarmac road so from there on progress was much slower. A couple of locals hitched a lift in the back with us as we proceeded towards Nyika National Park. The landscape changed from dry savannah to rolling hills and grass land on the plateau. In the distance we could see the blue tinted mountains of Zambia.

There was a quick stop at Thazima park gate to sign the log book where Harriet was set upon by ants - only to later be walked across by a rat (which had hitched a lift in the truck from Mzoozoozoo). A few hundred yards down the road we stopped again at the park headquarters to meet the officials. It was gone 4pm by the time we left. Chelinda, our camp for the night, was a good two hour drive away. The sun set just before 6pm so we knew we would be cutting it fine.

Above & inset – The truck on the road to Nthalire, heavily laden with the team's equipment and materials.

We had barely been going a minute when a loud grating noise from the back of the truck forced us to pull over and see what was wrong. The mud guard and metal surrounding the back wheel had got caught in the wheel and shredded the tyre. Half an hour later we had the tyre changed and were on our way, very much aware that we would now be arriving in the dark.

The dirt road was very bad in places and seemed to go on forever. We eventually arrived at Chelinda, in the middle of the park, soon after 6:30pm, in the cold and dark. We started a fire, the first of many, and cooked a hearty pasta aubergine concoction to warm everyone up. As the food was served, we realised we had forgotten to bring eating utensils, so improvisation was called for and spoons were cut from an old plastic bottle.

Saturday 7th July – Arrival in Uledi

I woke up having almost dried to death in an overheated room at Chelinda camp. The mysterious deaf night guard who kept watch and stoked the fire as we slept was nowhere to be seen by morning.

I went for a quick stroll around the buildings to see the picturesque lake and the conifers which were imported from abroad and looked out-of-place on the otherwise tree-less plateau. A deer roamed around the camp and everyone got excited with this the teams first close encounter with an African animal in the wild.

Our home-made plastic spoons didn't work too well as they were too bendy so Naomi and Harriet searched for suitable wood to carve into spoons while I attempted to cut a pair of chopsticks. With the porridge ready, I ended up eating breakfast with one chopstick much fatter than the other.

By 11am we had met with the park officials, picked up some timber from the saw mill, and collected a scout who would stay with us in Uledi together with several other people who wanted dropping off on the way. The truck was positively brimming as we pulled out of Chelinda; Naomi lying on the timber planks which stuck out above the cab. The views were stunning as we wound our way around the plateau. A zebra ran along the dirt road in front of the truck, escorting us for a while before disappearing off into the bush.

Lunch was at Nthalire, a small dusty village at the foot of the plateau which Bill Clinton had apparently visited via helicopter and decided to upgrade to a town by providing the necessary school, medical and road facilities. Harriet, Jumana and I had our first taste of Nsima, the national dish served with some local relish and a small piece of leathery chicken. It was nothing special but I was glad we had tried it.

It was another long four hours or so on bumpy dirt tracks before the truck climbed one last ridge before descending down to Uledi. On the far side of the river, a line of hills led down from the plateau. A deep valley between the two end hills divided the national park from open, indigenous space. The truck pulled into the scout outpost and Laxon, the resident head scout, came out to welcome us, somewhat surprised by our unexpected arrival. Before long quite a crowd had gathered to witness our arrival. We were invited to stay in the National Park buildings. These were ground level bricked houses with corrugated steel roofs and cement filling – well cement up to about waist height above which mud had been used instead. Inside was completely bare, except for the insect nests. Laxon had the concrete floors swept and everyone lent a hand in carrying everything from the truck to the rooms.

We went to inspect the bridge site just before the sun set. We waded through the ten foot high grass before coming to a mound and a tower, semi covered in vegetation. It looked just like I imagined it would.

Sunday 8th July – Surveying the Site

Our first day on site began at 07:30am, when four people who had helped us unload our truck the previous evening arrived to begin clearing the long grass from the site. Dan stayed in camp, unpacking and sorting out the equipment. He also built some low shelves from bricks and planks to stop vermin getting at our food supplies.

Harriet, Jumana and I did some surveying in the morning. We used stakes, a clear hose pipe filled with water, a measuring tape and, well, pure skill. At 11:30am we broke for lunch and all went down to the river for a wash. It was cold at first but nice to get all the dust from travelling out of our hair.

After lunch the workers cleared the vegetation from the pathways to the site and removed earth from the access pit behind the anchor block. Meanwhile Harriet, Jumana and I continued surveying, this time on the other river bank. The river level was notably higher than the previous year. When we waded across the river the water level reached the tops of our thighs, whereas the year before you could cross and still keep your shorts dry. This was probably a little bit of both annual and seasonal river level fluctuations as last year we didn't arrive in Uledi until a month later in the year.

While surveying I encountered for the first time what Naomi accurately called 'evil beans'. These small furry Buffalo beans cause severe irritation and had reappeared on the eastern side of the river despite the site having been cleared of them the year before.

That evening we were joined in camp by a group of scouts who were going out the following day to patrol and walk along the northern boundary of the national park. The measurements from the survey were plotted up and when compared with Andras' results from the previous year were close considering the various inaccuracies. Only one result appeared inconsistent enough to warrant recalculating and that was the difference in height between the two towers.

I ended the day with another first. I braved the Uledi toilet facilities for the first time. Not a fine dining experience for sure. In fact, my stomach had been playing up all day.

Below & inset – Digging the foundations for one of the retaining walls; four of these trenches were dug in total.
Inset – The top of the concrete anchor block can be seen in the background.

Monday 9th July – Digging Trenches

Jumana and Harriet went down to the bridge site early to check a couple of survey measurements. Dan had bit of a temperature and felt dizzy, and I battled with a constant feeling of indigestion, so we both hung around camp until later.

Some twenty odd workers had turned up by 7:30am, somewhat unplanned as the previous day had been a Sunday and we hadn't been able to meet the chiefs to arrange anything definite. Naomi organised them into groups to dig out trenches, one metre wide and 40 cm deep, on either side of the towers back to the anchor. These trenches were the foundations for walls that would retain the embankments that were to lead up to each tower. There weren't enough shovels, picks and hoes for everyone so the remaining workers collected rocks.

At 11:30am we broke for lunch. Clothes were washed in the river and left out to dry. Lunch consisted of cheese (with the mould scrapped off) and tomato sandwiches. After lunch, Naomi continued to supervise the workers, who carried on with what they had been doing in the morning. Once the trenches had been dug on both sides of the river the teams got stuck into soil excavation and accumulation. This soil was needed for building the embankment as well as to fill the sacks for the retaining wall.

Harriet, Teck and Jumana had a lengthy discussion on site to try and work out how the retaining wall was going to be built. The discussion centred on how the sacks would fit together. In the end, an interlocking pattern of two rows, staggered vertically by half filling some sacks, was agreed upon after being tried and tested.

Later Harriet and Jumana claimed to have spotted a snake on the path from the site to the camp, which was relatively unnerving. Thankfully though, I was not witness.

Tuesday 10th July – Handrail Cable Installation

The day started earlier than normal with us on site by 7am to re-measure the height difference between the east and west tower. When initially measured on Saturday the height difference came to 2.9 m. This was either clearly wrong or we had a problem. The Abney level was used instead of levelling across the river as done before. The angle came out as 1° over a distance of 37 m, giving a vertical difference of roughly 0.6 m; a much more reasonable amount.

The workers soon arrived and we got them filling sacks with sand and earth for the retaining wall. Harriet supervised the east bank which was in the shade, while Jumana and I looked after the sunny west side; Jumana took half the workers to start the retaining wall on the downstream side of the bridge and I started on the upstream side with the remaining workers. The outer row of sacks were half filled, whilst the inner row were fully filled. Jumana's team had a three bag head start, but my side finished way ahead of them. I would like to say it was because of me but in truth it was because I had two of the best workers.

The soil was compacted in the sacks by jumping up and down on them. Then 8 mm metal rods were cut into metre long stakes which were driven through at a 60° angle to peg the outer row of sacks to the inner row. Those workers not needed to help with the retaining wall continued excavating earth and transporting it to the site in wheel barrows.

Meanwhile Naomi fitted the metal plates over the saddles, which we had bent into curved shapes the previous evening. Wellington helped us, and with superior strength, he ended up over bending some of them. Some holes in the metal plates were too close together so the holes were enlarged rather laboriously with a chisel. Fixing the plates was a greasy, mucky job; luckily this was not my task.

After lunch, Wellington drove the truck back up the hill for a hundred metres or so, to allow the 134 m long handrail cable to be removed from the reel. The cable had to be removed in a special way to prevent it from being damaged and weakened. Once off the reel, the cable was laid on the ground, measured and the centre marked. Many local children had come to watch and they looked on excitedly. The whole thirty strong workforce were then spaced out about every 6 m alongside the cable, ready to pick it up. 'Pa choko, pa choko' which roughly translates to 'little by little' the workers picked up the cable and slowly marched with the cable through the camp, down the river cliff and across the river. One end was threaded through the upstream side of the anchor block, and then fed back across the river over first the east and then the west tower. The whole process took about three hours and ended with the hand rail cable hanging over the North Rukuru River, tied roughly but securely in place.

Dan spent much of the day in camp, out of the sun as he continued to feel unwell. His temperature read 40°C and he felt dizzy when wandering around the site. He remained very coherent though and still contributed to discussions. And me; I haven't seen my face for four days (I haven't unpacked sufficiently far enough to find my shaving mirror yet).

Wednesday 11th July – Filling Sacks

It was another 7am start for us. Naomi was down on site setting up pulleys to haul the handrail cable into position. Once the workers arrived on site at 7:30am, our first activity was to raise the handrail cable above its final resting position so it could be left for twelve hours to find its natural sag. The cable was hauled in a bit at a time. Fasteners linking hauling ropes with the cables had to be repositioned further back down the cable so that more cable could be hauled in. I was on the west bank and when, finally, the cables sag aligned with the appropriate mark painted on the west tower, I shouted across for them to stop and the cable was fastened off. My careful tiptoeing around the west bank in fear of evil bean attack was thwarted when my bag dislodged one, which went down the back of my T-shirt. It was crazy; the itching almost drove me insane. The T-shirt was subsequently quarantined.

Above & inset – The walkway cable being carried across the river.

Lunch was the same old semi-stale bread and fillings that we'd had since arriving in Uledi and whose novelty had worn off. Dan was still suffering from a fever. His temperature had dropped a bit but he was still quite weak. Naomi was thought he should see a doctor in Mzuzu if there was no improvement within twenty four hours. My stomach continues to feel strange and even Harriet is beginning to feel unwell. One of Jumana's toe nails fell off the other day and her toe now looks in quite a bad way.

I was stationed back on the east bank in the afternoon. I supervised four workers as they filled sacks with earth to build up the retaining wall. Four others excavated earth. One of the older workers, who always wore a cap, wants me to get him some grease for his bicycle.

The UV sterilising pen died yesterday as water got inside the battery compartment and what little iodine we had has run out – we can't find the unopened new bottle that we brought. We have therefore resorted to boiling our drinking water but the smoky flavour wasn't quite to my taste, so I took to drinking the river water straight. This isn't recommended but the risk is relatively low as the area is remote and there is no civilisation upstream. I figured, if I was already suffering stomach issues, water borne germs wouldn't make it much worse, surely? They may even fight each other, and then I'd be free of stomach cramps, not to mention the fact I'd be able to enjoy the fresh taste of Nyika mineral water.

Our other big activity of the day came at the end when we unrolled the walkway cable at sunset. This was done in the same way as the handrail cable with it being driven a hundred metres up the road on the back of the truck. The cable was then taken off the reel, by dragging the reel round in circles on the back of the truck and walking the cable back down the road as it was removed from the reel. With the help of Wellington, I measured and marked the centre of the cable. Thankfully it was 134 m as expected otherwise we would have been in trouble.

Thursday 12th July – Walkway Cable Installation

Jumana, having felt ill yesterday, stayed in bed so the team on site was down to three with Dan's condition not improving overnight. I waded across the cold river to the east bank so I could sight the handrail cable's sag against a second lower line that we had painted at the correct height on the west tower. I spent the morning shouting across the river to Naomi and Harriet the number of bricks above the line the cable was. 'Two bricks ….. One and a half bricks ….. One brick above'. Naomi and Harriet, together with a team of workers, released the cable a little at a time until the correct amount of sag was obtained and the cable was fastened off.

We then got all the workers together to carry the walkway cable down to the site. The workers were spaced every five metres along the cable before it was picked up and, as with the handrail cable, walked down to and across the river. The ends were fed through the eastern anchor block and hauled back across the river over the east, and then the west, tower to the anchor on the west bank where it was tied off. The walkway cable was larger and therefore significantly heavier than the handrail cable so a slightly different approach was used when hauling the cable up between the two towers. This involved putting pulleys on the handrail cable and supporting the walkway cable from these. A rope was attached to the end of the walkway cable and it was pulled across the river on the pulleys, which ran along the handrail cable.

By lunch time, it wasn't going exactly to plan, with the pulleys causing more problems than they solved and the large cable was left dangling from the handrail cable. We discussed the issues over crackers and crisps, and decided to return to the initial idea of walking across the walkway cable on the downstream side of the bridge. This required a lot more manpower but was accomplished much more efficiently.

The afternoon was a hot one. Naomi, Harriet and I were all on the west bank where we attempted to solve the problem of 'threading' the cable through the loop of plastic tubing in the anchor block. The radius of the loop was just large enough, but due to concreting and subsequent burial, the inside was rough and difficult to get the walkway cable through. Naomi, being the smallest, spent most of the time stuck in the trench on her knees trying to feed the cable through. There was not much room to manoeuvre, squashed in by earth, with ants inches from your face, trying to force the cable through. In the end, it was a combination of brute force, clever knots and cutting some of the cable threads that got it through.

The group decided that Dan and Jumana should leave for Mzuzu in the morning so that they could see a doctor and pick up supplies; namely more sacks, cement and fresh food. Wellington offered me some yoghurt tasting fermented drink. I'm not confident it would be popular in the UK. And we saw a scorpion in camp!

Friday 13th July – Truck Returns to Mzuzu

Dan, Jumana and Wellington were up at 5:30am and they left for Mzuzu soon after, just as I was getting up. I felt pretty bad and before long was visiting the toilet, suffering from diarrhoea. A truly bad experience when your toilet doesn't flush because it is little more than a hole in the ground.

I was back on the east bank for another session of cable sighting. This time it was the walkway cable, which was to be raised above its final sag position and left to reach its natural sag before it could be lowered to the correct level. Harriet and Naomi co-ordinated teams of workers as they hauled in the cable inch by inch until the cables' sag was in line with the correct mark painted on the west tower.

I also kept a close eye on a group of workers who were collecting sand for the embankment. The sand was used to fill sacks for the retaining walls on either side of the embankment and to build the embankment itself. I patrolled up and down, ensuring those wheeling barrows full of sand to the site didn't slacken off and checking the aggregate collected for concreting was the right grade material. One of the poorer workers wasn't doing his fair share of work which meant I had to watch him almost constantly otherwise he would stop working altogether. This was something I really could have done without.

Below & inset – The cables are held in place while the wire rope grips securing them are tightened.

I was pretty delirious all afternoon, feeling weak and on the verge of vomiting. I collapsed into bed when the working day ended at 4:30pm and didn't get up until the next morning. Sometime during those fourteen hours when I was flat on my back on the concrete floor I had my first ever hallucination, which was quite scary; a cable was coming through the bedroom window! Finally, I realised how much I missed sitting down on a chair. With no chairs in Uledi, there simply was no where comfortable to sit down.

Saturday 14th July – Adjusting the Cables

I woke up feeling significantly better than when I went to sleep. I was very hungry and thirsty seeing as I went to bed before tea and didn't leave, except to be sick. I managed some cornflakes with UHT milk and kept it down.

I was once more stationed on the east bank, again sighting the cable's sag, this time for the final adjustments. First the walkway cable was lowered bit by bit into its final resting position, before the handrail cable was checked and some small adjustments made.

I spent a good part of the morning chatting to Chamdindi, father of two labourers and uncle to many more. He had an interesting knowledge of agricultural practices in China, apparently stemming from Malawi's most significant post independence leader's education there. He asked me why so many things from China broke easily. My patriotism wasn't aroused enough to defend economic policy through a lengthy diatribe, but I decided against giving him my shoes, which he had asked for.

Those collecting aggregate for concreting had stock piled enough for the time being so they moved to the west bank to start collecting aggregate there. Naomi pointed to movement in the tree overhanging the bridge; I spotted two monkeys and reached for my camera, but they were too quick for me and disappeared off into the bush.

At the end of the day, two workers realised that they were suffering from head aches and asked for ibuprofen. Naomi wisely prescribed water and rest – the workers, as far as I am noticing, are drinking far too little water.

It was just Naomi, Harriet and me for the evening, as Jumana, Dan and Wellington were away in Mzuzu. We had beef "flavoured" soup for dinner, the one that comes as a powder and consists of three different kinds of salt. The children broke their usual routine of laughing at us from a safe distance and sat in front of us staring. For them this was reality TV! Harriet tried to teach them snakes and ladders, and they helped us to re-light the camp fire.

Sunday 15th July – Rest Day

In many parts of Malawi Sunday is still reserved as God's day, so the workers had the day off and we took a rest ourselves. I got up later than Harriet and Naomi, and ate rusks and jam for breakfast. The morning was spent sitting around camp discussing things and doing odd jobs. We talked about how we planned to lay the decking, along with various ways to secure the decking units to the cables.

Around mid-morning we made a picnic and walked half a kilometre upriver to where the Miwanga River joined the North Rukuru. It was quite a picturesque place with large rock pools and small rapids in between. Some of the rock pools were filled with stagnant water which smelt a bit but it was nice where the water was moving. The three of us floated down the rapids which I thought was quite scary. My concerns were perhaps justified as I hit my knee on a rock injuring it. Injuries here have however become so commonplace and everyday (I must have cut myself at least five times on the corrugated steel sheeting used around site) that I don't bother to treat or put plasters on them anymore. Oddly, they seem to heal faster, though this is not scientifically proven. After that we lay on the warm rocks in the sun, drying out while eating tuna, tomatoes and coconut ice.

We returned to camp and started thinking about making some formwork for concreting around the anchors. Harriet was very keen to start making the formwork but with not much suitable material on site it was never going to be straightforward. We only had planks of wood available (rather than sheets) and the corrugated steel roofing material which had bits of my blood all over it. What we assembled was fairly shoddy but this didn't matter. The framework only had to keep the soil out, while the embankment was built and then it would be removed.

That evening around 5pm as the sun went down I made my first meal of the expedition. Rice and fried cabbage; not something I was particularly proud of. Later, just before we were about to go to bed, the truck returned from Mzuzu with Jumana, Dan and Wellington. We had expected the truck back today but it was quite unexpected by the time it did arrive as it was so long after dark. Apparently they had lost a few hours fixing a puncture. Jumana had returned to health, but Dan had been diagnosed with malaria. Luckily, it was not thought to be a serious strain, and he was put on strong medication.

Monday 16th July – Installing the Suspender Cables

The mood around camp in the morning was notably better now the team was back all together. I was positioned on the west bank once again, where I wanted to be, filling sacks for the embankment's retaining wall. I cut myself badly using my Leatherman and felt feint at the sight of all the blood. The heat and me being somewhat dehydrated probably didn't help either. After patching myself up in the shade of the tower and drinking some water I was soon back on site, though taking a bit more care when using my knife! By the time it was 11:30am and we broke for lunch, the retaining wall stood at 3 sacks high on both sides, all with stakes holding the sacks in position.

Below – Naomi fastens a wire rope grip around a 10mm suspender cable to secure it in place.
Inset – Jumana helps Naomi by attaching suspender cables on the other side.

We had tinned fish sandwiches for lunch. Jumana and Dan had brought fresh bread back from Mzuzu. I had got a bit fed up of bread after the first few days in Uledi but when it ran out I found we didn't have anything quite as substantial to eat at lunchtime, so its return was very much welcomed, despite part of one loaf tasting of diesel! The fish was also appreciated as we've all been semi vegetarians for the past week. Jumana and Dan were even kind enough to bring some Fanta and Coke which we all have been irrationally craving. However, some ants found their way into my bottle as I was 3 quarters through, spoiling the end and leading me to declare war against the ants.

The first piece of decking was placed on the walkway cables soon after lunch, and we technically stood on the bridge for the first time. However, the decking unit was soon removed when we decided the suspender cables linking the handrail and walkway cables should be attached first. Jumana spent most of the afternoon on top of the west tower fastening the end of the suspender cables with grips. I took over towards the end, and appreciated just how frustrating this was. Bending the suspender cables into such a tight radius was difficult enough, but to then have to attach the grips with a good and uniform tension was fiddly and, well, really annoying.

Teams of workers continued to build up the embankments between the retaining walls on both sides of the river. The termite poison barrel was filled with water in anticipation of compacting activities. After earth was deposited, water was poured on and workers trampled all over the sticky mud, to compact it. It sounds silly, but this was very important to ensure the embankment wouldn't subside in the future. Meanwhile Harriet placed the formwork around the cables coming out the anchor block on the west bank.

Tuesday 17th July – Formwork Construction

I awoke feeling slightly light headed and spent about an hour on site before having to return to camp and lie down. On site, Harriet and a few workers constructed the formwork around the cables which were to be buried underground on the east bank. Jumana and Naomi attached more suspender cables in between supervising the workers who continued to build the earth embankments and collect aggregate for concreting.

I managed a few sweets for lunch and finished my second book of the expedition in the afternoon. The others made tuna pasta for dinner which I managed to keep down – just about.

That evening we asked Henry, the scout who had accompanied us from Chelinda, if we could listen to his radio with him. He turned up the volume and Wellington told us the stories behind some of the songs. One was about a man who left to go to England and promised to send money back. He didn't and soon his family was eating second rate corn and his wife turned to begging and prostitution - an important lesson in life if you ask me. Another was about a man serenading a woman by telling her how good wife material she would be.

Wednesday 18th July – Laying the Decking

I was once again on the east bank. My task for the day was to start to build the earth embankment. There were a total of eight workers set aside to help me; five spread and compact the earth while the other three brought more earth in wheelbarrows. Jumana had a team of eight doing the same thing on the west bank.

Chamdindi, one of the older workers, along with his relatives were quite lazy and always looking to shy away from the hard work. One of Chamdindi's preferred methods of skiving off the task he was given was to constantly rearrange the wooden planks which the wheelbarrows were pushed along to reach the top of the earth mound, even when they were just right and didn't need rearranging. My preferred method of punishment was to send him to get more water; a virtually endless supply was needed to dampen the freshly laid earth before it was compacted.

My whole team was lacking somewhat in discipline, especially compared to the team on the west bank which contained Bonface and Shubert - two of the best workers. The three people pushing wheelbarrows would wait for each other before returning to collect more earth. This meant they bunched up and so they stood around a lot of the time waiting for their wheelbarrow to be filled. This annoyed me, especially when I got attacked by the evil beans. Anyway, because of this, I took away their breaks and watched over them like a hawk.

At lunch I inspected the west bank and compared their progress with what we had achieved on the east bank. All seemed to be going well though it was clear Jumana's team had done more than us.

Meanwhile Harriet and Naomi spent all morning in their high rope access equipment, dangling from the cables. They alternated between spacing the suspender cables out across the bridge and placing the decking units on the walkway cable. Dan was either feeling a little better or bored with being stuck in an empty concrete room, and made it onto site around mid morning. He spent time wandering around assessing progress and taking photos.

The earth embankments continued to be built in the afternoon and Wellington showed his handy work by re-enforcing Harriet's formwork. A fire broke out behind one of the scout's buildings. It spread quickly through the long dry grass. Fortunately the wind carried it away from the village and it was soon brought under control with everyone rallying round to collect buckets of water or help thrash it out.

Back at work, I had the unenviable task of attaching the remaining suspender cables, glancing over my shoulder every now and then to check Chamdindi was earning his wage. Every time I looked up another piece of decking had been laid and by 3pm the last piece was being put in place. It was pretty spectacular to see the bridge's structure more or less complete and the workers took time out from what they were

doing to have a look. I was proud to be the first to cross the bridge without a safety harness, though the honour of crossing first 'without getting wet' belonged to Harriet and Naomi.

The workers were not allowed to use the bridge as its construction was not fully complete and the bridge wouldn't reach full strength until the cables which descended to the anchor blocks were concreted and buried underground. However, the bridge immediately proved quite handy for the team as it made crossing to the other side to collect supplies or a forgotten piece of equipment much easier than taking your shoes off, rolling up your trousers and wading through the cold water.

The day ended with some workers being relieved of their duty to collect sand from the river, ready for making concrete. The sand was shovelled into sacks in the river and these were passed up the bank, along a human chain, to the site where it was stock piled.

Before dinner, we went for a wash in the river, apart from Dan who was still getting better. The sun was setting fast and it was cold so we didn't spend long in the water. Afterwards we warmed ourselves around the campfire eating rice, vegetables and meat balls for dinner. It seemed so long ago since we last had meat – not that the meat balls could be called meat!

Thursday 19th July – Preparing the Trenches

I woke up not feeling well again, so my first duty was to pay a visit to the camp toilets – this alone was enough to make you feel ill. The wind was blowing strongly, especially up on the towers. It was good that it wasn't that windy when the decking was being laid otherwise it could have caused some problems.

The morning was spent excavating trenches around the cable lengths buried by the embankment. These trenches would then be filled with concrete to protect the buried part of the cable. I was once more looking after the proceedings on the east bank. We ended up having to remove the formwork which Harriet and Wellington had spent so long putting into place as it got in the way of digging.

Jumana supervised the team on the west bank and they also had difficulties, this time with stopping the trench sides from collapsing. I would like to think we did not have this problem because the embankment on the east had been better compacted, but in reality it was probably due to the difference in soil types with one being clayey and the other sandy. Bonface was tasked with removing any soil that fell into the trenches, which became quite farcical at times as every time some earth was removed more fell in.

A group of monkeys paid us a visit. First, as I walked downstream to check on the rock collectors, a monkey ran across the path in front of me. Then, later, a pack of around five monkeys were seen near the river just upstream from the bridge. They looked very cute, though this was probably deceptive.

Dan was up and about by midmorning, which was a good sign. It didn't take him long to get back in to the swing of things and he was soon complaining about how inefficient some site operations were; most notably those collecting rocks.

After a lunch of nuts, cheese and crackers we were ready to concrete in the trenches on the east bank. Harriet and Naomi organised teams into mixing batches of concrete. The workers who had helped out the previous year soon remembered what they were doing, and before long they got on with the mixing themselves. Several batches were needed and it took all afternoon to fill the trenches. That evening we ate another tomato sauce mixture thing with rice – all the main meals were beginning to seem the same to me.

Friday 20th July – Concreting the Cables

Everyone was up early. Naomi made some chapattis and we ate these with baked beans and eggs. After the morning roll call had been performed at 7:30am to see who if anyone was missing, the workers were sent on various duties; namely shovelling earth or collecting rocks.

Naomi looked after the workers collecting rocks up river while Dan filled in gaps between the bricks in the top of the west tower with cement. Meanwhile Jumana, Harriet and I spent the morning with the elite team of concrete mixers, filling in the trenches on the west bank. Most of the time we were on our hands and knees in the trenches with buckets of mortar being passed down to us to be shoved by hand into every nook and cranny. A morning I won't forget too soon! The concrete was mixed in a pile on the ground and very skilfully turned by hand - four pairs of hands to be precise. The workers knew what they were doing and didn't need us to tell them to add a bit more water if the mixture was looking a bit dry. Once the trench had been filled with concrete I made a print of my hand on the top surface and put my initials next to it.

During the break for lunch I had a bath in the river for the first time this week. It would have been embarrassing if I was the only one. But there had been little time for keeping clean and once clean you soon got dirty again. Before and after work, the sun was low and the temperature too cold for bathing in the river and no one (apart from Wellington) could be bothered to warm water over the fire to wash with. So the best time was at midday when the sun was warm but often we were too tired from the morning's activities. Also during the day local women and children were down by the river collecting water, doing their washing or having a bathe themselves. Dan hasn't washed since the day we arrived in Uledi, some two weeks ago, due to his illness.

After lunch I was on the west (sunny) side supervising the filling of more sacks, as we had decided to add another row of sacks to the top of each retaining wall. I didn't have much to do, as one of the workers called Bonface made sure everything ran smoothly. I sat on the west tower, watching as one of the workers chopped a large branch down, under Dan's guidance, which overhung and partially blocked the river channel. Those collecting rocks upstream were summoned to float the large log upriver where they

Above & inset – Earth is dug from the ground and transported to the site in wheelbarrows.

Above & inset – Earth being ferried up to the site where it was used to build up the embankment.

then hauled it up onto the east bank with help from Naomi and Harriet. It was held in place with stakes and formed the first part of Dan's plan to protect the river bank.

At the end of each working day, the workers gathered together back at the camp before being dismissed. Naomi took this opportunity to pull aside some fifteen workers whom we agreed were not pulling their weight on site – essentially the slackers and skivers. They included a lot of people I didn't really recognise because they had been so inconspicuous. Naomi gave them all a stern talking too, warning them to do better, otherwise they would be sacked. Jumana made a spaghetti and tomato sauce with potato and vegetables for tea, which was nice.

Saturday 21st July – Protecting the East Bank

The bridge was out of bounds to everybody as the concrete which had been placed around the cables was left to set. So we were all once again wading across the river to reach the east bank. The day saw more of the same - the collection of earth and rocks.

Wellington was stationed on the east bank where the earth was being dug from a pit before being transported to site in wheelbarrows. He had some of the worst workers and his unenviable task was to motivate them, and get them to work hard. I went down to check on them every so often. One of the workers was quite deceptive, working hard on occasions, though these short periods of effort were frequently interrupted when he would distract other workers from the task in hand. Personally I thought he was a bit arrogant. He stood around a lot, making jokes and being rude, though in a language I didn't understand. Apparently, he admitted to only bathing once every fortnight and not wearing any underwear. I taught him the term 'going commando', which he liked. For lunch, I consumed a whole tin of peach slices – they have genuinely never tasted so good.

Jumana and I were stationed on the west bank in the afternoon, supervising those collecting earth. There was no work that needed doing onsite so we spent the time up where the earth was being sourced. We introduced a rotation system where by all workers took turns between the various tasks; namely excavating with a pick axe, shovelling earth into wheelbarrows, transporting earth to the site and having a break. Using the pick axes to break up the tough clayey soil was definitely the most demanding of the tasks, especially in the strong afternoon heat. One of the workers was quite elderly, so we let him off doing turns with the pick axe.

Meanwhile Naomi, Harriet and Dan were on the east bank doing a similar thing while also continuing to protect the river bank. Naomi had a load of workers collecting rocks and ferrying them up on to the river bank where they were placed behind the log that had been staked into position the previous day. Under guidance from Dan, one of the workers continued to clear the river channel by chopping down the branches from overhanging trees. The larger branches were stripped bare and manhandled one at a time up the river bank with considerably difficulty, often being dragged a few inches at a time by ten or more workers. Harriet and a few of the workers covered the rocks with wire mesh which was nailed to the front of the log and held down at the back by a new log which was placed, further back up the river bank. The process was then repeated behind this log, with more rocks being deposited and covered by mesh.

We all ended up going to bed quite late, at around 9pm. This was mainly due to the fact we had decided to have chips and they took ages to prepare and cook. We were only able to cook a few at a time and the fire was not really hot enough. Though at one point we did set the pan alight!

Sunday 22nd July – No Rest on Rest Day

At around 1am, we were all woken up by the sound of drums in the distance. Apparently it was something to do with it being a religious day of worship. It marked our third and last planned Sunday in Uledi - three weeks in truly the middle of nowhere.

I slept in until 9am which was pretty luxurious. Outside I was met by a goat. One of the workers had brought the animal, to see if we were interested in purchasing it. The bridge opening day had been arranged for Wednesday and we were planning to organise a celebratory meal, for which we'd been advised to buy a goat. I could have eaten it there and then, but settled instead for several plastic cups of hot chocolate.

Uledi isn't a village in the traditional western sense of the word. It is more a collection of houses and settlements spread over a large area, interspersed with small fields and rough pasture. For all the time I had been in Uledi, I hadn't ventured beyond the approach road as there had been no need to go beyond the area between the scout camp and bridge site. So Wellington and I set off to wander around and take a look at the village, while the rest of the team stayed back to discuss engineering matters, such as possible methods for attaching the ladders to the side of each tower.

We walked past dry yellow fields of all manner of crops, including mustard, tobacco and cotton; which was surprising as I thought cotton needed wet conditions to grow. There was the primary school into which we wandered. An exam schedule was pinned on the wall. Next to the school was the only water pump in the village. The names of those who had built it were inscribed on the side. Those living closer to the river, including ourselves, collected water directly from the river.

We crossed the river downstream of the bridge site, where it was quite a bit deeper and very much faster flowing. I took a photo of a family and showed it to them. The mother was so pleased to see it - she gave me several handfuls of peanuts. There were three churches in the village. Celebrations in one of them had just finished and the congregation were coming out as we walked past, back towards the camp. The whole trek lasted about an hour and was well worth it.

Above – The last piece of decking is carried across the river.
Inset – Children stop to watch while on their way down river to go fishing (background).

In camp, the rest of the team were being more productive. Despite it being our day off, several tasks still needed to be done. Naomi and Harriet had gone down to the site early to sprinkle water over the concrete that had been laid around the cables, thus helping it to cure. Dan meanwhile had tidied up around the camp and had dismantled the large cable drums which Naomi made into a sign for the bridge.

The main task of the day was to concrete the foundation blocks for the steps which would lead up the east and west towers from the top of each embankment. This had to be done to ensure the concrete would be set and cured in time for the official opening arranged for Wednesday. Without workers on site to assist, we did all the hard labour ourselves. Carrying the 50 kg bags of cement and buckets of aggregate around the site was most difficult. With the bridge out of bounds due to the concrete curing around the cables and the stock pile of aggregate depleted on the east side, we had to carry aggregate across from the west bank. Wading through the river with the very heavy buckets was very difficult. Fortunately we did not need a lot of aggregate as only a small batch of concrete was required. Jumana and I did the mixing, though we were no match for our workers who'd had much more practice. It was tiring work in the heat of the day. Fortunately Wellington was on hand to take over from me before I collapsed. Meanwhile Naomi and Harriet measured, dug and prepared the holes which the concrete was then laid in.

The concreting took longer than expected and it was mid afternoon by the time we had made lunch. We walked along to the picturesque tributary where we ate our picnic in the shade. The three girls swam in the river and went down the rapids, but since last week's injury, I decided to abstain. A lady selling bananas came over to the camp and I ate too many too quickly. I was surprised by the lack of fruit we had come across. Apart from bananas, the only fruit we'd eaten was the occasional apple, orange or tinned guava, brought from Lilongwe. Maybe it's not the right season?

Monday 23rd July – Securing the Decking

Only a handful of the better workers had been asked to come and work today, as although there were still plenty of jobs to do, they were mainly small technical jobs which needed our constant attention and which only required a few workers. The select few workers continued to build up the back of the embankment which required the collection and transportation of more earth. Harriet, Naomi and Dan did various different jobs on the bridge and around the site. Some of the workers who were building the embankment helped them as and when needed. Jumana and I looked after those that remained building the embankments, with Jumana taking the shady east side and me in the sun on the west bank. I found a box of sweets in our food store and had remembered to take them to site today. I ate quite a lot of them, and shared them with the workers. Patson was a big fan of them!

After a lunch of leftovers and snacks I got harnessed up to work on the bridge. The concrete around the cables had now been left long enough that we could once again walk on the bridge. My job was to hammer nails into the decking so they could be fastened with wire to the walkway cable. This was to prevent the decking units from becoming dislodged and lifting off the walkway cable. It would also act as a deterrent from anyone who may want to remove decking units. Hammering while leaning over and under the bridge was hard work. Slow progress was made and in the end Jumana took over while I readjusted some of the suspender cables which were loose.

Dan finished off protecting the eastern river bank by constructing a few more tiers of rocks, which extended back up to the foot of the east tower. These rocks were held back behind logs and all covered with wire mesh. Finally more rocks were placed on the mesh around the foot of the tower to hold the mesh in place and protect the base of the tower.

In the room where we have been sleeping I have been finding more little brown things near and around our airbeds. My imagination is screaming 'mice poo', but we are yet to have an official sighting of the rodents. Jumana has heard scuttling and Dan has sighted mice next door in the room where the food is stored, though thanks to his cunning storage techniques they have not yet eaten any of our food.

Tuesday 24th July – Protecting the West Bank

Today was the last day of employment for our workforce, and the final day before the bridge was officially opened. There was a lot of finishing off to do, so we were all up at the crack of dawn. Jumana and Wellington left soon after 6am to go to the market at Nthalire where they bought food and other things for the party planned to celebrate the opening of the bridge. Felix and several other locals hitched a lift in the back of the truck too. With Felix gone, the team left behind didn't have to keep watching him to make sure he wasn't stealing stuff, which was nice for a change. After the truck had departed the rest of us managed a bowl of cornflakes and a cup of tea before the workers began turning up.

I took a group of workers down to the west bank and supervised them while they finished off the embankment. Harriet did likewise on the east bank. Dan was already on the bridge hammering nails into the remaining decking units and tying them all with wire to the walkway cable. Naomi took the bulk of the workers off to collect rocks. The braid bars were by now quite depleted in suitable rocks, especially those parts closest to the site, so the boulders had to be collected further upstream than normal.

With the embankment nearing completion, Dan borrowed a couple of my workers and got them to start building the protection for the west river bank. He left me to supervise them while he continued to fasten the decking units. The remaining wire mesh was cut into 10m long strips and each one tied to the side of the previous one. By lunch four strips had been fastened next to each other and after a quick stop for some noodles Dan attached ropes to the mesh so it could be hauled out over the riverbank, into place.

When the workers returned, Naomi and Harriet took some of them down into the river where they used the ropes to haul the mesh off the top of the west river bank. Meanwhile Dan and I had another team up on the west bank lifting up the mesh as best we could to prevent it catching on the grass. The mesh

Above & inset – The bridge is officially opened by a National Park representative (L) and the local village chief (R).

was hauled out over the river and lowered into place on the river bank, in front of the west tower. Just as the mesh reached its final resting place, Jumana and Wellington returned with a truck load of people and supplies.

Rocks were placed on the mesh on top of the west bank to hold it in place. Spare lengths of railway track were carried down and Harriet tied them to the bottom of the mesh. These weighty pieces of steel were to hold the mesh down against the base of the river bank where with time they would become embedded in the river bed. Finally a fearless worker volunteered to scale the steep river bank and hammer in metal stakes that held the mesh against the face. This was done to keep any loose blocks in situ and prevent them from falling out. The protection was completed just in time for the end of the day.

Dan found time to plug the gaps between bricks in the top of the east tower with mortar and he re-cemented a few of the bricks on the saddle which had come loose. With most people taking time out to help with protecting the west bank, some other jobs did not get finished. Harriet didn't manage to secure the ladder on the east side and not all the suspender's cable grips had been tightened.

It was pay day for the workers and they gathered on the ledges in front of the scout huts, where they had congregated everyday, before and after work, for the past couple of weeks. They were called up one at a time and Dan gave them their hard earned money. They were also given a share of the left over materials, namely some spare chicken wire and a sack. We also handed out some photos of workers from the previous year, which those pictured could keep, and were very much delighted with.

Felix had returned from Nthalire drunk. He kept asking me to take photos of him and his family which got quite annoying. No one was very happy with him because and he kept causing problems. He had not properly tied up the feet of the chickens that Jumana had purchased and apparently the birds had taken this opportunity to run literally for their lives. Thankfully Wellington chased after them and he managed to catch four of the five chickens!

It was late by the time the workers finally headed home and the camp quietened down. We cooked spaghetti with a tomato and onion sauce. Naomi painted the sign for the bridge and Harriet made a game of snakes and ladders out of a cornflakes box for the local children to keep.

Wednesday 25th July – Official Opening

We rose early to find a goat tethered to a tree in the camp. The goat had been bought so the team could lay on a meal for the workers and VIP's to celebrate the opening of the bridge. There was some difficulty in finding a suitable knife with which to slaughter the animal. Eventually one materialised. More waiting ensued as the knife was sharpened on a nearby rock. Some of our workers who had gathered then led the goat around the back of one of the buildings. Four workers held the goat on the ground in such a way that it couldn't move at all and with the minimal of fuss its throat was cut. We watched as the animal was hung up from a nearby tree and skinned efficiently.

A few of the best workers had been asked to do overtime and they helped us clear up the site before the bridge opening ceremony. All the random nails, rocks and wood which lay around site were cleared away. Dan took some workers to put together the signs, which were then cemented in place. I checked and tightened as necessary the suspender cables, Harriet put the final ladder in place on the east tower and Jumana helped with the preparations for the celebratory meal back at camp. A large fire had been constructed and several women came to help Laxon's (the head scout's) wife with the cooking.

By midday all tasks were complete, the site had been cleared and the signs covered with tarpaulins ready to be officially unveiled. Back at camp there was a hive of activity where lots of people had already gathered. A small jeep arrived with half a dozen people and some senior officials from Nyika National Park. They wanted feeding so after checking it was alright with the cooks, they were given their food before the ceremony.

We all sneaked out the back of the camp and had a quick bathe in the river, including Dan who hadn't done so since we arrived in Uledi due to contracting malaria. The layers of dirt were washed away before the least dirty clothes we could find were put on.

At 2:30pm everyone made their way down to the bridge, where a crowd assembled on the west bank ready to witness the handover of the bridge to the National Park and the local community. A lot of people had come, some walking for several hours, to see the completion of this two year project. Naomi made a short speech addressing all the workers, the village chiefs of which there were four I think and an assortment of people from the park comprising both scouts and officers. The head chief of Uledi and the senior national park officer from Chelinda then said a few words before they jointly pulling the tape and declaring the bridge officially open.

The chiefs and national park staff were the first to cross the bridge one at a time, and they were followed by the workers. Some crossed with confidence, others were a bit more cautious but everyone was smiling from ear to ear. Many group photos were taken of us with the people we had worked so closely with over the past few weeks. By the time most of those who wanted to, had crossed the bridge and returned to the west bank the sun was starting to descend. People wandered back to camp where a feast was laid on for our workers. Each had been told to bring their own bowl which they gave to one of the cooks to fill. Everyone jostled for position at the entrance to the room in which the food was being served, waving their bowls each time a cook came near. Before the situation got out of hand they were ordered to sit down and wait. In the serving room there were heated debates over how much food each person should have and who got various parts of the goat, with the husband of one of the cooks disapproving of what the women were doing. Proceedings almost ground to a halt as food started being removed from some plates and returned to the pot. Thankfully though they wiped the sweat from their foreheads, buried their differences and continued serving slightly smaller portions.

Once the workers all had food we took ours. We sat and ate around the back of one of the buildings with a group of workers. The goat was nice, but there wasn't much meat on it. My serving of nsima on the

other hand was massive and difficult to finish. The bean stew thing was very good though. The workers all went back for seconds before some sort of doughnuts were handed around for pudding.

As darkness fell the workers gathered together for the prize giving ceremony. There were a number of prizes on offer and each winner could choose what they wanted from whatever prizes were left. Schubert and Bonface Mesoko were the two best workers and in recognition of this they chose a wind-up torch and a tarpaulin respectively. Comedy awards followed and the prize for the best dressed went to Bonface Kaonga who always wore a suit jacket and trousers on site. The award for the best hat was given to Manuel and a prize was given to Chamdindi for taking the most toilet breaks.

The locals started drinking once some water had been warmed over a fire and added to the grainy fermented maize stuff in buckets. This was the local brew which was drunk communally through a straw from a large bucket. This local beer flowed liberally all evening and there was also plenty of Malawi gin, 'Kandi' on hand.

Jumana and I joined a group at the back of one of the scout houses where we danced to a song we called the 'baby song' (because it sampled baby sounds) and other Banda classics. Patson did his 'chicken' dance and we wore the costumes that we'd made a few days previously from local sugar cane sacks. I mistakenly let one of the workers have my head torch because I didn't need it anymore, which caused a small scuffle to break out as some of the workers fought over it.

Thursday 26th July – Leaving Uledi

The morning was a struggle for everyone. We wanted to get to Vwasa Marsh nature reserve and spend the night there, and to do this we had to leave Uledi before 10am. It was therefore another 6am start as we hadn't really sorted anything out. Packing up all our personal and group equipment was a daunting prospect especially given some of us had sore heads from the night before. Nevertheless after three hours, our rucksacks, sleeping bags and various other bits of equipment which we had brought over from the UK were all loaded onto the truck. Many locals had come to see us off and some of the workers helped carry our bags to the truck. Spare food and random bits and pieces that we no longer needed were given to the scouts for them to use. The concrete rooms which we had called home for the past three weeks were once again bare, ready for the insects and mice to re-colonise them.

We managed to sum up just enough energy to stagger down the rocky path to the bridge for one final look at the bridge. Hungry, dehydrated and hung over, we got one of the workers to take a group photo of us in front of the bridge before saying goodbye.

Back at the truck we had to virtually fight for a space as the rear was full of men, women, children, babies and animals who all wanted dropping off on the way. At first there must have been more than twenty local people crammed on the truck. We were totally packed in, with literally no room to move. A bunch of people waved us off from the scout's camp and the truck made its bumpy way along the uneven dirt track. Schubert, one of our best workers who often wore a ridiculous hat, was one of the last to be dropped off at his house some 30 minutes after leaving the scout hut - the distances these people travelled daily on foot or by bike in order to find work was quite unbelievable.

It was a real struggle of a journey, and a reminder just how remote we were. We arrived in Nthalire just after 11am and immediately headed to the nearest open roadside mud building to satisfy our irrational soft drink craving. Tea and doughnuts were also ordered from the local café as a sort of late breakfast. I moved to the front of the truck as I was feeling ill travelling in the back – in fact everyone was feeling pretty rough. About halfway up onto the Nyika Plateau the truck began to struggle. It stuttered and then ground to a halt, tired and weary perhaps of having made the difficult journey many times before. The engine was very hot so we gave our only bottle of drinking water to Wellington who poured it on the engine to cool it, but the engine spat it straight back again. Very soon we were out of water. There was nothing we could do but stop and wait for the engine to cool. We made only a few hundred metres in half an hour. Dan got out and walked up the dirt road. He got further and further away from us until we could no longer make him out, showing just how painfully slow the trucks progress was.

Some time later we finally made it onto the plateau. The roads were flatter but we were still confined to travelling in first gear in order to prevent the engine from over heating. A few vehicles passed us on their way to drop tourists at Chisinga falls, and when one of the jeeps came back Dan hitched a lift in it to the Zambian guest house where he filled a bucket with water from a nearby stream. With sufficient water to cool the truck we were once again able to make good progress. We didn't have to go to Chelinda, as our scout had returned with those that had come to the bridge opening ceremony the previous day, so we continued straight on to Thazima. There we reported to the officer in charge, who thanked us very much before saying goodbye and sending us on our way just before 4:30pm.

With it being two hours to both Vwasa Marsh and Rumphi we knew we would be arriving late and in the dark. We didn't want to risk going to Vwasa only to find that we couldn't get in so we headed straight to Rumphi. The only place of stay recommended by our guide book was full so we searched around for other places. Many of these were full, but we eventually found one on the edge of town called the Pokani Motel, which was a collection of guest rooms situated around a central park like patch of ground. I was relieved to be reacquainted with my old friend the flushing toilet and we all had a hearty meal despite waiting an unbelievably long time for our food to come. This was made even more frustrating by the fact the restaurant was empty.

Friday 27th July – Vwasa Marsh Safari

Wellington was up early to take the truck to the local car wash, which involved driving it down to the river and scrubbing it with little more than a cloth and a bucket of water. "It's so dirty! I can't drive a dirty

Above & inset – Elephants were just some of many mammals seen at Vwasa Marsh Game Reserve.

vehicle" he exclaimed. Pride in ones work was always welcome, even if our first destination for the day was a muddy swamp!

Our thirty day visas had almost expired so our first stop was at Rumphi police station to try and get them renewed. Unfortunately they were unable to renew visas in Rumphi and they said we had to go to Mzuzu to do this. This was not good news especially as Vwasa Marsh, where we wanted to go was in the opposite direction to Mzuzu.

We decided to leave renewing our visas until the afternoon and headed to Vwasa Marsh, a dense wildlife conservation area, which I was quite looking forward to. It was our first truly tourist activity in the country and I had not been on an African safari before. We picked up a park scout who acted as our guide. He was armed with a rifle just in case anything came too close. Wellington drove around the reserve while we stood in the back of the truck with eyes peeled. The single dirt track was flanked on either side by spiky acacia trees and low branches brushed against the side of the truck causing us to duck and dive out of their way.

Apparently we were very lucky with what we saw. During the two hour drive around the reserve, we had come across antelopes, impala, monkeys, lots of colourful birds (whose names I don't remember), warthogs and hippos wallowing in the central lake, and three different herds of elephants. We even stopped a few times and got out to look at the hippos and the deep foot prints they and the elephants had made in the soft mud by the river. There was a small annoyance with flies and being mid-morning it was very hot. However, these discomforts were far outweighed by the animals that we saw. It was all very memorable indeed.

We returned to Rumphi for lunch at the highly recommended 'Chef's Pride' restaurant, which was still extremely busy at 2pm when we arrived. Everything came with nsima, rice or chips. I had my curry with chips which was a mistake because everything else they had ready cooked and it was brought out almost straight away. But those of us who ordered chips with our meals had to wait fifteen minutes according to the waiter, but it was more like half an hour. Either they were too busy to cook chips or they must have had to make them from scratch.

An hour after leaving Rumphi we arrived in Mzuzu where we stopped to renew our visas and get our passports stamped. We also changed some money, filled up with fuel and bought some bread and other basic supplies before heading on to Nkhata Bay, which was just over another hour down the road, on the shore of Lake Malawi. There we stayed at Butterfly Lodge, a quite place about fifteen minutes walk from the town centre. The place was stunning, set on the rocky lake shore with calm lapping waters, clear skies and lush vegetation. It was the perfect end to the past three week's hard work.

After Naomi and Dan had set up there tent down by the water and we had settled into our beach huts we visited Mayoka Village, the neighbouring resort which was much bigger and busier. At 8pm every Friday they had a barbeque buffet, which was why we went there to eat. We hadn't eaten meat for a long time, except for a smidgen of goat and some reconstituted pork in the form of hot dogs. The honey roast chicken, kebabs and steaks were all mouth-wateringly good. Needless to say we all tucked in until we could eat no more. Jumana and I then proceeded to lose in a pool competition with the regulars.

Saturday 28th July – Snorkelling at Nkhata Bay

The sun was high in the sky when we got up relatively late at 8 am. Naomi, Harriet and Dan went for a morning swim in the lake which was a warm 24°C. Jumana and I valued our sleep a bit too much to be persuaded to join them. After washing off the dust and dirt from travelling we had a late breakfast at Butterfly Lodge.

We chilled all morning and did some washing before walking into town around midday. There we checked out the diving and spent a couple of hours on the internet – there was only one (fairly slow) machine in the small town so we took it in turns to catch up on all the news we had missed over the past month and make contact with people back home.

We ate lunch back at Butterfly Lodge in the shady reception which looked out over the bay. A relaxing afternoon followed and we went snorkelling but it soon started to get cold when the sun began to descend at 4 pm. Again we went to Mayoka for food – this time it was a Mexican buffet. Cards, Bao and other games were played while we counted down the time to 7:30 pm when the food was laid out for us to help ourselves.

Sunday 29th July – Diving in Lake Malawi

A special effort was made to get up and order breakfast early so I would not miss my 9 am diving appointment on the other side of the bay. We were once again enticed to Mayoka Village by the appetising breakfast menu plus we thought the service might be a bit faster than we had become accustomed to as Mayoka had a more substantial restaurant and were used to dealing with tourists. However, it wasn't to be. The items we wanted were not available and what we did order took an unbelievably long time to arrive at our table – just like everywhere else where we had eaten out in Malawi. I think we waited about thirty minutes just to get a cup of tea! Something we could have understood if other people who ordered before us were being served, but this was not the case. When the food did finally arrive it was very good and the portions were huge. My food arrived just as I had to leave so I quickly ate half and left the rest for the others to share, so as not to be late for diving.

After an hour or so of theory, I got kitted up and followed my instructor into the lake. We started by the lake shore and made sure everything was alright before gradually making our way out into deeper waters where we explored the sandy and rocky lake bed. There were loads of fish which swam all around us ranging from the size of my finger nail up to the size of my forearm. The rest of the team were waiting for me after the dive. They had been busy ordering some expedition T-shirts from a street seller who had

Above & inset – Naomi swims with the cichlids in Lake Malawi

Below & inset – Kayaking on Lake Malawi; Naomi holds the kayak while Harriet prepares to get out.

made T-shirts for the 2006 expedition team. Once the order had been placed, we headed back to Butterfly for another late lunch, stopping off in town and along the way, to pick up some supplies from the market and look at the souvenirs on offer.

The afternoon was a hot one, so there was only one thing to do, and that was to spend it swimming and snorkelling in the lake. In the evening Naomi and Dan went for a night dive with the dolphin fish. They took a small boat out of the bay and dived off the rocky headland to the north of Nkhata Bay. Jumana, Harriet, Wellington and I went across the bay later and waited for them to return. We watched as their small boat, chugged back in through the still waters, guided by a man sat on the bow with only a torch for light. Concerned that the few restaurants in Nkhata Bay might stop serving at 8 pm, we went down the road to the Safari restaurant and ordered some dishes while Dan and Naomi got changed and warmed up. Again we were treated to waiting over an hour or so for our food, and if this wasn't bad enough they forgot to cook one of the meals that we had ordered. It was the best part of another half hour before this last meal arrived. Still at least I got to try the local butter fish.

Monday 30th July – Canoeing at Chikale Beach

By the time Jumana and I got up, Naomi, Dan and Harriet were setting off to go canoeing. They walked round to Chikale Beach where they hired canoes and went on a day trip along the lake shore. After a while the rocky shoreline opened out into a series of long sandy bays which stretched as far as the eye could see. Locals on the beaches shouted and waved as the three of them paddled by. After a few hours on the water they pulled up on the beach to stretch their legs only to be instantly surrounded by inquisitive children wanting to say hello. The wind picked up and whipped up waves on the lake so the three of them headed back knowing the return would be much harder. They stopped for lunch on some rocks and even saw a fish eagle feeding, which I'm told was pretty spectacular. When they returned to Butterfly, Jumana and I had a go in one of the canoes. We went round in circles a bit at the start but soon had the thing under some sort of control and we even managed a lap of Nkhata Bay without capsizing. Afterwards we tried to teach Wellington to swim but the conditions were too rough and he was quite frightened following previous experiences. However, we did manage to get him to put a snorkel on and put his head under the water while standing still to see all the fish. At the end of the day Harriet and Dan paddled the canoes back to Chikale Beach while the rest of us collected the souvenirs we'd had made to order.

Our last evening in Nkhata Bay was spent at Mayoka again. The lights went out soon after 9 pm and while power cuts were not uncommon in Malawi, the commotion that could be heard from across the bay was. Word went around that the market was on fire and everybody gathered at the highest point to take a look. An orange glow came from the town centre where people rushed backwards and forwards with buckets of water.

Tuesday 31st July – Back to Lilongwe

We got up at 5:30 am to see the sun rise over the lake. Some haze and low clouds meant it wasn't as spectacular as normal but it was worth watching nonetheless. At breakfast the man turned up with our expedition T-shirts. They were late and not up to scratch, which did not go down to well. We packed up, checked out of Butterfly Lodge and hit the road. The scale of the fire soon became apparent with much of the market having been destroyed. Police were on hand to stop looting while stall owners salvaged what they could. It was awful to see the destruction that had been caused to people's livelihoods.

We took the main road that runs down the exposed lakeshore back to Lilongwe. A strong wind blew in off the lake buffeting those of us in the back of the truck. It wasn't too bad while we passed through the rubber tree plantations as the forests sheltered us from the wind but as we travelled along the exposed Chintheche strip (famous for hosting the annual Lake of Stars Malawi Music Festival) we felt its full strength. We reached Nkhotakota a little windswept, after some three hours on the go. After a quick stop to get snacks, drinks and more oil for the truck we continued down the M5 towards Salima, where we left the lakeshore and headed inland to Lilongwe along the M14.

Our first port of call was Mabuya Camp, where we amended our reservation having mistakenly booked in for the following evening. After unloading and having a bite to eat, Dan dropped Wellington back at his house on the other side of the city. Meanwhile we got ready to go out for our post-expedition dinner. Dan drove us to an elegant restaurant on the edge of the city called Buchanan's Grill. We felt a bit out of place in our dirty clothes but no one seemed to mind. The food was good, as was the service (for once) and it was a fitting place to have our final meal in Malawi. Back at Mabuya, where the expedition began four weeks previously, there were drinks all round and card playing late into the night.

Wednesday 1st August – Flying Home

Naomi and Dan were up early sifting through all the food and equipment, sorting out what to keep, what to pack and what to leave with Wellington. The rest of us had an easy task by comparison. All we had to do was pack our personal belongings and order breakfast. Wellington arrived soon after breakfast with two fellow workers in a different truck and explained that we had to swap vehicles because the truck we had was needed on another job.

By 10 am, with the packing and sorting complete, we were finally ready to leave. We stopped off in the city for an hour to do some final bits of shopping. We all managed to buy any remaining souvenirs we wanted, and some we didn't really want, like my crocodile ashtray! Then we drove to the airport where we said farewell to Wellington and gave him an expedition T-shirt which he was very proud to receive. After checking in, Harriet, Jumana and I said goodbye to Naomi and Dan (who were staying on to do a two-

week tour of southern Malawi) and boarded our plane to start the long journey back to England via Zambia, Ethiopia and Italy.

A few weeks later – Biosearch Visit Bridge

Later in the month of August, the 2007 Biosearch Expedition team visited Uledi. They were led by Quincy Connell, whose idea it was to build the bridge. This was the first time he saw the work that both the 2006 and this expedition had done. Below is an extract from Quincy's diary describing this visit

From Quincy's Diary (reproduced here with his kind permission)

"It was quite a while before I bucked up enough courage to wander out to the bridge. This is a structure that I am responsible for, as having passed through here several years ago I became aware of the difficulties of crossing the river here for both the Scouts and the villagers during the rains. Locals took advantage of this period to poach in the area from the other side. I had found members of the Imperial College (London) Exploration Society willing to tackle the task and they had completed the crossing, after two expeditions, only a few weeks before we arrived.

I can only say how unexpected and spectacular it was after I had overcome my fears and excitement. I climbed the short ladder onto the western pier and strode out into the centre. Chris very kindly kept the others off the bridge to leave me alone with my emotions and I became a little moist eyed while he took some photos of me.

My first impression is of how massive it was, with huge main cables and not much smaller 'hand rails'. I took a series of photos for posterity and returned to the Scouts quarters, emotional again after I had read the various signs the builders had left and realised that they had been so kind as to add mine to all theirs.

The village headman being seen and spoken to, my main reason for being on this expedition this year was complete. They had only praise for the builders and were to start carving a new road from the bottom of the bridge to their village on the far bank the following day. There were few complaints, but one being that the women of the village were not used to the sway and height of the bridge above the water, and they asked that for the children's sake could some wire mesh be placed between the 'hand rail' cables and the 'foot bed' cables. They were already planning its maintenance ahead a good few years and with eventually replacing the soft wood of the foot bed with hard wood."

CONCLUSION

Written by Naomi Bessey

1. This expedition achieved its primary aim of completing the construction of a footbridge across the North Rukuru River in Uledi. The team's objectives were fulfilled by;

- Re-surveying the existing site, foundations and superstructure and assessing their stability one year on from the initial site survey.
- Following the design brief throughout the construction process
- Carrying out all the necessary ground-works, testing, reinforcement and protection to maximise the bridges lifespan.
- Enlisting local villagers and scouts to help with the bridge's construction, and thereby continuing the work done by the 2006 expedition which imparted a sense of 'ownership' amongst the community to ensure the community continued to maintain the bridge.
- Building the bridge's core structure from non-burnable materials so as to withstand any potential threat from bush fires and poachers
- Using local materials as much as possible to ensure the community can easily maintain the bridge.
- Employing and training local unskilled workers to help construct the bridge.

2. This expedition saw the completion of a safe, environmentally friendly bridge over the North Rukuru River in Uledi. The site was initially cleared and re-surveyed. The majority of man-hours were spent extracting, moving and placing raw materials comprising earth (for the embankments), sand (for making concrete and cement) and rocks (for protection and bulk fill in concrete). Having one overall site manager with allocated micromanagers worked well. However, for jobs such as moving the cables, more complex hierarchies were put in place.

3. This expedition had more 'team members' than the five individuals who actually travelled out to Uledi. Andras Szollar in particular, who headed the design team and was part of the team that went out in 2006, played a vital role in passing over engineering experience and expertise to the 2007 team of engineers led by Harriet Kirk. Every team member except Dan was new to their expedition role. This meant steep learning curves all round. The team pulled together to overcome the obstacles they faced; these included language barriers, illness, fatigue and other logistical issues. Above all every member of the team returned safe, happy, more-or-less healthy and with a great sense of accomplishment.

4. Throughout the expedition, meetings with both the National Park staff and the village chiefs were successful in fostering an atmosphere of co-operation. Representatives from the National Park and the community played equal roles in opening the bridge, with both giving speeches to the gathered villagers. Later that day a spokesperson from Uledi was nominated by the chiefs to chair the newly formed bridge committee and this was approved by the national park. The team are confident that the bridge committee, under the nominated spokesperson, will see that the bridge is properly maintained and will make repairs when necessary. The National Park is ultimately responsible for ensuring checks are made, maintenance carried out and the bridge is safe to use. Both the national park and the bridge committee were provided with an information booklet detailing the checks to be made and the maintenance to be undertaken.

Above & inset – A full moon rises over Lake Malawi at Nkhata Bay.

ACKNOWLEDGEMENTS

Compiled and written by Naomi Bessey & Daniel Carrivick

Below & inset – The workers sit patiently, with bowls at the ready, for the celebratory meal after the bridge opening ceremony while children sit in the truck and watch.
Below right – A crowd gathers to listen as the bridge is officially opened.

The expedition team thanks everyone involved with this expedition, the 2006 expedition team and everyone involved with that expedition, together with all those who helped and supported team members throughout their training and development in previous years, for without them all, the footbridge across the North Rukuru River at Uledi would not have been constructed. In particular our thanks go to the following:

INDIVIDUALS – John Anderson, Anthony (from Expedition Engineering), Philip Carrivick, Steven Carrivick, Wellington Chimtengo (truck driver), David Chinn, Quincy Connell, Lorraine Craig, David Dalgado, Sergio Dale, Mark Daniels, Andrew Dorward, Felix (a scout stationed at Uledi), Harry Foot, William Z. C. Gondwe, Christopher Green, Jason Hoadley, Gillian Hoyle, Kien Hoang, Rafael Holt, Ruth Hopgood, Tom Hull, Ramosh M. Jiah (Deputy Director Ministry of Information & Tourism), Susan Johnson, Rod Rhys Jones, Harriet Kirk, Brighton Kumchedwa, Mike Labuschagne, Davood Liaghat, Robert Lloyd, Stuart P. Lungu, Zedi M Nyirenda, Phineas C. Mbota, Ed McCann, Ganisyeje McDonald, Ciaran McKeown, Clever Mfune, Lackson Mhango, Tommy Mhango, Sarah Morgan, Leonard Moyo, Dr. Washington Y Ochieng, Ole (from the Nyika-Vwasa Trust), Marianne Overton, Peter Overton, Dr Mautz E Rainer, Nararya Sastrawinata, Bob Schroter, Jane Simpson, Sophie Smith, Dr Jamie R Standing, Andras Szollar, Martin Threakall, Dr Niel Tsang, Nigel Wheatley, Catherine Wilson, Shane Winser, Alastair Muir Wood, Peter Wong, Marie-Odile Zanders, Chiara Zatti.

BRIDGE BUILDERS – This expedition; Bodmas Chiango, Shubert Chiango, Sangwari Kaira, Bonface Kawanga, Channudindi Kawanga, Clever Kawanga, Doctor Kawanga, Gift Kawanga, Hayison Kawanga, Kandwani Kawanga, Kenford Kawanga, Kiniwelo Kawanga, Marklin Kawanga, Mweyeye Kawanga, Nchaci Kawanga, Roderick Kawanga, Victor Mughogho, Lackson Muhango, Mabona Muskale, Ganjani Musongole, Moses Musongole, Bonface Musukwa, Manwell Musukwa, Patson Musukwa, Botayi Mwandira, Bright Sichinga, Feckson Sichinga, Stevin Sichinga, Amini Sichinga and Jeogi Sigukwe. In 2006; Kachindewe Badda, Chenjelani Chilenga, Herrings Chilenga, Patikani Chilenga, Rombani Chilenga, Tyford Chilenga, Nkhuchucha Chilenga, Zakzazka Chilenga, Kesings Kandawa, Hyson Kaonga, Kenford Kaonga, Khwimani Kaonga, Macreen Kaonga, Mavuto Kaonga, Ntchachi Kaonga, Owms Kaonga, Sangwani Kaonga, Tawonga Kaonga, Werani Kaonga, Yato Kaonga, David Mhango, Bonface Mshali, Goodwell Mshali, Kondwani Mshali, Freedom Msongole, Ganizani Msongole, Moses Msongole, Patson Msukwa, Stephan Sichinga, George Sifukwe and all the other workers and volunteers.

COMPANIES & ORGANISATIONS – Adventure Rope Co. Ltd, BCH Camping, Biosearch Expeditions, Black & Veach, British Mountaineering Council, Buro Happold, Burton McCall, Cargo Services Ltd. (Lilongwe Airport), Cotswold Outdoor, Dale Silvio S.R.L., Ellis Brigham, Engineering Without Borders, Ethiopian Airlines, Expedition Advisory Centre, Expedition Engineering, F. L. Nkhalamba Vehicle Rentals, Felix – Imperial College Student Newspaper, Field & Trek, Gordon Foundation, Halcrow, The Happold Trust, ICON Direct, Imperial College Civil & Environmental Engineering Department, Imperial College Exploration Board, Imperial College Finance Division, Imperial College Health Centre, Imperial College Insurance Division, Imperial College Occupational Health Centre, Imperial College Union, Imperial College Union Exploration Society, Imperial College Union Outdoor Club, Imperial Reporter (College Newspaper), Interserve, Kayaks and Paddles Ltd, Land & Lake Safaris, LifeVenture, London Student Newspaper, MacAlloy, Malawi Revenue Authority, Malawian Government – Department of National Parks & Wildlife – Ministry of Information & Tourism, Mouchel Parkman, Nyika-Vwasa Trust, Old Centralians Trust, Paydens Pharmacy, Redaelli, Robert Harwood Trading Ltd, Rohan, Royal Geographical Society, Royal School of Mines, SDV Airfreight Services, Snow and Rock, Stanfords, Tensoteci Engineering, TLC Direct, Trailfinders, University of London Convocation Trust, My Visa Advisor, WhitbyBird.

A special mention goes to Andras Szollar, who co-ordinated the design of the bridge, for without his knowledge and leadership this project would probably have never got off the ground and if it had, then it definitely would not be the impressive structure that it is today (and likely to be for many years to come). Andras travelled out to Malawi in 2006 where he was the chief site engineer and it was he who convinced everyone else that a bridge could still be built despite the span of the bridge turning out to be more than 10m longer than that which had been designed for. Andras continued to oversee the engineering preparations for this expedition despite being unable to go out to Malawi to finish the bridge. The success of this expedition therefore owes a lot to Andras; for the time and commitment he so selflessly gave. Thus the team thanks him for his continued guidance and help in the build up to this expedition.

The team also thanks Imperial College and in particular the Imperial College Exploration Committee for without their continued support this project would never have left the drawing board. Firstly the team thanks the University for having procedures and a recognised body in place to facilitate its students to fulfil their expedition ambitions and dreams. Secondly the team thanks that body, Imperial College Exploration Committee, for their time, backing, generous financial assistance, dedication, guidance and belief in this expedition.

Finally, team member's thank their friends, family and relatives for their understanding and positive encouragement throughout.

Inset – The team have lunch on the go in the back of the truck which is full of the team's expedition supplies. **Below –** Harriet has a sandwich surrounded by kit bags full of equipment.

APPENDICES

APPENDIX A – Group Equipment List

By Naomi Bessey & Daniel Carrivick

List of the group equipment taken out to Malawi from the UK along with some notes about their usefulness based on the team's experiences. Items marked with an * were bought in Malawi during the 2006 expedition and brought back to the UK for safe keeping until this team returned to complete the bridge. Quantity of each item is shown in brackets where more than 1.

CONSTRUCTION EQUIPMENT & CONSUMABLES

Abney Level – used to measure vertical angle or inclination when marking out and measuring site; consists of a telescope and an adjustable tubular spirit level, which is connected to a vertical scale marked in degrees
***Adjustable Spanner 8"** – Reserve spanner for tightening small-medium wire rope grips
***Adjustable Spanner 12"** – Reserve spanner for tightening medium-large wire rope grips
Barrier Tape 75mm x 500m – Red and white tape for marking out-of-bound areas / hazards on site
Cable Cutters – Felco C112; force transmission system with maximum cutting diameter of 12.7mm (0.5 inches)
Gaffer Tape 50mm x 50m (3) – General purpose both on and off site
Hacksaw 150mm – Reserve method for cutting small cables
Hacksaw 300mm (2) – Reserve method for cutting medium and large cables
Hacksaw Blades 150mm (10) – Replacement blades for small hacksaw
Hacksaw Blades 300mm (10) – Replacement blades for large hacksaw
Knife Sharpeners (2) – Two different types taken for sharpening pangmas (machetes) as sold blunt
***Mug** – Large plastic mug used on site for adding small amounts of water to cement and concrete
Plumb Bob – Weight with a pointed tip that is suspended from a string and used as a vertical reference line
Ratchet Straps 5 tonne 10m (4) – Mainly for hauling cables into place, but also for securing loads onto the truck
Ratchet Torque Wrench ½" Square Drive 40-210Nm – Used to tightening the medium and large wire rope grips to the correct torque, as recommended by the wire cable manufacturers
Ratchet Wrench ½" Square Drive – General wrench used to attach wire rope grips
Rubble Sacks (10) – Taken for general purpose; not used
Self Amalgamating Tape 19mm x 10m (4) – Used to wrap around cables where they needed protecting
Socket Set ½" Square Drive 8-22mm – Thirteen piece set of sockets mainly for attaching wire rope grips but also useful to have, to use on the truck as and when necessary
Spanner 10mm – Back-up tool for fastening wire rope grips for use on 8mm cable
Spanner 13mm – Back-up tool for fastening wire rope grips for use on 10mm cable
***Spanner 17mm –** Back-up tool for fastening wire rope grips for use on 11.3mm cable
***Spanner 22mm –** Back-up tool for fastening wire rope grips for use on 26mm cable
Spirit Level 200mm – Handy size for keeping in pocket while on site
Spirit Level 600mm – Used with string and a plumb bob to mark site levels
Socket ½" 10mm – Spare socket for fastening wire rope grips for use on 8mm cable
Socket ½" 13mm – Spare socket for fastening wire rope grips for use on 10mm cable
Socket ½" 17mm – Spare socket for fastening wire rope grips for use on 11.3mm cable
Socket ½" 22mm – Spare socket for fastening wire rope grips for use on 26mm cable
Tape Measure 3m – Pocket sized, kept handy on person
Tape Measure 5m – General use on and around the site
Tape Measure 30m – For measuring and marking out the site
Tarpaulin 1.8m x 2.4m (2) – General purpose; mainly used as a groundsheet on which collect aggregate was placed
Tarpaulin 3.0m x 3.6m – General purpose; used to cover the back of the truck; essential for keeping dew off cement
Two-Way Radios, Charger & Accessories (2) – Useful aid to ease communication between the two sides of the river
Wire Cable 10mm x 70m – 48m of 8mm cable needed for additional suspender cables due to the increased span of the bridge; 70m of 10mm cable taken in case a cable was needed to be put up to assist getting the hand and foot rail cables across the river; once the main cables were in place this cable could then be chopped up and used as suspenders
Wire Rope Grips 8mm (300) – Lost in transit during shipping, hence replacements were taken out
Wire Rope Grips 10mm (100) – Larger grips needed for the 10mm suspender cables

PERSONAL PROTECTIVE SITE EQUIPMENT

Ascenders (2) – For ascending ropes and rescuing an injured person working at height
Belay Devices (2) – For general safety in case a team member needed to be belayed
Chest Harnesses (2) – For general safety when working at height to keep individual upright while sitting on harness
Descender – For descending ropes while rescuing an injured person working at height
Harnesses (4) – Lightweight DMM Alpine harnesses taken; compatible with chest harness
Helmets (4) – Lightweight climbing helmets taken rather than hard hats as helmets with chin straps required when working at height
Prusik Loops (4) – General piece of 6mm cord used to ascend or grip ropes; useful for backing-up a pulley system
Pulley Double (2) – Petzl Tandem Speed pulleys taken as designed for use on cables as well as ropes; dual purpose – used for travelling along cables and in pulley systems for hauling cables
Pulley Karabiner (6) – Special shaped karabiner designed for pulleys
Pulley Self Jamming (2) – Used in pulley systems to restrict rope movement to one direction through pulleys
Pulley Single (4) – Petzl Fixe pulleys used in pulley systems to haul cables across river
Rope 10.5mm x 75m – Static multi purpose old caving rope used to haul the cables across the river; also for use as a safety line across the river and to rescue an injured person working at height as necessary
Ropeman – Dual purpose; can be used to ascend ropes and in pulley systems to lock rope and prevent it slipping back
Safety Glasses – General purpose for team members
Safety Gloves (15) – For workers when hauling cables and handling concrete
Safety Goggles (2) – For workers that were breaking rocks with a rock hammer
Screwgate Karabiners (8) – Used in conjunction with slings and prusiks to set up pulley systems for hauling cables
Slings (8) – Assorted sizes, mainly used in pulley systems
Tibloc – Mechanical device which does the same job as prusik loop
Via Ferrata Lanyard (2) – Safety attachment used to link team members to cables when working at height

CAMPING & COOKING EQUIPMENT

Airbeds (4) – Mixture of single and double airbeds taken; single airbeds were thought to be better as a hole in one would only affect one person rather than two, but they proved to be a bit narrow and some team members kept falling off theirs
Chopping Board – Useful to take a small chopping board; easier to chop things on than plates
***Cooking Pots (set of 9)** – Malawian set of cooking pots for use on an open fire
Duffel Bag 100 litre (4) – For storage and transportation of group equipment
Food bags (20) – Assortment of sizes taken for decanting foods as necessary
***Frying Pan** – Non-stick, thick based frying pan purchased from a supermarket in Lilongwe in 2006
Fuel Bottle – For use with the stove
Fuel Funnel – For filling fuel bottle
Pole Sleeves (2) – For mending tent pole breakages in the field. Not used
***Plastic Food Containers (5)** – Used to store open packets of food in
Plates (6) – One for each team member and one for the driver
Pump – Foot pump for inflating airbeds
Screw Top Containers 50-200ml (8) – Much better than bags for items used regularly; useful for salt, herbs and spices as well as things like shower gel; larger ones would have been useful for things like sugar and milk powder
Sleeping Mats (5) – Taken in case airbeds failed and they could not be repaired; used under airbeds to protect them
Stove & Maintenance Kit – Primus Himalaya Multifuel stove taken for emergencies; cooking done over an open fire on a day-to-day basis; used while camping at Nkhata Bay as more convenient
Tents (3) – Wild Country Sirocco tents taken as emergency accommodation for the team and truck driver; two 2/3 person tents and one 3/4 person tent; only one tent was used – once at Chelinda and once at Nkhata Bay
Turner – Cheap plastic one taken as lightweight and does not scratch non-stick frying pan
Vegetable Peeler – Mainly for peeling potatoes but in the end these were scrubbed using a nail brush
Water Carrier (10 litre bag) – Lightweight fold-up bag for collecting and storing water in; taken for use in an emergency and not used; plastic buckets used on a day-to-day basis for water collection and storage
Windshield – To protect the stove from the wind
Wooden Spoon – Main utensil used to when cooking; long handle is best for cooking on open fire

TRAVEL ITEMS

Altimeter Watch – Not essential, but a team member had one so it was taken anyway
Antibacterial Gel 150ml (4) – Refills for the pump action gel bottles; better and more convenient than washing hands
Compass (2) – Used to gauge general site orientation when mapping site out
Documents (5) – Copies of each team members important documents i.e. passport, insurance, flight tickets etc.
First Aid Kit - Group (2) – See appendix C for complete breakdown of contents
GPS – Took a Garmin Etrex to map bridge site but in the end their wasn't time to do this
Guide Books (2) – Lonely Planet guide to Southern Africa and Bradt guide to Malawi
Insect Repellent 50% DEET 100ml – Protection against biting insects; not used in Uledi; used in Lilongwe though
Insect Repellent 100% DEET 50ml – Contains high concentration of DEET to give long lasting protection
Iodine Drops (2) – Back-up method of purifying water; used occasionally when UV water purifier was not in operation
Maps (3) – Two road maps and one laminated contoured map; used more out of interest than necessity
Nail Clippers – Useful, one small pair amongst the group was sufficient
Pump Action Gel Bottle Large (2) – Taken out empty so they wouldn't leak; filled with anti-bacterial gel for hand washing; one kept near the toilet and one kept with food preparation utensils
Sewing Kit – For stitching up worn clothing; not really used
Solar Battery Charger – Palm sized solar panel which charged 4 AA batteries in about 12 hours; the main problem was finding somewhere on site to leave it where it wouldn't get pinched or damaged
UV Water Purifier – Steripen; portable water purifier that uses UV light to destroy waterborne microbes; takes four AA batteries at a time and battery consumption is high which makes it rather heavy for backpacking
Whistle (2) – For emergencies; also good for letting the workers know when it was lunch time

OTHER EQUIPMENT / MISCELLANEOUS

Black bags – For rubbish; also to put clothing and equipment in while travelling to keep them dry
Frisbee – Workers loved to play with this and children enjoyed watching; doubled up as a spare plate
Playing Cards – Essential for passing the time while travelling

Above – Naomi uses a pangma to whittle a spoon from a dead piece of wood; spoons were the one thing the team forgot to take / buy.
Inset – Harriet and Naomi (L-R) soaking up the morning sun at Chelinda while making spoons.
Right – Workers sit and wait to be debriefed at the end of another working day; their equipment is stacked in the foreground.

Above & inset – Naomi shows the sort of clothes that were typically worn on site and the safety equipment worn when working at height.

APPENDIX B – Personal Clothing & Equipment List

By Naomi Bessey & Daniel Carrivick

List of the clothing and equipment taken on the expedition by each team member, together with details and comments for each item. Expedition members used old clothing that they already owned and didn't mind getting damaged rather than buying new clothing especially for the expedition. Waterproofs were not taken as it rarely rains in July in Malawi – the team had a few spits and spots one day in Lilongwe but it didn't last long. Warm hats and gloves are recommended for those who easily suffer from the cold though these are not included here as team members took buffs or jackets/jumpers with hoods. The quantity of each item taken is shown in brackets where more than one.

CLOTHING & FOOTWEAR

Boots – Steel toe capped boots recommended for working on site; in reality walking boots or approach shoes were worn
Buff – Very versatile piece of headwear clothing; can be used to keep you cool or warm; protects you from the sun
Gloves (workman) – For wearing on site; worth looking after otherwise they will fall apart or go missing
Jacket – must be 100% windproof e.g. synthetic insulated jacket or a soft shell; essential when travelling in the back of the truck late in the day / early morning; also some days at Uledi were quite windy as the wind blows down off the plateau
Jumper (2) – One lightweight fleece and one heavier warmer one (or thick jumper); both needed in the mornings and evenings as it got quite chilly at night; also used to keep warm when travelling in the back of the truck
Long Sleeved Top – e.g. a travel shirt; to cover and thus protected arms from the sun; some of the team also took thermal tops to stay warm as evenings were chilly especially up on the Nyika Plateau
Sandals – Sandals were taken as a third pair of footwear by some of the team; not recommended around camp because of snakes, scorpions and other creatures but handy for wading across the river, at Lake Malawi and while travelling
Shoes – Trainers or approach shoes; second set of footwear for wearing in and around town and while travelling
Shorts – Worn by male members of the team on site and while swimming; females need to be sensitive to the local traditions; female members of the team only wore shorts while swimming at Lake Malawi
Socks (4/5) – good quality socks are essential for looking after feet, especially as they will be in the same hot shoes day after day; should be comfortable and functional
Sun Hat / Cap – Wide brimmed and light in colour is best; if taking a cap consider taking something to cover your neck
T-shirt (3) – One really old one for wearing on site and another for wearing in towns and cities; the third should be breathable to be able to cope with strenuous activity in hot climates
Trousers (2) – One old durable pair for working on site and trekking through the bush and another pair for travelling; convertibles proved handy when wading across the river as the bottoms could be easily removed
Underwear (4) – The moisture wicking type are best; quick drying and breathable

EQUIPMENT & ACCESSORIES

Book – Each team member took one reading book and these were swapped amongst team members once they had been read; books mostly read while travelling and when in towns/cities – not read much in Uledi
Camera & Batteries – Compact camera's preferred as able to keep in pocket ready for those unpredictable moments; camera's which took AA batteries worked best as these could be recharged using the solar panel
Earplugs – Not used but could be useful if other team members snore
First Aid Kit – **Personal –** Contains none emergency items together with personal medication and other day-to-day medical supplies; see appendix C for complete breakdown of contents
Head Torch & Batteries – LED torches recommended as have long battery life; batteries did not have to be changed once despite torches being used most evenings in camp as it got dark around 6pm when the team often ate dinner
Lip Salve – Occasional use; to stop lips drying and cracking
Penknife / Multi-tool – One multi-tool in the group is good but not everyone needs one; same with multi-function penknives - single blade sharp knives were sufficient for most uses
Rucksack Large – 60-80 litre rucksack for storing and transporting personal belongings
Rucksack Small – 20-40 litre rucksack for things needed while travelling
Sleeping Bag – Used old, heavy and cheap synthetic bags were fine
Sleeping Bag Liner – Good for keeping sleeping bag relatively clean; can be used on its own to sleep in when hot
Soap 200ml – All purpose travel liquid soap for people, clothes and food; made from biodegradable organic ingredients
Shampoo & Conditioner 50ml – Small luxury item especially for those with long hair; disposable hotel sachets and bottles are ideal as long as the shampoo/conditioner is biodegradable
Spoon – To eat with; no need for a knives and forks
Sun Cream – Only used on face and arms as everything else was kept covered up
Sunglasses – Worn by some team members and not by others; up to each individual
Toothbrush – No need on this expedition to chop the handle off or anything to save weight
Toothpaste 50ml – No need to take a standard 100ml tube unless it is for the whole team to share; if small tubes of toothpaste are hard to find take a two-thirds empty 100ml tube
Travel Towel – One that is small, lightweight and good at absorbing moisture
Water Bottle 1Ltr – Nalgene bottle or similar with a measuring scale on the side are good as when cooking specific quantities of water may be needed; transparent bottle recommended as any foreign objects in the water can be seen

DOCUMENTS

Flight Tickets – Essential to keep safe for the return journey
Insurance – Details of emergency assistance instructions should be kept on all team members at all times
Money – Sterling changed to Malawian Kwacha in Malawi; US dollars needed to pay the departure tax but dollars could be got at the airport and everything else could be paid in Malawian Kwacha
Passport & Visa – Essential to keep safe; should be kept with you at all times

APPENDIX C – First Aid Kit List

By Daniel Carrivick

List detailing all the first aid items taken on this expedition along with useful information and personal experiences where applicable. Each team member took a personal first aid kit, the suggested contents of which are listed separately at the foot of this list. Everything else listed made up the group first aid supplies. These were split up to form two group first aid kits; one main one that stayed on site at Uledi and a smaller travel one that stayed in the truck. The personal and group first aid kits were designed with some overlap so that group first aid supplies could be used to top-up personal first aid kits, or vice versa depending on the nature of the expedition's first aid requirements. Where relevant, dosages are given to put into context the quantities taken. This information should not be used as a guideline when administering drugs. Always read carefully and refer to the information leaflet which accompanies all drugs. The information provided below is no substitute for proper training.

ANTI-MICROBIALS – None taken by team members; team member with suspected Malaria took a course of Arinate 100mg, available locally from a pharmacy in Mzuzu; see medical report p31 for more details

Amoxicillin 250mg Capsules (21) – 2 courses, very versatile. Amoxicillin is an antibiotic in the class of drugs called penicillin's. Used to treat many different types of infections, such as pneumonia, bronchitis, venereal disease (VD), gonorrhoea, and infections of the ears, nose, throat, urinary tract, and skin. Antibiotics work by killing bacteria – they will therefore not work for colds, flu, or other viral infections. Overlaps with Co-Amoxiclav, don't need both, only taken as left over from previous expedition. Dose: One capsule three times daily.
Chloramphenicol Ointment 4g – An antibiotic ointment used to treat bacterial eye infections. Dose: Apply ointment under the lower eyelid four times a day for five days.
Ciprofloxacin 250mg Tablets (28) – Ciprofloxacin is an antibiotic used to treat certain infections caused by bacteria e.g. pneumonia, bronchitis, diarrhoea caused by bacteria, typhoid fever, and bone, joint, skin, prostate, sinus, and urinary tract (bladder) infections. Dose: One tablet twice daily. Treatment for a severe gut infection is 3-7 days and for a chest infection is 7-14 days.
Co-Amoxiclav 250/125mg Tablets (42) – Amoclan. Commonly used for chest, urinary, skin and wound infections. Each tablet contains 250mg Amoxicillin and 125mg Clavulanic acid. Penicillin based antibiotic for treating infections. Dose: One tablet three times a day.
Doxycycline 100mg Tablets (28) – Doxycycline is a tetracycline, a broad-spectrum antibiotic, which is used to treat chest infections, malaria (with a course of quinine sulphate), acne and sometimes travellers diarrhoea. Dose: One tablet twice daily for seven days in the treatment of malaria, with plenty of water. Taken by all team members to prevent malaria. Side effects caused one team member, in 2006, to vomit and become nauseous due to not taking with plenty of water. No major problems were experienced with increased sensitivity to sunlight; team members took appropriate clothing so they could cover up as necessary.
Flucloxacillin 250mg Capsules (28) – 1 course. Flucloxacillin is a narrow spectrum antibiotic that has specific activity against penicillinase-producing bacteria. Used to treat certain skin, chest, and soft tissue infections. Dose: One capsule four times daily.
Quinine Sulphate 200mg Tablets (28) – 1 course. Used to treat malaria. Taken with Doxycycline. Dose: Three tablets three times a day for three days. Individual with suspected Malaria was prescribed Arinate 100mg which was purchased locally and taken with Doxycycline in preference to Quinine Sulphate.

CREAMS AND OINTMENTS – Standard sized tubes of cream (50g) are quite heavy and are often way more than is needed so try to source smaller (15g) tubes; a few free-sample sized tubes are ideal if they can be found

Caneston Cream 20g – For fungal skin infections; applied twice daily
Daktarin Dual Action Cream 15g – For the treatment of athletes' foot; Applied twice daily
E45 Cream 50g – Treatment for dry skin conditions including dry, itching, flaking, chapped skin and sunburn; also recommended for eczema, dermatitis and ichthyosis; applied liberally 2-3 times a day
Hydrocortisone Cream B.P. 1% 30g – Relief for mild eczema, insect bites & contact dermatitis; applied sparingly, twice daily for a maximum of 7 days
Savlon Cream 60g – Antiseptic cream, prevents infection and aids healing; used to treat minor injuries to workers

DRESSINGS – Tape and plasters, along with a few small dressings were predominantly used to treat workers who suffered minor injuries while working on site

Antiseptic Cleansing Wipe (12) – Only a few taken as surplus to personal supplies as betadine (and iodine solution, taken for purifying water) could always be used to clean wounds instead of antiseptic wipes
Betadine 200ml (1) – Antiseptic skin cleanser for major and minor surgical procedures
Cotton Wool Pads – Soft and absorbent for cleaning skin around wounds
Crepe Bandage 7.5cm (4) – Useful to have lots as may have to keep replacing dressings
Dressing, Large & Sterile, No.9 (2) – For covering large wounds
Eye Dressing No.16 (2) – Specific dressing for an eye injury
Fluorets (10) – Flourescein sodium BP 1mg; sterile ophthalmic strip which makes foreign bodies and scratches on the surface of the eye easier to identify
Gauze Swabs 7.5x7.5cm (4) – Not used, essential for open wounds
Inadine 5x5cm (2) – Used for the prophylaxis and treatment of infection in minor burns, leg ulcers, and superficial skin loss injuries; use saline solution to remove dressing if adhered to the wound surface
Melolin Dressing, Non-Adhesive 5x5cm (2) – For cuts, grazes and minor burns; good for blisters
Melolin Dressing, Non-Adhesive 10x10cm (2) – For cuts, grazes and minor burns; can be cut to size as necessary
Meopore Dressings, Adhesive, Assorted (10) – Ideal for covering large wounds while healing as well as minor wounds which are too large to cover with a standard plaster
Micropore (1cm x 15m) – More breathable than zinc-oxide tape but doesn't stay on as well
Plasters, Assorted (20) – Adhesive dressings; quantity was fine, variety of sizes were useful
Saline solution (2) – Reserved for emergency wound cleansing; Betadine taken for day-to-day wound cleansing
Steri-strips (2) – 6x75mm; good for holding closed superficial, gaping wounds
Triangular Bandage (2) – For immobilising limbs; source extra from personal kits as necessary
Zinc Oxide Tape 2.5cm x 10m (2) – Wider tape is better as it is more likely to stay on and in place

Above & inset – Just some of the first aid supplies that were taken out to Malawi.

Above & inset – Crowds gather on the shore of Lake Malawi to watch as Naomi and Harriet get out of the canoe.

HARDWARE – This expedition was not limited by weight or size of equipment so a fairly comprehensive first aid kit was taken with quite an assortment of hardware; cost was the main factor limiting what equipment and supplies were taken

Anaeroid Sphygmomanometer – For taking blood pressure readings
Dental First Aid Kit – See below for contents information
Scalpels (2) – For use by qualified people in countries where medical hygiene levels are less than satisfactory
Isolaide Resuscitation Aid – Face shield for personal protection during mouth to mouth resuscitation
Latex Gloves (10) – Non Sterile, medium size; for general hygiene and protection
Safety Pins (5) – Handy to have a few even though they are perhaps not essential
Sam Splint (2) – For immobilising limbs; worthwhile investment - highly recommended
Scissors, Medical – Tuff cut scissors which will cut through most materials; essential to have for emergencies; knifes, multi-tools and other substitutes are not suitable
Sterile Supplies Kit - See below for contents information
Stethoscope – Economy, for listening to internal sounds such as heart beats and breathing
Stifnek Select Neck Immobiliser – For immobilising the neck
Thermometer – Digital one, waterproof with an alarm
Tweezers – Useful to have a large separate pair rather than relying on a tiny pair found on some pen-knifes

PAINKILLERS – Ibuprofen was taken frequently by team members suffering from various aches, pains, and stomach upsets. Individual who suffered from suspected Malaria was on Ibuprofen for a week or so.

Aspirin 300mg Caplets (16) – For mild to moderate pain and fever; also an anti-inflammatory and has a blood thinning effect; dose: 300-900mg every 4-6 hours (max 4g daily)
Co-Codamol Tablets 30/500mg (60) – For moderate to severe pain; probably only need half this amount but they came in a box of 100; dose two tablets three to four times daily (max 8 tablets in 24 hours)
Ibuprofen 200mg (64) – Anti-inflammatory drug for muscle, joint and period pains; dose: 400mg every 8 hours with or after food; supplementary to the Ibuprofen carried in personal kits
Paracetamol 500mg Tablets (64) – For mild to moderate pain and fever; dose: 1g every 6 hours (max 4g daily)

OTHER MEDICATION – The local environment coupled with personal preferences dictated that the following other medication was also included in the group first aid kits.

Chlorpheniramine Tablets 4mg (30) – Piriton allergy tablets; antihistamine primarily for hay fever relief; may also relieve insect bites and stings, allergic rashes and itching; dose: One tablet every 4-6 hours
Imodium 2mg (26 Capsules) – May prolong gut infections; use restricted to when travelling and when in harsh environments; dose: 4mg initially then 2mg after each loose stool (max 16mg daily)
Prochlorperazine Tablets 5mg BP (42) – Anti-sickness medicine; dose: 5-10mg every 4-6 hours
Rehydration Sachets (6) – Each oral rehydration sachet contained 277mg of sodium and 4g of Dextrose, to which 200ml of water had to be added; expensive so only a few taken for real emergencies; in less serious situations a rehydration drink would have been made by adding 1/2 tsp salt (3.5g) and 4 tbsp sugar (40g) to one litre of water

DENTAL FIRST AID KIT – Not Used

Cement – Temporary cavity filling material
Clove Oil (10ml) – Temporarily relieves toothache by killing the bacteria eating through your tooth and getting at the nerve; applied sparingly - clove oil is very powerful so only a little is needed
Cotton Rolls – For applying small amounts of clove oil to a tooth
Guide – Advice and help regarding basic dental care
Needle & Syringe – To be given to a qualified person in countries where levels of medical hygiene are not always of the same standard as they are back home
Mirror – For seeing behind teeth and inside mouth
Spatula – For smoothing and removing excess cement

STERILE KIT – Wilderness sterile kit to be given to a qualified doctor or nurse should a member of the team have required sudden medical attention on the expedition

Alcohol Swabs (10) – Sterets pre-injection swab
Dental Needles (2) – For injecting anaesthetics
Hypodermic Needles (15) – Three lengths; 0.5x16mm, 0.6x30mm & 0.8x40mm, five of each size
I.V. Cannula (4) – Venflon drip needles for providing intravenous solutions; two sizes - 1.0x32mm (54ml/min) and 1.2x45mm (80ml/min)
I.V. Multifusion Set – Intrafix set for giving intravenous solutions; suitable for pressure or gravity infusion
Scalpel – Disposable and sterile scalpel
Syringes (15) – Three sizes; 2ml, 5ml & 10ml, five of each size

PERSONAL FIRST AID KIT (5) – Each team member took their own personal first aid kit. The contents of this varied slightly according to each team members personal needs. However, the recommended minimum contents were:

Adhesive Plasters (10) – For minor cuts, grazes and to prevent blisters
Antiseptic Wipes (6) – Used to clean cuts and scrapes sustained from handling materials
Blister Kit – Sand and gravel in shoes caused abrasion and damage of feet
Crepe Bandage (1 or 2) – For strapping dressings over wounds and protecting the area around them
Dressing, Large & Sterile, No.9 – For covering a large wound
Ibuprofen 200mg (24) – To relieve day-to-day aches and pains
Latex Gloves (2) – For general hygiene and protection; worn whenever first aid administered
Melolin Dressing, Adhesive (2) – Good for blisters and thus handy to have in personal kit
Paracetamol 500mg (12) – For pain relief; Ibuprofen tended to be used in preference
Triangular Bandage – For immobilising limbs; also can be used as an emergency sun hat
Safety Pins (6) – Variety of uses, not just for first aid
Survival Blanket – Heat reflecting emergency blanket 2150x1500mm; small and compact, folds up to pocket size; has a multitude of uses and can be a lifesaver
Zinc Oxide Tape 25mm x 5m – Used to tape up feet to prevent blisters and to fasten small dressings; wider tape stays on longer, 40-50mm is great if it can be found!

APPENDIX D – Construction Equipment List

Written and compiled by Naomi Bessey & Daniel Carrivick

Below – Wheelbarrows and shovels were in constant demand; they were two of the most used pieces of equipment.
Inset – Another wheelbarrow is filled with earth for the embankment.

The data tables in Appendix D were all needed by team members when planning this expedition, and thus they are printed here for general information and as they may be of use for similar future projects. Table D1 lists the things which were left with the community at the end of the 2006 expedition. The village chiefs were responsible for looking after the materials and equipment which were to be made available for locals to borrow and for use on any future community projects. Key tools such as shovels and wheelbarrows etc. were returned to the 2007 expedition team so they could be used on site during this expedition.

Table D1 Items donated to the Uledi community at the end of the 2006 expedition

Quantity	Item	Detail
1	Bow saw	
2	Bucket	metal buckets
1	Chisel	
2	Crowbar	double ended
1	File	for sharpening blades
4	Gloves	leather palm, battered
3	Hammer	small, metal head
1	Hoe	2.5 lb
1	Hosepipe	8m; clear plastic
1	Mallet	metal
1	Metal pipe	for rebar bending
3	Metal sheet	corrugated; door sized
2	Nails (bag of)	4 and 2 inch
2	Pick axe	
2	Plastic pipe	thin diameter, 6m pieces
5	Rebar pieces	assorted off cuts
20	Sacks	at least half were worn / damaged
4	Shovels	
2	Sieves	for aggregate; made from large plastic bowls
1	Spade	
1	Spirit level	20cm
1	Square trowel	large
3	Trowel	
2	Wheelbarrows	Rigid wheel
4	Wire brushes	wooden handle, battered
4	Wire cutters	
1	Wooden board	8ft x 4ft 1 inch thick plywood

Table D2 lists the materials which were left in a locked room, in one of the National Park buildings in Uledi. These items were left there at the end of the 2006 expedition ready for when a team could return to complete the bridge. When this expedition arrived a year later, the team found all items untouched. Everything was still present and nothing had suffered any major ill effects for being stored for such a long period of time.

Table D2 Items left in the National Park storeroom at the end of the 2006 expedition

	Quantity	Item	Detail
Wood / Timber	3	Crossbeam	for replacement
	1	Decking ½	end piece
	18	Decking units	2m x 1m including 3 crossbeams each
	2	Ladder	10 of 2" x 8" steps on each
	7	Ladder chocks	for replacement
	2	Ladder steps	for replacement
	7	Off cuts	1" x 2" ~1m each
	1	Plank	1" x 6" ~ 6m each
	4	Plank	2" x 4" ~ 6m each
	4	Plank	2" x 6" ~ 6m each
Metal	1	Bolt	20mm diameter
	100	Metal plates	15 x 30 cm; 2mm thick with two holes in
	1	Nails	4 inch length, 5kg bag
	34	Nuts	to fit 20mm bolt
	2	Steel mesh	5m long, 1.2m high (20 x 20)
	2	Train track	3m long
	1	Wire	9m of 2mm diameter
Misc.	5	Cement bags	
	1	Drill head	26 mm diameter to fit wood drill
	1	Earth Compactor	concrete headed
	5	Grease	1 litre
	2	Inner tubes	for bike, broken
	1	PVC pipe	6m of 10cm diameter
	1	Wood drill	

Below – Earth is shovelled into a wheelbarrow from the stockpile so it can be added to the embankment.
Inset – Workers use their feet to compact the earth (foreground) while more earth is brought down to the site (background).

Table D3 lists the tools and materials purchased during the 2006 expedition, how much they cost and where they were bought. For completeness, a few examples of things available in Malawi but not purchased because they were taken out by the team from the UK are included at the bottom of the table.

Table D3 Construction equipment and consumables purchased for the 2006 expedition

Qty	Item	Unit Price *		Where item was purchased
	EQUIPMENT			*Average exchange rate in 2006 was MWK 261.60 to £1.
1	Adjustable Spanner large	MWK 295	£1.13	Market, Mzuzu
1	Adjustable Spanner small	MWK 165	£0.63	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Axe	MWK 450	£1.72	Market, Mzuzu
1	Bow saw frame 60cm	MWK 995	£3.80	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
3	Brick laying trowels	MWK 495	£1.89	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Bucket	MWK 420	£1.61	Arkay Factory Shop, Mzuzu
1	Bucket	MWK 350	£1.34	Market, Mzuzu
1	Bucket	MWK 470	£1.80	Market, Mzuzu
1	Chisel 12"	MWK 750	£2.87	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Claw Bar	MWK 650	£2.48	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Crowbar 3"	MWK 1,950	£7.45	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	File	MWK 295	£1.13	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Hammer	MWK 395	£1.51	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
2	Hammer + handle	MWK 225	£0.86	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Hammer 4lb rock hammer	MWK 950	£3.63	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Handsaw	MWK 1,695	£6.48	Yogi Agricultural + Hardware Supplies, Mzuzu. Tel. 09206898
2	Hoes	MWK 325	£1.24	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
10	Hose pipe (m)	MWK 130	£0.50	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Lasher Hand Saw 24"	MWK 1,295	£4.95	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Panga / Machete	MWK 350	£1.34	Market, Mzuzu
1	Panga / Machete	MWK 270	£1.03	Market, Mzuzu
2	Pick axe	MWK 825	£3.15	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
4	Pincers	MWK 225	£0.86	Market, Mzuzu
1	Plumb Bob	MWK 135	£0.52	Promat P.O. Box 30041 Lilongwe 3, Malawi. Tel. 01710388
1	Set of spanners	MWK 695	£2.66	Agricultural Equips Ltd. P.O. Box 1223 Lilongwe. Tel. 01724624/617
4	Shovels	MWK 995	£3.80	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Slimy Trowel	MWK 295	£1.13	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Spade	MWK 1,950	£7.45	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Spanner 12"	MWK 450	£1.72	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
1	Spanner 8"	MWK 350	£1.34	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
2	Wheelbarrows	MWK 5,400	£20.64	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
4	Wire brushes	MWK 95	£0.36	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
	CONSUMABLES			
100	Askar Cement 50kg	MWK 1,475	£5.64	Shayona Cement Corp. P.O. Box 679 Mzuzu. Tel. 01752791
31	Askar Cement 50kg	MWK 1,500	£5.73	Chipiku Stores, Nthalire
4	Bars 112x12m	MWK 8,800	£33.64	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
6	Bars 116x12m	MWK 29,700	£113.53	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
1	Bars 120x12m	MWK 6,250	£23.89	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
5	Bars 18x12m	MWK 5,500	£21.02	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
9	Bars R6x12m	MWK 6,300	£24.08	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
1	Bars R6x6m	MWK 350	£1.34	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
1	Bars R8x12m	MWK 1,450	£5.54	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
17	Bolts + nuts mix	MWK 390	£1.49	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
1	Cement	MWK 1,543	£5.90	Chipiku Stores, Rumphi
2	Chipboard 8ft x 4ft	MWK 2,350	£8.98	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
6	Corrugated Metal Sheets	MWK 1,400	£5.35	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
5	Grease 1kg	MWK 650	£2.48	CCA Auto Parts + Acc P.O. Box 1852 Lilongwe. Tel. 01750728
1	Hacksaw Blades	MWK 90	£0.34	Yogi Agricultural + Hardware Supplies, Mzuzu. Tel. 09206898
10	Hessian Sacks	MWK 500	£1.91	Market, Mzuzu
2	Irons Plates 50x50x5	Not Known		Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
76	Metal Plates 1.2mm MES	MWK 22,000	£84.10	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
20	Metal wire MTR A98	MWK 29,450	£112.58	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
10	Nylon Rope (1mtr)	MWK 500	£1.91	Promat P.O. Box 30041 Lilongwe 3, Malawi. Tel. 01710388
2	Plastic pipe 6m 110mm	MWK 1,320	£5.05	Promat P.O. Box 40 Mzuzu Malawi. Tel. 01333653
2	Plastic pipe 6m 40mm	MWK 366	£1.40	Promat P.O. Box 40 Mzuzu Malawi. Tel. 01333653
2	Rolls Builders' line	MWK 250	£0.96	Builders Wholesalers P.O. Box 210 Lilongwe. Tel. 01727395
12	Wire mesh MTR A98	MWK 18,000	£68.81	Steel + Hardware Co. Ltd P.O. Box 777 Mzuzu. Tel. 01333374
3	Wire nails (1kg)	MWK 190	£0.73	Select + Save Ltd P.O. Box 654 Lilongwe. Tel. 01724638
21	Wire nails (1kg)	MWK 4,725	£18.06	Yogi Agricultural + Hardware Supplies, Mzuzu. Tel. 09206898
3	Wire nails 1 inch (1kg)	MWK 295	£1.13	Yogi Agricultural + Hardware Supplies, Mzuzu. Tel. 09206898
1	Wire nails 2 inch (1kg)	MWK 230	£0.88	Yogi Agricultural + Hardware Supplies, Mzuzu. Tel. 09206898
	OTHER			
2	Football	MWK 2,800	£10.70	Children's corner
1	Jerry Can 20ltr	MWK 600	£2.29	Market, Mzuzu
2	Pencils	MWK 45	£0.17	Market, Mzuzu
1	Pump	MWK 135	£0.52	Children's corner
1	Set of cooking pots	MWK 3,000	£11.47	Market, Mzuzu
1	Straw mat	MWK 350	£1.34	Side of the road
	EXAMPLES			
	5m tape measure	*MWK 400*	*£1.53*	*Shoprite, Lilongwe*
	Back Saw	*MWK 369*	*£1.41*	*Shoprite, Lilongwe*
	Hand Saw	*MWK 699*	*£2.67*	*Shoprite, Lilongwe*
	Rubber mallet	*MWK 300*	*£1.15*	*Shoprite, Lilongwe*
	Spirit Level 600mm	*MWK 300*	*£1.15*	*Shoprite, Lilongwe*
	Tape measure 30m steel	*MWK 3,500*	*£13.38*	*Shoprite, Lilongwe*

APPENDIX E – Food list

Compiled by Daniel Carrivick

Table E1 shows the items purchased from Shoprite in Lilongwe. This was the team's main shop where the bulk of the expedition food supplies were purchased. A few additional items were also bought in Mzuzu and at local markets on the way to Uledi. These were primarily perishables such as bread, fruit and vegetables.

Table E1 List of items purchased from Shoprite in Lilongwe. Exchange rate used is £1 = MWK 285 (the average exchange rate received during this expedition).

* Indicates these sizes have been estimated as exact size is not known.

Item	Size	Qty	Unit Price		Total Cost	
Apples	2kg	4	MWK 699.99	£2.46	MWK 2,799.96	£9.82
Baked beans	400g	1	MWK 149.99	£0.53	MWK 149.99	£0.53
Baked beans	400g	12	MWK 119.99	£0.42	MWK 1,439.88	£5.05
Biscuits - bourbons	200g	3	MWK 115.99	£0.41	MWK 347.97	£1.22
Biscuits - creams	75g	14	MWK 18.99	£0.07	MWK 265.86	£0.93
Biscuits - creams	100g	6	MWK 19.99	£0.07	MWK 119.94	£0.42
Biscuits - custard creams	100g	7	MWK 54.99	£0.19	MWK 384.93	£1.35
Biscuits - lemon creams	100g	15	MWK 33.99	£0.12	MWK 509.85	£1.79
Biscuits - plain	150g	6	MWK 54.99	£0.19	MWK 329.94	£1.16
Bran flakes	1kg	1	MWK 1,099.99	£3.86	MWK 1,099.99	£3.86
Brandy	750ml	2	MWK 529.99	£1.86	MWK 1,059.98	£3.72
Bread	700g	6	MWK 78.99	£0.28	MWK 473.94	£1.66
Bread flour	2.5kg	1	MWK 699.99	£2.46	MWK 699.99	£2.46
Butter beans (tinned)	400g	5	MWK 169.99	£0.60	MWK 849.95	£2.98
Candles	6's	2	MWK 199.99	£0.70	MWK 399.98	£1.40
Caramel	170g	1	MWK 169.99	£0.60	MWK 169.99	£0.60
Caramel (tinned)	400g	1	MWK 339.99	£1.19	MWK 339.99	£1.19
Carrots (tinned)	*400g	3	MWK 249.99	£0.88	MWK 749.97	£2.63
Cheese - cheddar	100g	30	MWK 208.89	£0.73	MWK 6,266.80	£21.99
Chilli hot sauce	*100ml	1	MWK 129.99	£0.46	MWK 129.99	£0.46
Chilli sauce	100ml	4	MWK 109.99	£0.39	MWK 439.96	£1.54
Chocolate powder	500g	1	MWK 739.99	£2.60	MWK 739.99	£2.60
Cling film	30m	1	MWK 339.99	£1.19	MWK 339.99	£1.19
Cocoa	200g	1	MWK 439.99	£1.54	MWK 439.99	£1.54
Coconut	100g	1	MWK 169.99	£0.60	MWK 169.99	£0.60
Coffee - instant	250g	2	MWK 399.99	£1.40	MWK 799.98	£2.81
Condensed milk	400g	2	MWK 279.99	£0.98	MWK 559.98	£1.96
Cordial - mixed fruit	1ltr	1	MWK 149.99	£0.53	MWK 149.99	£0.53
Corn flakes	1kg	2	MWK 999.99	£3.51	MWK 1,999.98	£7.02
Corned meat (tinned)	400g	6	MWK 329.99	£1.16	MWK 1,979.94	£6.95
Cream Crackers	400g	3	MWK 459.99	£1.61	MWK 1,379.97	£4.84
Crisps - puffs	*500g	4	MWK 214.99	£0.75	MWK 859.96	£3.02
Cucumber halves	2	1	MWK 139.99	£0.49	MWK 139.99	£0.49
Evaporated milk	380g	1	MWK 349.99	£1.23	MWK 349.99	£1.23
Flask - thermos	1ltr	1	MWK 499.99	£1.75	MWK 499.99	£1.75
Flour - cake	1kg	1	MWK 198.99	£0.70	MWK 198.99	£0.70
Foil	*10m	2	MWK 159.99	£0.56	MWK 319.98	£1.12
Football		1	MWK 1,199.99	£4.21	MWK 1,199.99	£4.21
Garlic	whole	1	MWK 326.00	£1.14	MWK 326.00	£1.14
Gin	750ml	2	MWK 899.99	£3.16	MWK 1,799.98	£6.32
Green beans	410g	3	MWK 259.99	£0.91	MWK 779.97	£2.74
Guava (tinned)	825g	2	MWK 379.99	£1.33	MWK 759.98	£2.67
Hot chocolate	500g	1	MWK 689.99	£2.42	MWK 689.99	£2.42
Hot dogs (tinned)	390g	6	MWK 339.99	£1.19	MWK 2,039.94	£7.16
Icing sugar	200g	3	MWK 117.99	£0.41	MWK 353.97	£1.24
Jam - strawberry	454g	1	MWK 539.99	£1.89	MWK 539.99	£1.89
Knife set	2	1	MWK 249.99	£0.88	MWK 249.99	£0.88
Ladle		1	MWK 499.99	£1.75	MWK 499.99	£1.75
Lemons	loose	1	MWK 378.83	£1.33	MWK 378.83	£1.33
Lentils - red	500g	2	MWK 279.99	£0.98	MWK 559.98	£1.96
Lollies – sweets	7	2	MWK 89.99	£0.32	MWK 179.98	£0.63
Maize flour	1kg	2	MWK 134.99	£0.47	MWK 269.98	£0.95
Margarine	500g	7	MWK 269.99	£0.95	MWK 1,889.93	£6.63

Above & inset – Jumana and Dan buy some beans and lentils from the market in Mzuzu.

Below – Traditional local food cooked for the bridge opening celebrations; relish and stew with nsima or rice.
Inset – A typical portion is dished up; a large ball of nsima is accompanied by a small amount of goat or chicken stew and green vegetable relish.

Item	Size	Qty	Unit Price		Total Cost	
Marshmallows	400g	2	MWK 439.99	£1.54	MWK 879.98	£3.09
Matches	10's	1	MWK 44.99	£0.16	MWK 44.99	£0.16
Mayonnaise	*750g	2	MWK 449.99	£1.58	MWK 899.98	£3.16
Meatballs (tinned)	400g	6	MWK 319.99	£1.12	MWK 1,919.94	£6.74
Milk powder	400g	10	MWK 439.99	£1.54	MWK 4,399.90	£15.44
Mint Imperials	*200g	1	MWK 179.99	£0.63	MWK 179.99	£0.63
Mug	7cm	7	MWK 14.99	£0.05	MWK 104.93	£0.37
Nail brush		1	MWK 199.99	£0.70	MWK 199.99	£0.70
Noodles - instant	75g	10	MWK 59.99	£0.21	MWK 599.90	£2.10
Oil - cooking	1ltr	4	MWK 299.99	£1.05	MWK 1,199.96	£4.21
Onions	10kg	1	MWK 1,849.99	£6.49	MWK 1,849.99	£6.49
Onions - loose	*1kg	5	MWK 207.47	£0.73	MWK 1,037.35	£3.64
Orange juice	500ml	1	MWK 134.99	£0.47	MWK 134.99	£0.47
Orange squash	2ltr	2	MWK 259.99	£0.91	MWK 519.98	£1.82
Oranges - 4's	*1kg	6	MWK 581.84	£2.04	MWK 3,491.04	£12.25
Pasta - linguine	500g	4	MWK 209.99	£0.74	MWK 839.96	£2.95
Pasta - macaroni	500g	8	MWK 169.99	£0.60	MWK 1,359.92	£4.77
Peach slices (tinned)	800g	2	MWK 359.99	£1.26	MWK 719.98	£2.53
Peanut butter	450g	2	MWK 204.99	£0.72	MWK 409.98	£1.44
Peanuts - salted	*1kg	1	MWK 429.99	£1.51	MWK 429.99	£1.51
Pear halves (tinned)	800g	2	MWK 359.99	£1.26	MWK 719.98	£2.53
Peas - processed (tinned)	400g	8	MWK 139.49	£0.49	MWK 1,115.92	£3.92
Pilchards	*std tin	5	MWK 299.99	£1.05	MWK 1,499.95	£5.26
Piri piri powder	50g	1	MWK 99.99	£0.35	MWK 99.99	£0.35
Plastic basin	36cm	5	MWK 249.99	£0.88	MWK 1,249.95	£4.39
Plastic basin	25ltr	1	MWK 723.99	£2.54	MWK 723.99	£2.54
Plastic bucket and lid	10ltr	2	MWK 649.99	£2.28	MWK 1,299.98	£4.56
Plastic bucket with lid	*9ltr	2	MWK 383.99	£1.35	MWK 767.98	£2.69
Plastic plate	24cm	2	MWK 39.99	£0.14	MWK 79.98	£0.28
Popcorn kernels	*500g	3	MWK 59.99	£0.21	MWK 179.97	£0.63
Porridge	1kg	1	MWK 319.49	£1.12	MWK 319.49	£1.12
Porridge (instant)	500g	10	MWK 279.99	£0.98	MWK 2,799.90	£9.82
Potatoes	10kg	2	MWK 1,999.99	£7.02	MWK 3,999.98	£14.04
Rice	1kg	6	MWK 149.99	£0.53	MWK 899.94	£3.16
Rusks	*500g	2	MWK 389.99	£1.37	MWK 779.98	£2.74
Salt	500g	1	MWK 28.99	£0.10	MWK 28.99	£0.10
Sardines	*std tin	6	MWK 279.99	£0.98	MWK 1,679.94	£5.89
Scourers	3's	2	MWK 199.49	£0.70	MWK 398.98	£1.40
Soap - laundry	bar	3	MWK 13.99	£0.05	MWK 41.97	£0.15
Soup (powder) assorted	1 pint	20	MWK 89.99	£0.32	MWK 1799.80	£6.32
Soya mince	*200g	2	MWK 179.99	£0.63	MWK 359.98	£1.26
Soya mince	100g	2	MWK 99.99	£0.35	MWK 199.98	£0.70
Spaghetti in tomato sauce	400g	6	MWK 169.99	£0.60	MWK 1,019.94	£3.58
Split peas	500g	1	MWK 159.99	£0.56	MWK 159.99	£0.56
Sugar - brown	1kg	5	MWK 96.99	£0.34	MWK 484.95	£1.70
Sugar - white	1kg	5	MWK 104.99	£0.37	MWK 524.95	£1.84
Sweet corn (tinned)	400g	5	MWK 179.99	£0.63	MWK 899.95	£3.16
Sweets	170g	3	MWK 169.99	£0.60	MWK 509.97	£1.79
Teabags	50's	2	MWK 149.99	£0.53	MWK 299.98	£1.05
Toilet rolls	9's	5	MWK 399.99	£1.40	MWK 1,999.95	£7.02
Tomato ketchup	*1kg	2	MWK 279.99	£0.98	MWK 559.98	£1.96
Tomato puree (tinned)	450g	5	MWK 289.99	£1.02	MWK 1,449.95	£5.09
Tomatoes (pre-packed)	6	1	MWK 169.99	£0.60	MWK 169.99	£0.60
Tomatoes (tinned)	400g	15	MWK 269.99	£0.95	MWK 4,049.85	£14.21
Towel	Bath	1	MWK 1,159.99	£4.07	MWK 1,159.99	£4.07
Tuna chunks (tinned)	185g	20	MWK 219.99	£0.77	MWK 4,399.80	£15.44
UHT milk	250ml	9	MWK 199.99	£0.70	MWK 1,799.91	£6.32
Washing up liquid	*1ltr	1	MWK 299.99	£1.05	MWK 299.99	£1.05
Water	1ltr	5	MWK 74.99	£0.26	MWK 374.95	£1.32
Water	2ltr	3	MWK 99.99	£0.35	MWK 299.97	£1.05
Total		**449**			**MWK 105,209.46**	**£369.16**

Below & inset – Some of the fish seen while snorkelling in Lake Malawi; the lake has more fish species than any other body of water in the world, most of which are cichlids.

APPENDIX F – Finances

Compiled by Chris Green and Daniel Carrivick

Table F1 shows all the transactions from the expedition accounts up to 1st February 2008. The accounts were managed by Imperial College Finance Division and each transaction was overseen by the Imperial College Exploration Board Honorary Treasurer. Table F2 gives a detailed breakdown of the expedition's expenditure which totalled £13,168.04 at the time of publication. The remaining sum of £61.96 will be used to cover the costs associated with publishing this report and travelling to give presentations.

Table F1 Income and expenditure from the expedition account. Income is listed under contributions and expenditure under payments. All figures are in UK pounds (£).

PAYMENTS AND RECEIPTS FOR BUILDING BRIDGES, MALAWI 2007 EXPEDITION (ICIS ACCOUNT HQEX.0.867134)			
Transaction Date	**Description**	**Amount**	
	Personal Contributions		
12-Jun-07	Personal contribution Miss Jumana Al-Zubaidi	500.00	
12-Jun-07	Personal contribution Miss Naomi Bessey	500.00	
12-Jun-07	Personal contribution Mr Dan Carrivick	500.00	
12-Jun-07	Personal contribution Mr Li-Teck Lau	500.00	
12-Jun-07	Personal contribution Miss Harriet Kirk	500.00	
			2,500.00
	Other Contributions		
30-Jun-07	Grant from The Happold Trust	1,000.00	
05-Jun-07	Grant from the Gordon Foundation	1,500.00	
05-Jun-07	Grant from Interserve Project Services Limited	500.00	
12-Jun-07	Donation from M Threakall	80.00	
13-Jul-07	Grant - University Of London Dunsheath Expedition Award	2,000.00	
13-Jul-07	Grant - Old Centralian's Jack Fenton Award	1,500.00	
01-Nov-07	Grant - Carillion Construction Ltd	150.00	
01-Nov-07	Grant - Engineers Without Borders UK	500.00	
*30-Nov-07	Grant - Whitbybird	1,000.00	
			8,230.00
	Imperial College Exploration Board contribution		2,500.00
	Total Contributions		**13,230.00**
	Payments		
20-Mar-07	Carrivick Mr Daniel Martin - return flights to Lilongwe for 3	1,776.30	
24-May-07	Carrivick Mr Daniel Martin - return flights to Lilongwe for 2	1,180.60	
15-Jun-07	Equipment purchases	247.23	
28-May-07	Truck hire in Malawi	1,476.12	
21-Jun-07	Carrivick Mr Daniel Martin – advance **	4,000.00	
21-Jun-07	Carrivick Mr Daniel Martin - equipment	809.24	
04-Jul-07	Carrivick Mr Daniel Martin - supplies	961.90	
15-Nov-07	Carrivick Mr Daniel Martin - equipment and consumables	1,628.48	
***30-Jan-07	Carrivick Mr Daniel Martin - miscellaneous equipment and supplies	1,065.75	
	Carried Forward		
	Deficit from the 2006 expedition - report publication costs	22.42	
	Total Payments		**13,168.04**
	BALANCE AT 1st Feb 2008		**61.96**
	Anticipated Future Payments		
	Carrivick Mr Daniel Martin – presentations, report binding & postage	61.96	
	END BALANCE (estimated)		**0.000**

* Money received by Imperial on 30th Nov 07 but sent to wrong department and not received by this expedition until the end of Jan 08

** A breakdown of how the advance was spent has been submitted to Imperial College Finance Division, together with receipts.

*** Payment delayed until Whitbybird grant money had been located to prevent accounts going overdrawn.

Below & inset – The hire of a three tonne truck was the biggest expense once the team were in Malawi; there were a lot of additional costs associated with the hire of the truck such as fuel and repairs; here a tyre is being replaced because the mud guard came off, shredding it.

Table F2 Grouped expenditure summary detailing exactly what the money was spent on.

EXPEDITION EXPENDITURE			
Description	Amount	Total	Detail
ACCOMMODATION			
Camping, lodges & huts	£467.66		*Main cost was in Lilongwe and at Nkhata Bay*
	Total Accommodation	**£467.66**	
EQUIPMENT			
Group expedition equip	£581.67		*Water sterilisation UV light, kit bags, airbeds etc.*
Personal clothing & equip	£549.86		*Boots, travel clothes, sleeping bags, torches, first aid etc.*
Replacement equipment	£329.69		*Cost of replacing lost or damaged equipment*
Cooking equipment	£124.01		*Emergency stove & cookware, knives, chopping boards etc.*
	Total Equipment	**£1628.27**	
HEALTH			
Vaccinations	£180.00		*Rabies*
Anti-malarials	£105.08		*Doxycycline*
First aid supplies	£70.17		*Group medical supplies; prescription drugs*
Prescription	£4.69		*Cost of one course of malaria treatment (Arinate)*
Doctors fees	£3.56		*In Mzuzu*
	Total Health	**£363.50**	
FOOD			
Expedition food supplies	£525.63		*Majority spent in Lilongwe; some in Mzuzu and Rumphi*
Eating out	£217.77		*Sit-down & takeaway meals while not in Uledi*
Opening ceremony	£41.51		*Cost of laying on a meal when the bridge was opened*
UK supplies	£29.03		*Food purchased in the UK and taken out to Malawi*
	Total Food	**£813.94**	
INSURANCE			
	Total Insurance	**£0.00**	*Covered FOC by Imperial College*
TRAVEL			
Flights (5)	£2,956.90		*London Heathrow to Lilongwe return with Ethiopian Airlines*
Vehicle hire	£1,786.87		*Vehicle hire: 3-tonne pickup truck and misc. car hire*
Vehicle fuel	£473.88		*Fuel for the 3 tonne truck and car*
UK travel	£247.80		*Expedition preparations & presentations*
Driver	£140.87		*Cost of hiring a driver, includes tip for assisting on site*
Truck consumables	£127.47		*New tyres, oil, puncture repairs etc.*
Airport taxes	£74.60		*Departure tax (5 x US $30)*
London	£59.20		*Taxi's and underground to and from Heathrow*
Other - Malawi	£34.54		*Local transport; taxi's, buses and tips*
Drivers expenses	£27.23		*Accommodation and meals while travelling*
Parking	£2.29		*Mainly at the airport*
	Total Travel	**£5,931.65**	
CONSTRUCTION			
Personal safety equipment	£900.49		*High ropes access kits and pulley systems*
Tools - UK	£397.97		*Purchased in the UK e.g. cable cutters, torque wrench etc.*
Cable extras	£397.76		*10 mm cable, 8 mm and 10 mm grips and ratchet straps*
Workers wages	£374.51		*30 workers, 2920 workman hours*
Steel, mesh and wire	£259.46		*Steel rods for retaining wall and mesh for bank protection*
Cement	£257.41		*50 kg bags*
Other materials	£215.01		*Sacks, plastic tubing, paint, grease, timber etc.*
Tools - Malawi	£136.18		*Purchased in Malawi e.g. wheel barrows, shovels etc*
Site equipment	£118.96		*Gloves for workers, two-way radios etc*
Bonuses	£70.75		*Given to workers - typically 15-20% of their total earnings*
Consumables	£56.47		*Amalgamating tape, gaffer tape, site safety tape etc*
Photocopying	£20.00		*During the research and design phase*
	Total Construction	**£3,204.97**	
OTHER			
Photography	£148.98		*Tripod, memory cards, batteries and printing*
Documentation	£141.50		*Passports and international driving license*
Printing	£98.81		*Cost of printing report, publicity material etc.*
Guide books & maps	£67.58		*Malawi and wildlife guides, maps of Uledi*
Gifts and prizes	£48.95		*Photos of workers, footballs, wind-up torches etc.*
Leisure activities	£48.33		*Boat trips and lakeside activities*
Currency exchange	£42.80		*Bank charges and exchange rate losses*
Fundraising	£34.43		*Telephone calls, sending out leaflets and letters*
Communications	£30.85		*Phone calls & internet while in Malawi*
Stationary	£28.12		*Paper, pens, envelopes etc*
Postage	£25.84		*General postage costs incurred*
Carried forward	£22.42		*Postage and travel costs from the 2006 expedition*
Scouts contribution	£19.44		*Food allowance for one national park scout*
	Total Other	**£758.05**	
TOTAL EXPENDITURE £13,168.04			

Above & inset – Eating round a fire at Chelinda; camp fires posed a substantial risk to team members.

APPENDIX G – Risk Assessment

Compiled by Naomi Bessey and Daniel Carrivick

Table G1 shows the evaluation of risks associated with this expedition. Compiling this risk assessment helped the team to prepare fully for the expedition not only by minimising the risks but also by making sure everyone knew what actions to take as and when certain hazards arose. The likelihood and severity of each hazard was quantified with five being the most likely or severe and zero being the least. Risks were deemed to be unacceptable if likely to occur (4/5) and the consequences were severe (4/5).

Table G1 Risk assessment detailing hazards, their risks and the precautions taken

Hazard	Risk	Precautions	Action	Likelihood	Severity
		CONSTRUCTION			
Cement	Burning of skin	Wear shoes & protective gloves	Administer first aid	4	2
Dropping large rock Collapse of material or structure	Crushed / trapped limb	Avoid handling very large rocks Ensure constructions are stable and protect where not	Evacuate to hospital	2	4
Dropping material / tool	Cut or bruise	Take time when handling tools and materials	Administer first aid	4	2
Falling	Head / other serious injuries	No work to be done in the dark Safe access paths to be created Use harnesses for suspended work	Evacuate to hospital	1	4
Falling materials	Head / other serious injuries	Avoid area below bridge / workers Wear helmet where necessary	Evacuate to hospital	2	4
Lifting heavy objects	Back injury	Know correct lifting technique Use several people to help	Prevent injured person from further work Administer first aid	3	3
River	Drowning	Use safety line in high water No crossing when river in flood	Search and Rescue	1	4
Rock Fragments	Loss of an eye	Wear eye protection	Evacuate to hospital	1	4
Timber	Splinters	Wear gloves	Remove	4	1
Uneven ground	Sprain / twisted ankle	Take time on uneven ground especially with heavy loads	Administer first aid	3	3
		ENVIRONMENT			
Cooking on open fire	Burns	Avoid handling hot pots Take care with boiling water	Administer first aid	3	3
Vermin	Disease	Store foods in sealed containers off floor	Administer drugs	2	3
UV radiation	Sun burn, skin cancer Eye damage	Cover skin where possible Protect using sunscreen and sunglasses	Tent rest and administer first aid	2	4
Ambient temperature	Heat exhaustion	Ensure adequate water supply. Use shade Regular breaks and monitor team	Evacuate to hospital	1	4
Dehydration	Heat stroke	Ensure adequate water supply Use of shade Regular breaks and monitor team	Rehydrate and cool body Regularly monitor core body temperature	1	4
		WILDLIFE			
Bees	Allergic Reaction / Death	Stay away from hives	Evacuate to hospital	1	4
Snakes	Allergic Reaction / Death	No one to be alone in the dark and away from camp.	Evacuate to hospital	2	5
Crocodiles & Hippos	Serious Injury / Death	Take care near lakeshores & river mouths and avoid during floods	Evacuate to hospital	1	5
Mosquitoes	Malaria	Use appropriate anti-malarials	Evacuate to hospital	2	4
Mammals	Rabies	Rabies injection	Evacuate to hospital	1	5
Water snails	Bilharzia	Avoided shallow water where reeds grow	Evacuate to hospital	1	4
		TRAVELLING			
Hit by vehicle	Severe injuries	Use designated crossings Avoid walking streets in the dark	Take casualty to hospital	1	5
Major vehicle accident	Severe injuries	No travelling in the dark	Take casualty to hospital	2	4
Minor vehicle accident	Minor injuries & shock	Wear seatbelt. Keep below the speed limit Watch out for animals	Assess, treat and monitor	2	3
		CRIME			
Car jackings	Loss of vehicle Injury to individuals	Avoid known problem areas Do not resist	Report to the police Give first aid	2	3
Corruption	Loss of money	Ask to see official documentation Get a receipt. Seek local advice if possible	Report the individual	2	1
Scams	Being conned	Awareness of tactics used Purchase from reputable officials	Report the individual	2	1
Theft / Robbery Pick Pockets	Loss of valuables	Avoid known problem areas Carry as little as possible Keep valuables out of sight Store valuables separately in hotel safe Divide money amongst team Travel in groups of no less than two	Notify Police	2	1
Muggings	Loss of valuables Serious Injury	Avoid known trouble areas Use a taxi to pass such areas	Avoid personal injury Hospitalise as necessary	1	3

Additional Notes:

- The risk of contracting fluid-to-fluid contracted diseases will be minimised by wearing gloves when treating open wounds.
- The risk of contracting tropical diseases will be minimised by taking the recommended vaccinations. Water-bourn diseases will be protected against by boiling or using iodine solution and/or a UV light to sterilise water before drinking.

Below & inset – Woven plastic sugar sacks are filled with earth and placed in the trench to form a retaining wall for the earth embankment.

APPENDIX H – 2006 Expedition Summary

Compiled by Daniel Carrivick

Table H1 shows a summary of the activities undertaken by the 2006 expedition team along with other facts and figures recorded, including some daytime temperatures recorded at Uledi.

Table H1 Day-to-day summary data from the 2006 expedition; E denotes work done on the east bank and W work done on the west bank. Driving days are when the truck was being used for a full (1) or half day (0.5) – Note this does not include brick runs which were comparatively short journeys. The number of workers for each day is shown. Where the number of workers in the afternoon was different from the morning, the change in the number of workers from morning to afternoon is shown in subscript (OT = number of workers who did overtime). The temperature at Uledi was recorded in the shade on a thermometer and the time each recording was taken is given in the adjacent column.

Date	Driving Days	No of Workers	Temp	Time	Summary of activities
Wed 19-Jul	0				Left London
Thu 20-Jul	0.5				Arrived in Lilongwe
Fri 21-Jul	1				In Lilongwe - shopping & admin
Sat 22-Jul	1				In Lilongwe - shopping & admin
Sun 23-Jul	1				Travelled to Mzuzu
Mon 24-Jul	1				Travelled to Chelinda
Tue 25-Jul	1				Arrived in Uledi
Wed 26-Jul	0		15°C	7am	Tour of sites, began surveys
Thu 27-Jul	0				Met the chiefs, surveying
Fri 28-Jul	1	2	15°C	6.30am	Truck departs for Mzuzu. Site cleared & surveyed new site
Sat 29-Jul	1	2	13°C	6am	Steel ordered. Site approaches cleared. Sand source found
Sun 30-Jul	0	0	20°C	7am	Sites marked, compactors made
			24°C	12pm	Wheelbarrows put together
Mon 31-Jul	1	16	21°C	6.30am	Truck returned to Uledi. Excavation of foundations began
Tue 01-Aug	0	16^{+4OT}	19°C	7am	Foundations finished being dug
Wed 02-Aug	0	20	18°C	6am	Collection of boulders and bricks. W - foundations; rocks laid (start)
Thu 03-Aug	1	21			Truck departs for Mzuzu. W - foundations; rocks laid (finish)
Fri 04-Aug	0.5	22^{+3}			Cement bought in Mzuzu. W - foundations; infilled
Sat 05-Aug	1	26			E - foundations; rocks laid (start). W - foundations; slab laid
					Truck returns to Uledi
Sun 06-Aug	0	19^{-19}	14°C	6am	E - foundations; rocks laid (finish). Football match with locals
Mon 07-Aug	0	36	14°C	6am	E - foundations; infilled. Collected a truck load of bricks
Tue 08-Aug	1	36	11°C	6am	Truck to Mzuzu. Two leave for UK
					E - foundations; slab laid. W - 1st tier; lower built with rocks
Wed 09-Aug	0.5	36^{-1}	10°C	6am	E - 1st tier; built with rocks. W - 1st tier; upper built with bricks
Thu 10-Aug	1	36	16°C	6am	W - 1st tier; infilled & slab laid. Truck returned to Uledi
Fri 11-Aug	0	36			Two runs in truck to collect bricks
Sat 12-Aug	0	32	28°C	1pm	E - 1st tier; infilled & slab laid. W - 2nd tier; bricks laid
Sun 13-Aug	0	19^{-19}			E - 2nd tier; brick laying began. W - 2nd tier; infilling began
Mon 14-Aug	0	29	20°C	8am	E - 2nd tier; brick laying finished. W - 2nd tier; infilled & slab laid
Tue 15-Aug	0	29	10°C	6am	1 run in truck to collect bricks
			30°C	2pm	E - 2nd tier; infilled and slab laid
			29°C	5pm	W - 3rd tier; bricks laid
Wed 16-Aug	0	40^{-1}	15°C	7.30am	E - 3rd tier; bricks laid. W - concrete anchor block
Thu 17-Aug	0	40	11°C	6am	Gravel, sand and rock gathered. W - 3rd tier; infilled and slab laid
Fri 18-Aug	1	38	10°C	6am	E - concrete anchor block. Truck collects timber from Chelinda.
Sat 19-Aug	0	38^{-2}	14°C	7pm	E - 3rd tier; infilled and slab laid
			26°C	12pm	W - top tier; bricks laid & infilled
Sun 20-Aug	1	15^{-8}			Truck departs for Lilongwe. E - top tier; bricks laid & infilled
Mon 21-Aug	1	7			Failed attempt to collect cables. Earthworks and decking made
Tue 22-Aug	1	7			Earthworks and decking made. Truck returned to Mzuzu
Wed 23-Aug	1				Community Day; site tidied. Truck returned to Uledi
Thu 24-Aug	1				Expedition team left Uledi
Fri 25-Aug	1				Visited Vwasa Marsh Reserve
Sat 26-Aug	0				Visited Nkhata Bay
Sun 27-Aug	0				Day on shore of Lake Malawi
Mon 28-Aug	1				Travelled to Lilongwe
Tue 29-Aug	0.5				Flew home from Lilongwe

Below – A worker enjoys his free meal after the bridge opening ceremony.
Inset – Teck socialises with the workers; the team learnt a few words of Tambuka while the workers were keen to learn some English.

APPENDIX J – Tambuka Words

Compiled by Harriet Kirk

Team members learnt a few words of Tambuka, the local dialect spoken in Uledi, while on site. Some of these words may be of use to others visiting northern Malawi and are therefore listed below for reference. None of these words were ever seen written down so all are written phonetically.

Pleasantries and greetings

Muri uri	Hello
Matandala	Hello (to someone you have met before)
Tatandala	Response to "Matandala"
Taowonga	Thankyou
Yewo	All-purpose polite thing to say. Complicated usage.

Numbers

Chimodzi	1
Ziwiri	2
Zitatu	3
Zinai	4
Zisanu	5

Instructions

Eeway (used to attract someone's attention)	You
Nandi	More
Pa choko	A little
Chinchera	Careful
Chowmaini	Very / very much
Pachanya	Up
Pass	Down
Pepeti	Left
Bassi	Enough / finished

Nouns

Chiwoko	Arm
Feruka	Fire
Jembe	Hoe
Kalundo	Leg
Karisya	Scorpion
Kuni	Tree
Maje	Water
Maribo	Stone
Masacka	Sack
Matope	Earth
Michenga	Sand
Musumari	Nail
Mutu	Head
Muzungu	White person
Nchoko	Snake
Nyomba	House
Tabwa	Plank
Tin	Metal bucket
Vimbuntu	Hand
Yiru	Foot

ADDRESS LIST

Compiled by Daniel Carrivick

Below is a list of names and addresses of key companies used by this expedition.

ACCOMMODATION – Range of accommodation in Lilongwe to suit the needs of most travellers including camping, dormitories and chalets. Bar and restaurant on site and internet service available. The grounds are enclosed and the entrance guarded.

Mabuya Camp
Tel: +265 (0)1 754 978 Mob: +265 (0)9 746 239 / +265 (0)9 664 651 E-mail: info@mabuyacamp.com
www.mabuyacamp.com

CONSERVATION – Biosearch expeditions organise annual scientific expeditions during which a series of projects are undertaken to help with the conservation of Nyika National Park.

Biosearch Expeditions
Wayfarer Lodge, Welbourn, Lincolnshire, LN5 0QH
Tel: +44 (0)14 0027 3323 Fax: +44 (0)14 0027 3003 E-mail: nyika@biosearch.org.uk
www.biosearch.org.uk

EXPEDITION LOGISTICS – Land & Lake Safaris are a professional and reputable tour operator in central Africa, who specialise in tours and safaris but are also willing to assist with expedition logistics. The truck used throughout this expedition was hired through them. Prices are not necessarily cheaper than anywhere else but they are more reliable than other local companies.

Land & Lake Safaris Ltd.
P. O. Box 2140, Lilongwe, Malawi
Tel: +265 (0)1 757 120 / +265 (0)1 754 303 Fax: +265 (0)1 754 560 E-mail: reservations@landlake.net
www.landlake.net

FLIGHTS – Flights were booked on the Ethiopian Airlines website and the tickets collected from their London office.

Ethiopian Airlines
1 Dukes Gate, Acton Lane, London, W4 5DX
Res: +44 (0)20 8987 7000 Admin: +44 (0)20 8987 9086 E-mail: lonam@ethiopianairlines.com
www.ethiopianairlines.com

FREIGHT HANDLING COMPANY – SDV Ltd. are a Malawian air freight handling company with an office at Lilongwe airport. They stored the team's cable consignment between the 2006 expedition and this expedition, while clearance from customs was sought. They waived their storage charges out of goodwill.

SDV Ltd
P.O. Box 648, Lilongwe, Malawi
Tel: +265 01-700931 E-mail: sdvkia@malawi.net

HELP & ADVICE – The Expedition Advisory Centre provides information, training and advice to anyone involved in expeditions, field research or outdoor learning.

Expedition Advisory Centre
Royal Geographical Society, 1 Kensington Gore, London, SW7 2AR
Tel: +44 (0)20 7591 3030 Fax: +44 (0)20 7591 3031 E-mail: eac@rgs.org
www.rgs.org/eac

Below & inset – Jumana attempts to beat Wellington at his own game; Bao was played using beans, marbles or pebbles on a carved wooden board.

NATIONAL PARKS & WILDLIFE – Malawian governmental body responsible for the National Parks and nature reserves throughout Malawi.

Ministry of Information & Tourism
Dept of National Parks & Wildlife, PO Box 30131, Capital City, Lilongwe 3, Malawi
Tel: +265 (0)1-759831 Fax: +265 (0)1-759832 E-mail: dnpw@malawi.net
www.tourismmalawi.com

MAPS & GUIDES – Stanford's stock a large range of maps and guides, and they will order items in specially if need be. Maps can be purchased in store or online.

Stanford's
12-14 Long Acre, London, WC2E 9LP
Tel: +44 (0)20 7836 1321 Fax: +44 (0)20 7836 0189 E-mail: sales@stanfords.co.uk
www.stanfords.co.uk

MEDICAL SUPPLIES – Cheap prescription drugs and anti-malarial medication. Prices were about 60% cheaper than on the high street. Quotes can be requested online. Allow plenty of time to send off prescription and for drugs to be delivered.

Payden's Pharmacy
38 Cheriton High Street, Folkestone, Kent, CT19 4ET
Tel: +44 (0)13 0327 7590 Fax: +44 (0)13 0327 6595 E-mail: contact@paydenspharmacy.co.uk
www.paydenspharmacy.co.uk

STEEL CABLES – Supplied cables for this expedition. Redaelli have led the Italian steel cable market for more than a century and supply their products all over the world. As well as manufacturing steel cables, they have an engineering subsidiary called Tensoteci who specialise in suspension and cable stayed structures.

Redaelli Tensoteci Engineering
Via A. Volta, 16, 20093 Cologno Monzese (MI) - Italia
Tel: +39 02 2530 7291 Fax: +39 02 2530 7292
www.redaellitensoteci.com

VEHICLE HIRE – Company used by Land & Lake Safaris to provide the truck for this expedition. F.L. Nkhalamba has a whole range of vehicles available for hire. Cheaper than hiring from the airport and cheaper than other hire firms advertising at tourist lodges; at the airport the cheapest car was MWK 2500 per day plus MWK 500 per day for insurance and MWK 25 per km where as Nkhalamba's charged (for the same type of car) MWK 1800 per day plus MWK 500 per day for insurance and MWK 18 per km. Vehicles were no dodgier than anywhere else. Money can be saved by cutting out the middle man (tour operators) and hiring direct from F.L. Nkhalamba's. However, they are not geared up for dealing with tourists.

F. L. Nkhalamba Vehicle Rentals
(Off Malangalanga Road), Private Bag 106, Lilongwe
Tel: +265 (0)1 796 969 Mob: +265 (0)8 869 288 / +265 (0)9 295 340

WILDERNESS FIRST AID – Wilderness medical training provide advanced medicine courses for remote foreign travel ideal for people going on expeditions. A course is run annually, every March by the Royal Geographic Society in London.

Wilderness Medical Training
The Coach House, Thorny Bank, Garth Row, Kendal, Cumbria LA8 9AW
Tel/Fax: +44 (0)15 3982 3183 E-mail: wmt@wildernessmedicaltraining.co.uk
www.wildernessmedicaltraining.co.uk

BIBLIOGRAPHY

Compiled by Naomi Bessey and Daniel Carrivick

BOOKS

MALAWI GUIDES

Briggs, P. & Bartlett, M-A., 2006. ***Bradt Guide to Malawi****, The Globe Pequot Press Inc., Connecticut, USA.* – Contains a little more information on Malawi than the Southern Africa Lonely Planet guide. However it is not as user friendly as Lonely Plant guides and the large paragraphs of text make it harder to dip in and out of.

Douglas, J. & White, K., 2003. ***Spectrum Guide to Malawi****, Camerapix Publishers International, Nairobi, Kenya.* - This is an extensive and detailed guide to all aspects of life in Malawi. Colour maps are clearer than those in the Lonely Planet guide (see below), but the writing is less succinct, and the layout makes it harder to navigate through the book. The guide is relatively cheap at £12 to UK addresses, and can be ordered over the internet from various sites including Amazon. It is quite large and bulky for carrying around – mainly due to the large number of superb photographs it contains.

Murphy, A., Armstrong, K., Firestone, M. D., Fitzpatrick, M., Grosberg, M., Luckham, N., & Rebold, A., 2007. ***Lonely Planet – Southern Africa****. Lonely Planet Publications Ltd., Australia. (4th edition).* - An excellent, recently updated guide, with 80 of its 800 odd pages dedicated to Malawi. Most used for finding places to eat. This edition includes some good restaurants not found in previous editions. The maps were useful too for finding out where places were!

Discontinued. ***Lonely Planet – Malawi****.* This guide was out of print, but if found will probably be better than the above as it will cover Malawi in more detail.

SNAKES

Marais, J., 2004. ***Snakes of Southern Africa****, Struick Publishers.* – Very clear and detailed guide to snakes in Southern Africa. Maps clearly show where each type of snake might be found though rather disappointingly these maps do not go north as far as Malawi. Apart from being a little large, the guide is user friendly and it clearly indicates how dangerous each snake is.

Mattison, C., 2006. ***Snakes****, Collins, London.* – Pocket sized guide to snakes. Its compact size means it is easy to carry around and therefore easily accessible. Snakes listed by type rather than the continents on which they're found which can make navigating through the book difficult.

MAPS

ROAD MAPS

Malawi - *Scale: 1:900,000, Format: Sheet Map (folded), Size: 67x98cm, RRP Price £9.95. Published by ITMB Publishing, Canada. Stanford's Catalogue No. 91672.* – This map was used when travelling around Malawi. It was accurate enough to be able to navigate with and easy to read. Enlarged maps of Lilongwe and Blantyre city centres were also included. These street maps were more detailed than those in the guidebooks, but the guidebook maps were more useful as they showed where individual places were located.

Southern Africa - *Scale: 1:4,000,000, Format: Sheet Map (folded), RRP Price £5.99. Published by Insight Travel Maps, London.* – Useful for international road travel, very good for planning routes. This map can be used to navigate between major towns and cities however a more detailed map or guide is needed to get in to, and out of, built up areas.

Southern Africa Road Atlas - *Scale: 1:2,000,000, Format: Book, RRP Price £8.99. Published by Lonely Planet, Australia.* – Better detail than the Insight travel map (above). Easier to use and look at while travelling. Not as good for planning as often journeys cover more than one page. (1st edition – Sept 2000).

TOPOGRAPHIC MAPS

The whole of Malawi is covered by the Department of Surveys 1:50,000 scale maps. They mainly show rivers, roads, tracks, boundaries, buildings and relief. Contours are spaced every 50 ft and kilometre grid squares are marked. These maps can be purchased in Malawi from the Department of Surveys Map Sales Office as long as they are in print. Offices are in Lilongwe and Blantyre. The maps used by this expedition are listed below.

Kisyombe - *Scale: 1:50,000, Format: Sheet Map, Price £2-3. Published by the Malawian Government's Department of Surveys, Blantyre. Sheet 1033B2.* - Contoured map of Uledi and an area 25 km to the east of Uledi.

Mwenewenya - *Scale: 1:50,000, Format: Sheet Map, Price £2-3. Published by the Malawian Government's Department of Surveys, Blantyre. Sheet 1033B1.* - Contoured map of an area some 25 km to the west of Uledi, showing the approach to Uledi from Nthalire.

DISTRIBUTION LIST

As well as being sent to our supporters, copies of this report will be lodged with the following:

Imperial College, London
Royal Geographical Society, London

Please contact the editor for an electronic copy of this report, or to purchase a paper copy.

Above & inset – The sun rise above Lake Malawi.
Right – The finished bridge looking downriver; the protection of the east (R) and west (L) banks can just be seen in front of the towers.

Original sketches found drawn by Andras Szollar in 2006
Redrawn here by Daniel Cornish and updated with work done in 2007

All drawings on this page are drawn to the same scale
All dimensions are given in millimetres

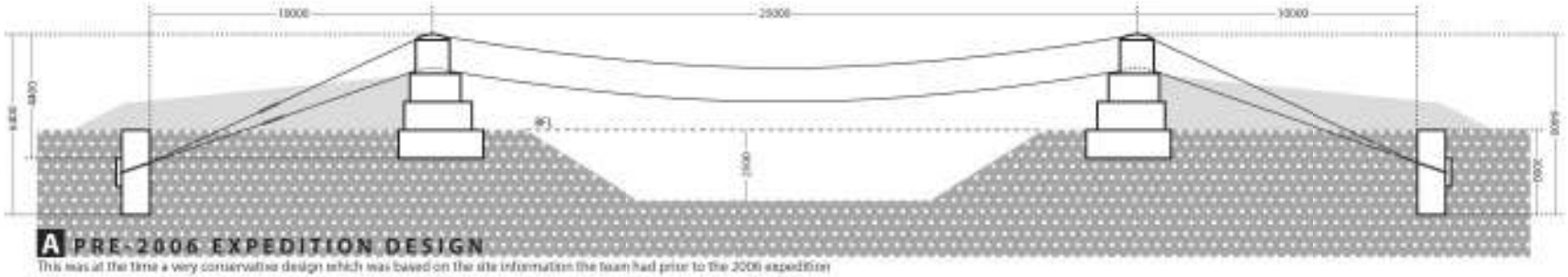
BRIDGE PLANS 1 SITE TRANSECTS & CROSS SECTIONS

KEY

- Embankment
- Top soil
- Sand - alluvium
- Clay breccia
- Clay & cemented sands
- Sandstone
- Subsurface not known

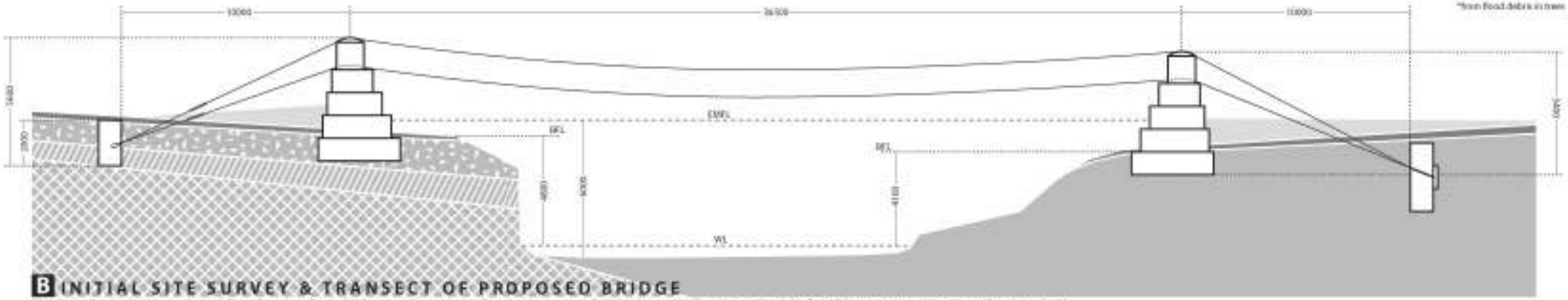
BFL Bank full level
EMFL Estimated maximum flood level*
WL Water level (Aug 2006)

*from flood debris in trees



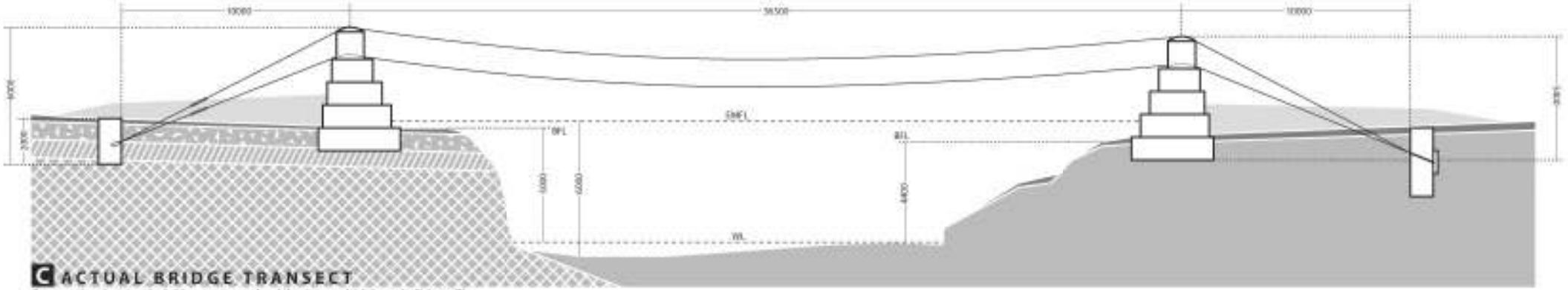
A PRE-2006 EXPEDITION DESIGN

This was at the time a very conservative design which was based on the site information the team had prior to the 2006 expedition



B INITIAL SITE SURVEY & TRANSECT OF PROPOSED BRIDGE

This shows the transect across the initially preferred site for the bridge (map D, no. 14) (note how the river was much wider than originally anticipated and this forced design changes (compare with section above)



C ACTUAL BRIDGE TRANSECT

Cross section showing the bridge constructed and the site on which it was built (map D)

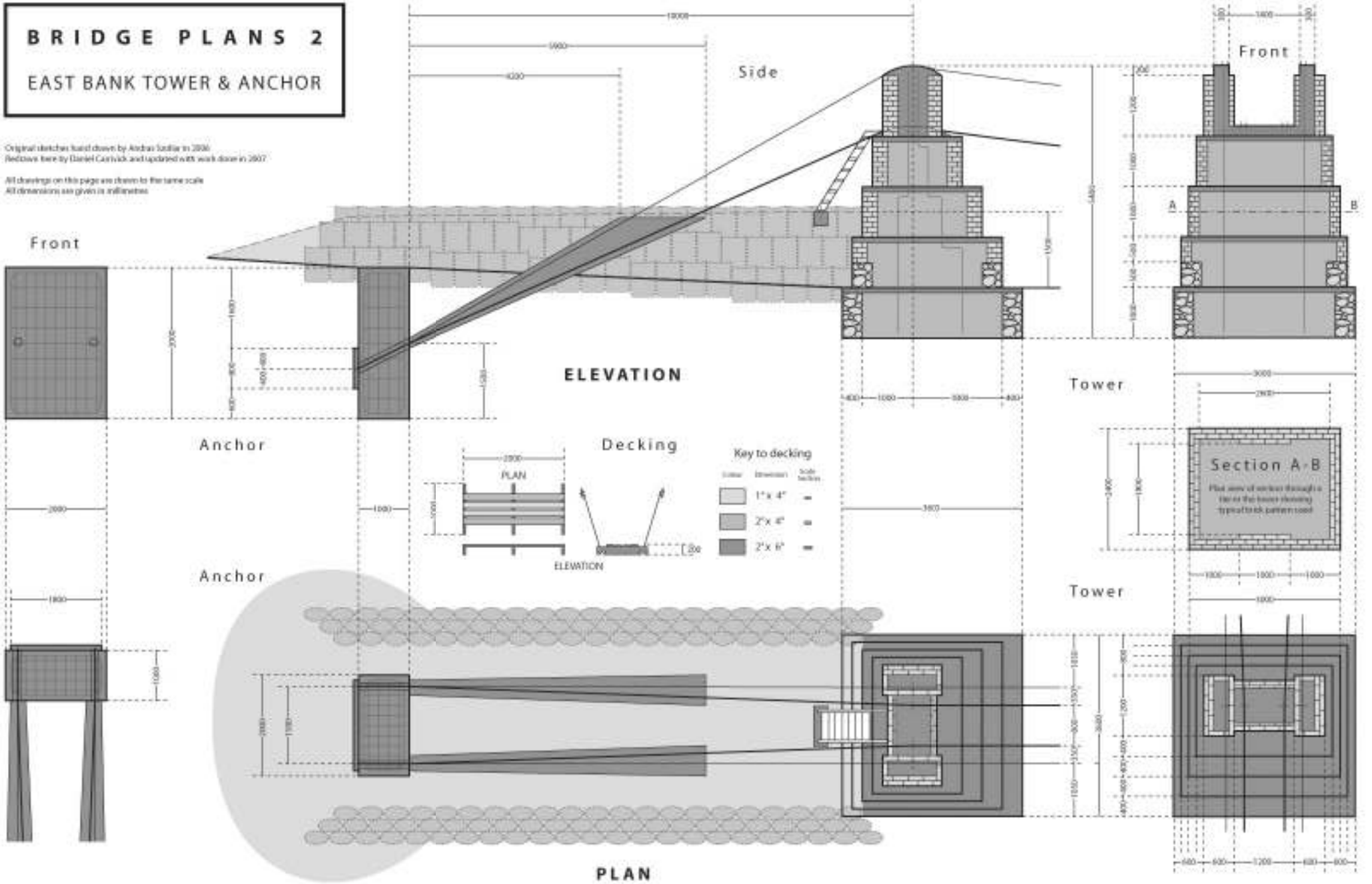
SCALE

BRIDGE PLANS 2

EAST BANK TOWER & ANCHOR

Original sketches found drawn by Andras Sedlar in 2006
Redrawn here by Daniel Cusnick and updated with work done in 2007

All drawings on this page are drawn to the same scale
All dimensions are given in millimetres

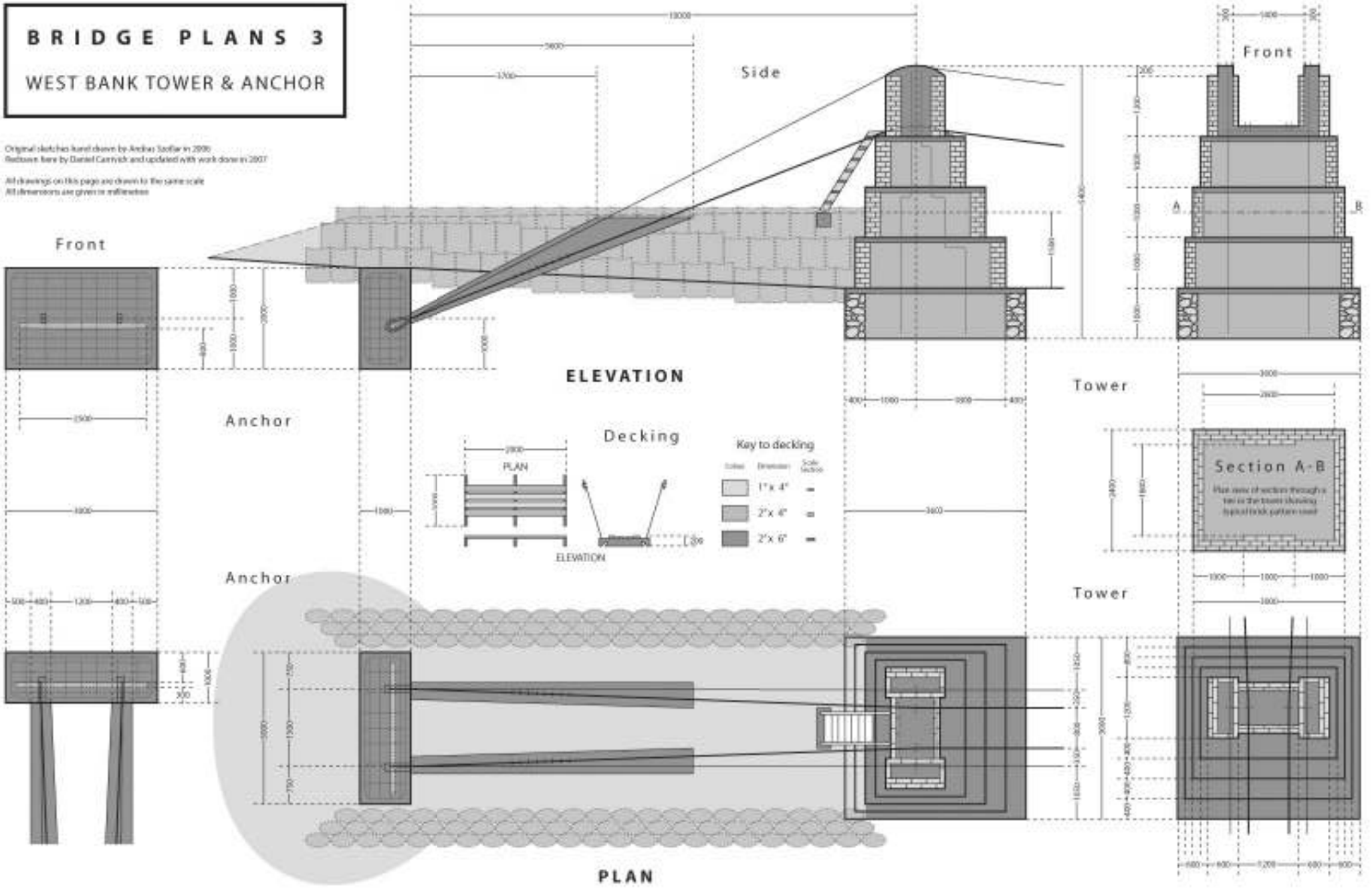


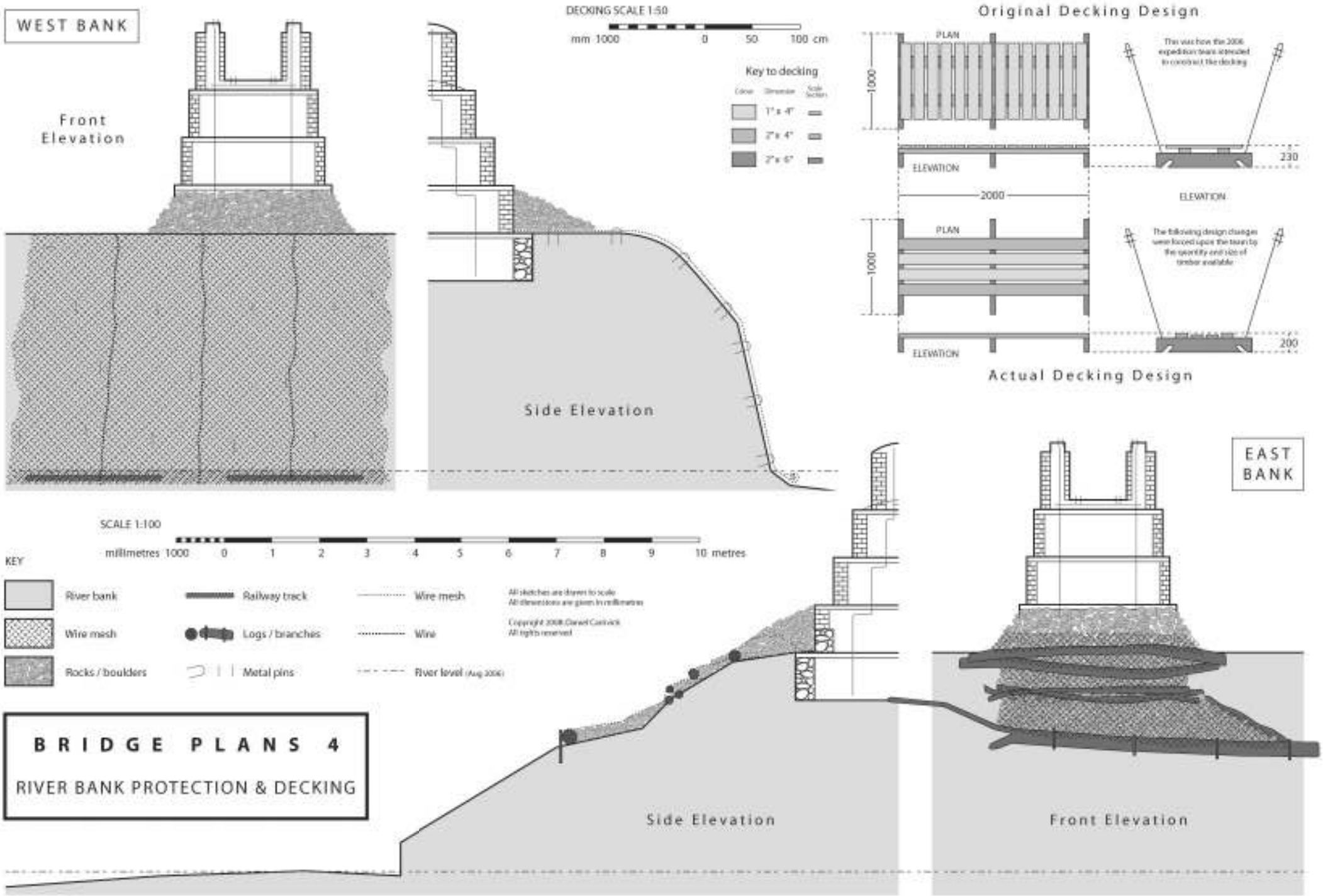
BRIDGE PLANS 3

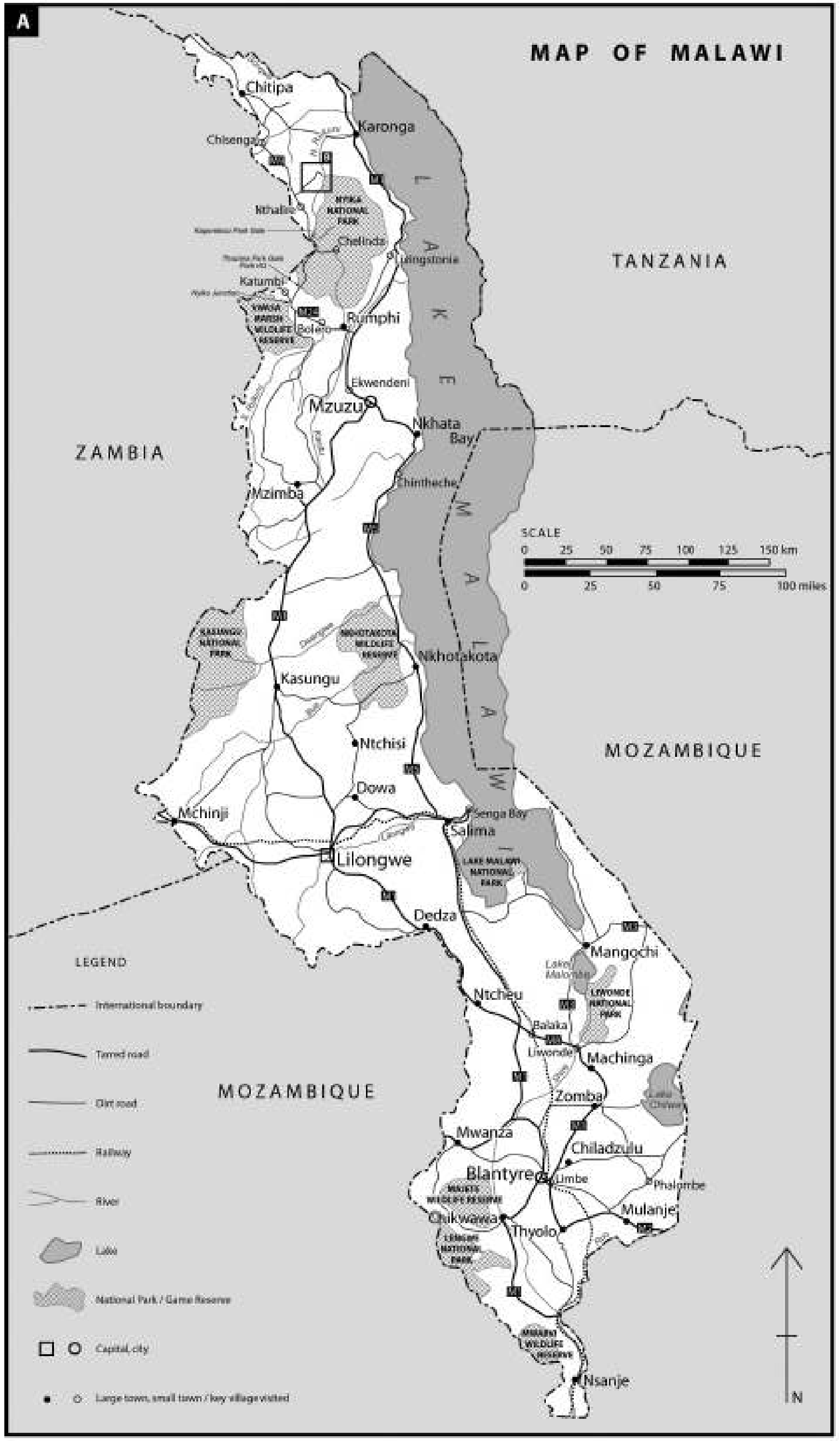
WEST BANK TOWER & ANCHOR

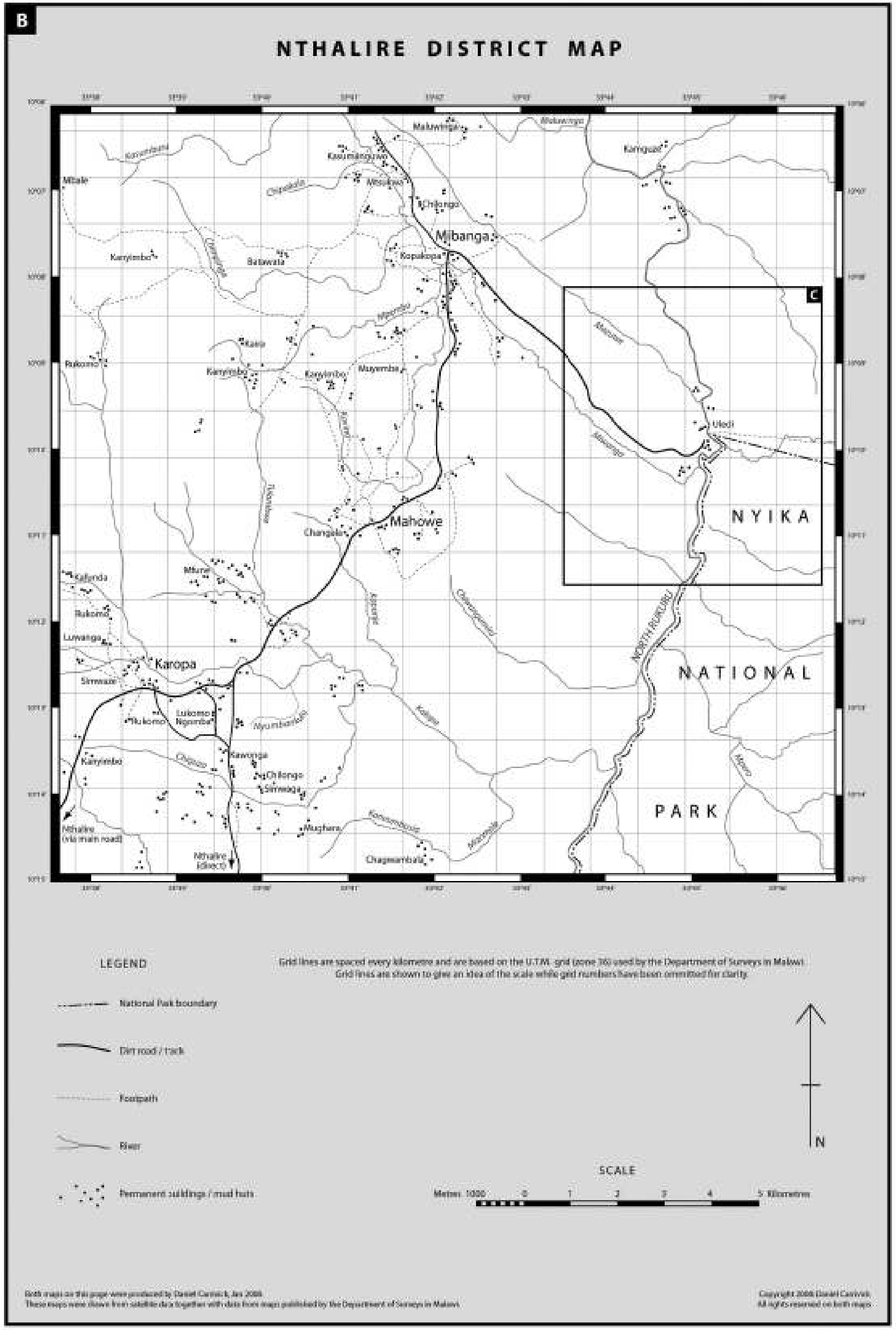
Original sketches hand drawn by Andrew Scollar in 2006
Redrawn here by Daniel Carrivick and updated with work done in 2007

All drawings on this page are drawn to the same scale
All dimensions are given in millimetres



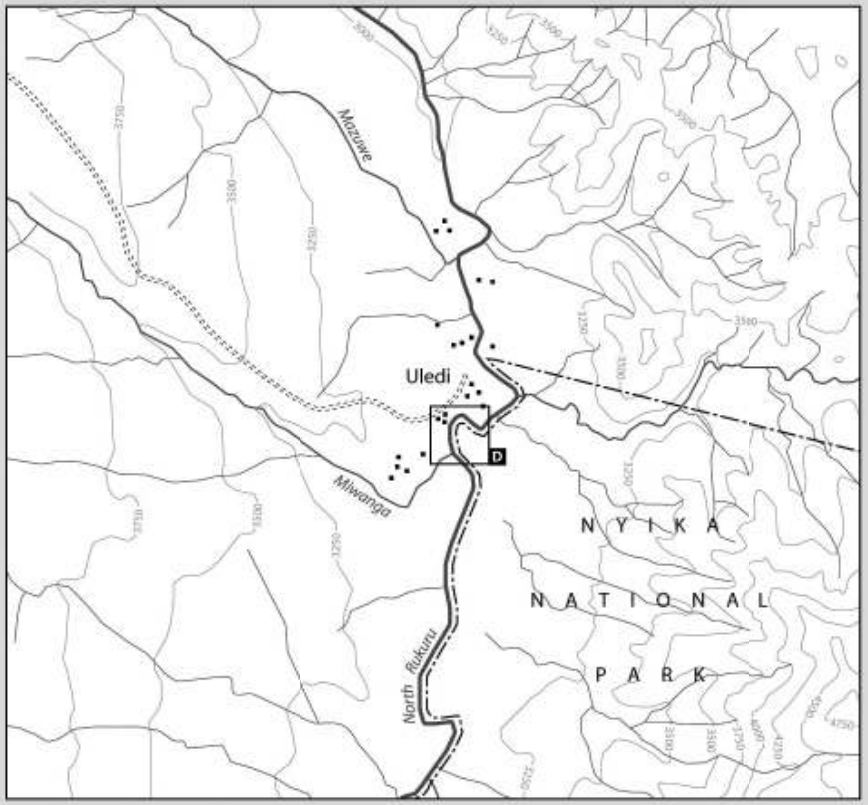

WEST BANK
Front Elevation
DECKING SCALE 1:50
mm 1000 0 50 100 cm
Key to decking
Colour Dimension Scale Section
1" x 4"
2" x 4"
2" x 6"
Side Elevation
Original Decking Design
PLAN
1000
ELEVATION
2000
230
This was how the 2006 expedition team intended to construct the decking
PLAN
1000
ELEWATION
200
The following design changes were forced upon the team by the quantity and size of timber available
Actual Decking Design
EAST BANK
SCALE 1:100
millimetres 1000 0 1 2 3 4 5 6 7 8 9 10 metres
KEY
River bank
Wire mesh
Rocks / boulders
Railway track
Logs / branches
Metal pins
Wire mesh
Wire
River level (Aug 2006)
All sketches are drawn to scale
All dimensions are given in millimetres
Copyright 2008 Darrell Cusbuck
All rights reserved
BRIDGE PLANS 4
RIVER BANK PROTECTION & DECKING
Side Elevation
Front Elevation


A
MAP OF MALAWI
TANZANIA
ZAMBIA
MOZAMBIQUE
MOZAMBIQUE
L A K E M A L A W I
Chitipa
Chisenga
Karonga
Nthalire
NYIKA NATIONAL PARK
Chelinda
Livingstonia
Katumbi
VWAZA MARSH WILDLIFE RESERVE
Bolero
Rumphi
Ekwendeni
Mzuzu
Nkhata Bay
Chintheche
Mzimba
KASUNGU NATIONAL PARK
NKHOTAKOTA WILDLIFE RESERVE
Nkhotakota
Kasungu
Ntchisi
Dowa
Mchinji
Senga Bay
Salima
Lilongwe
LAKE MALAWI NATIONAL PARK
Dedza
Mangochi
Lake Malombe
Ntcheu
LIWONDE NATIONAL PARK
Balaka
Liwonde
Machinga
Zomba
Lake Chilwa
Mwanza
Chiladzulu
Blantyre
Limbe
Phalombe
MAJETE WILDLIFE RESERVE
Chikwawa
Mulanje
Thyolo
LENGWE NATIONAL PARK
MWABVI WILDLIFE RESERVE
Nsanje
SCALE
0 25 50 75 100 125 150 km
0 25 50 75 100 miles
N
LEGEND
International boundary
Tarred road
Dirt road
Railway
River
Lake
National Park / Game Reserve
Capital, city
Large town, small town / key village visited


B
NTHALIRE DISTRICT MAP
C
NYIKA
NATIONAL
PARK
NORTH RUKURU
Maluwinga
Kamguali
Kasumanguzwo
Mtale
Mbalwa
Chilongo
Mbanga
Kanyimbo
Batawala
Kopakopa
Rukomo
Kanyimbo
Kanyimbo
Mayembe
Uledi
Changalu
Mahowe
Mtunsi
Kafenda
Rukomo
Luwanga
Karopa
Simwaza
Rukomo
Lukomo Ngonda
Kawonga
Chilongo
Simwaga
Kanyimbo
Mughera
Chagwambala
Nthalire (via main road)
Nthalire (direct)
LEGEND
National Park boundary
Dirt road / track
Footpath
River
Permanent buildings / mud huts
Grid lines are spaced every kilometre and are based on the U.T.M. grid (zone 36) used by the Department of Surveys in Malawi.
Grid lines are shown to give an idea of the scale while grid numbers have been ommitted for clarity.
N
SCALE
Metres 1000 0 1 2 3 4 5 Kilometres
Both maps on this page were produced by Daniel Carnick, Jan 2008.
These maps were drawn from satellite data together with data from maps published by the Department of Surveys in Malawi.
Copyright 2008 Daniel Carnick
All rights reserved on both maps

C

MAP OF ULEDI



LEGEND

Dirt track
Stream / River
National Park boundary
Building / Mud hut
Contours

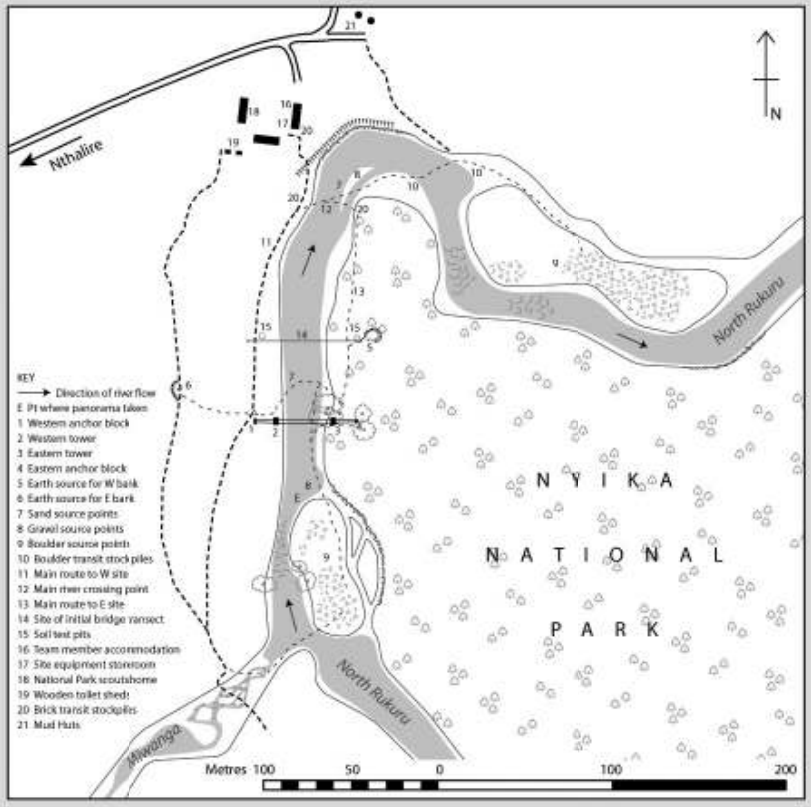
Metres 1000 500 0 1 2 Kilometres

N

Elevation in feet, Contours shown every 250 ft.

D

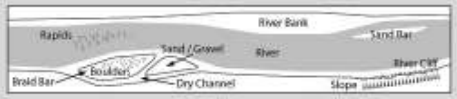
SITE MAP



KEY

→ Direction of river flow
E Pt where panorama taken
1 Western anchor block
2 Western tower
3 Eastern tower
4 Eastern anchor block
5 Earth source for W bank
6 Earth source for E bank
7 Sand source points
8 Gravel source points
9 Boulder source points
10 Boulder transit stock piles
11 Main route to W site
12 Main river crossing point
13 Main route to E site
14 Site of initial bridge ransect
15 Soil test pits
16 Team member accomodation
17 Site equipment storeroom
18 National Park scoutshome
19 Wooden toilet shed
20 Brick transit stockpiles
21 Mud Huts

LEGEND



Dirt track
Pre-existing path
Route taken / paths created
Bridge
National Park
Large trees
Earth pit
Buildings

All images on this page were produced by Daniel Cormick, Jan 2008.
The maps were drawn from satellite data together with data from maps published by the Department of Surveys in Malawi.

E

BRIDGE PANORAMA