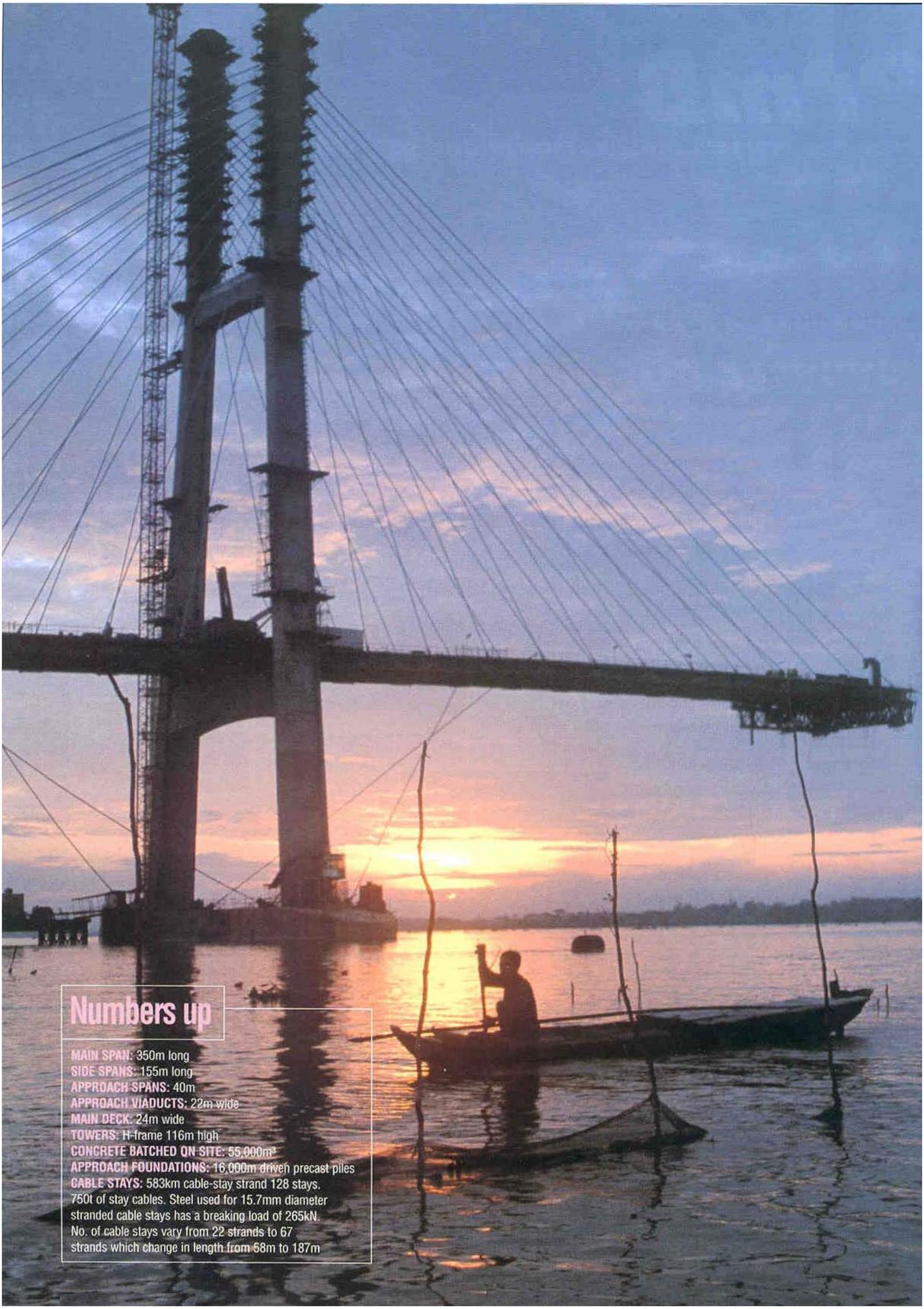
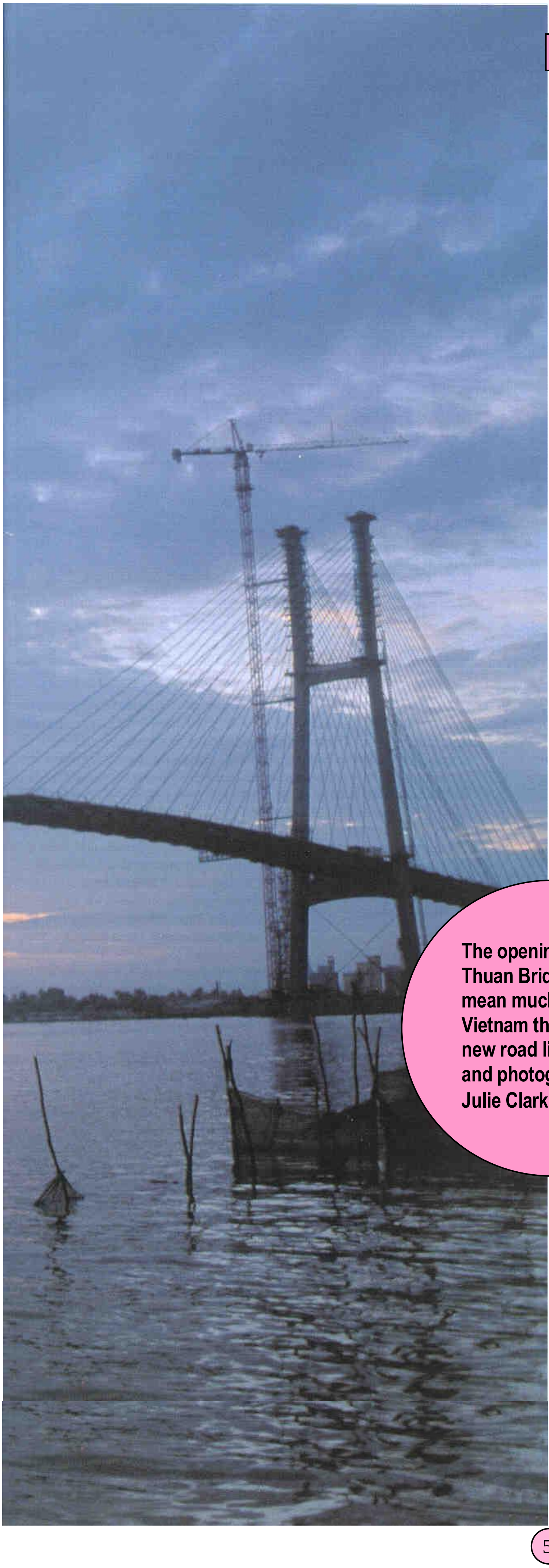


Numbers up

MAIN SPAN: 350m long
SIDE SPANS: 155m long
APPROACH SPANS: 40m
APPROACH VIADUCTS: 22m wide
MAIN DECK: 24m wide
TOWERS: H-frame 116m high
CONCRETE BATCHED ON SITE: 55,000m^3
APPROACH FOUNDATIONS: 16,000m driven precast piles
CABLE STAYS: 583km cable-stay strand 128 stays. 750t of stay cables. Steel used for 15.7mm diameter stranded cable stays has a breaking load of 265kN. No. of cable stays vary from 22 strands to 67 strands which change in length from 58m to 187m

Cables



Mekong milestone

The opening of the My Thuan Bridge will mean much more to Vietnam than merely a new road link. Words and photographs by Julie Clark

Running an incredible eight months ahead of its original schedule, the 3-50m main span cable-stayed My Thuan Bridge is more than just a Physical landmark on the flat landscape of the vast Mekong delta. Due to open to traffic in May, the completion of the bridge in March will be a turning point in the development of Vietnam. Such bridge construction has never before been seen in the country.

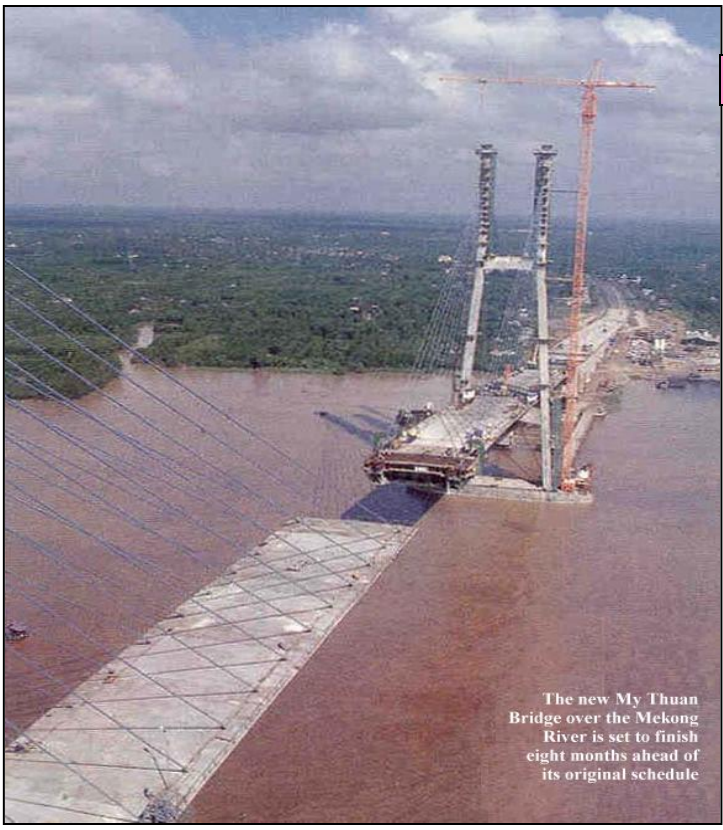
Providing infrastructure across the Mekong has been a priority for the Vietnamese Ministry of Transport & Communications for many years. The river is seen as a physical barrier between the cities and the agricultural area in the south of the country. This long sliver of a country extends from China to the Gulf of Thailand, bordering Laos and Cambodia on the way, but has only one highway. The logically-named Highway One is mainly single carriageway and stretches from Hanoi to Ho Chi Minh and beyond to Camau. The bridge lies 125km south-west of Ho Chi Minh city; a three hour drive on the congested highway.

The total cost of the structure is US$60 million; of this total cost the Australian Government's overseas aid programme, known as AusAid, has contributed 65% and the Vietnamese government will cover the remaining 35%. It is likely that the bridge will be tolled at the same rate as existing ferry charges, but this has not been confirmed.

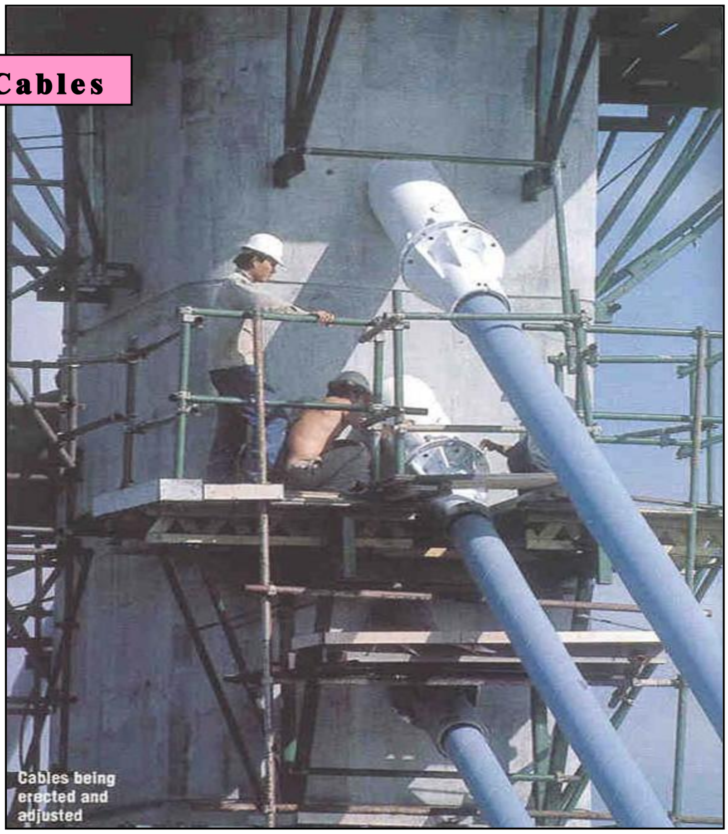
The My Thuan Project Management Unit was set up from various government departments, primarily the ministry of transportation, to administer the project. It has taken responsibility for liaising between AusAid and all the various Vietnamese government departments as necessary from the Vietnamese side.

In the same way, AusAid's role of liaison between the Vietnamese government and the Australian companies involved has been useful for the Australians in coping with the baffling bureaucracy that can sometimes be found in developing countries. AusAid has worked with Vietnamese counterpart agencies and has managed Australia's contribution to the project.

One of the organisation's main aims is the alleviation of poverty, hence technology transfer is a priority. "Nearly 20% of households in the Mekong are very poor and a further 5% are considered extremely poor with people living on as little as US$ 7 a month", explains Robin Taylor, first secretary of AusAid. Seventy percent of the population is rural-based and 90% of poverty exists in rural areas, he says. "There are about 15 Million people living south of the bridge; almost the population of Australia", says Taylor. "They are separated from the rest of the country by this river", he points out. "Project staff get immediate access to the ferry because they



The new My Thuan Bridge over the Mekong River is set to finish eight months ahead of its original schedule



Cables

Cables being erected and adjusted

have a pass but you can count hundreds of vehicles waiting."

Under an agreement with the Vietnamese government, materials used in the project are tax-free. "We have to abide by the laws of Vietnam so although we are exempt from taxes and duties we still have to administer taxes. In a lot of instances we have been paying the taxes and then gaining reimbursement," says Richard Magnusson, project manager for main contractor Baulderstone Hornibrook.

One of the conditions for AusAid's grant is that Australian-based companies are involved in the technology transfer. "Baulderstone Hornibrook was the lowest tender and was also a well-considered technical proposal," says Bill Kelly, resident engineer for consultant Maunsell McIntyre. "No major alternative designs were received," he remembers, and the contract was awarded in June 1997.

"By virtue of the relatively flexible foundation system, it was possible to control load transfer by using shear keys instead of the more expensive dynamic dampers which are commonly employed on structures of this type," says Kelly.

The consultant originally put the opening date at December 2000, believing the bridge would take 42 months to build. But in its bid, the contractor proposed a 36 month programme, and since the start has been targeting completion in three years. "Baulderstone Hornibrook has managed to reduce the programme further to 33 months, finishing at the end of March," says Kelly. "This has been done with a great deal of innovative planning and in particular by precasting components," he explains. As this is a lump sum contract, eight months of savings will manifest itself, from the contractors point of view, in relieving staff from the site early. "The main targets in advancing the programme were basically early engineering, early procurement, innovative and time-effective methods, also increased working hours and productivity of staff," says Magnusson. "Initially we worked 24 hours a day, seven days a week on the piling - a programme which would be difficult and more expensive to achieve in places like Australia," says Magnusson. "The labour force is more economical and flexible than it would be in a western country where more stringent limits may be set by unions," adds Kelly.

My Thuan milestones

OCTOBER 1995:
Feasibility study completed

NOVEMBER 1995:
Project given go-ahead

JUNE 1997:
Award of construction contract

MARCH 2000:
Bridge completion

MAY 2000:
Open to traffic

DECEMBER 2000:
Original contract completion

The contractor also had plans to accelerate the work by reworking the programme. "Our first instinct was to study the critical path, then if possible split that critical path into a number of paths," says Magnusson. Due to the unbalanced cantilever deck construction some cables had to be taken to the tie-down pier before closure and back down to the abutment 440m away. BH had the idea to place a temporary tie-down pier in the water, halfway along each side span.

Rather than tying back the towers and the main bridge through to the abutment requiring completion of the whole of the approach deck first, the towers were tied back through the tie-down piers only so that the critical path would be limited to construction between the two tie-down piers.

"The use of heavy lifts with strand-jacks has also accelerated the progress on site," says John Marchese of Austress Freyssinet. The nine hundred tonne precast lower crossbeam and the falsework for the knee fram was strand-jacked into position, a tremendous time saving compared with in situ construction.

All precasting was complete when *Bd&e* visited at the end of 1999. The fact that a lot of the deck components were precast - the cross-beams and the cable-stay anchorage blocks - was an advantage in speeding up the deck cycle time. Edge beams were cast in situ.

One contributory factor to progress was fast, effective feedback from the checking authorities, says Kelly. BH had to submit method statements, QA documentation and temporary works designs for approval. "Maunsell MacIntyre developed a system of considering initial drafts before the final submissions, which worked extremely well here," he explains.

Baulderstone Hornibrook employed consultant TY Lin International/DRC to carry out continuous analysis of the deck. An engineer from the consultant was on site full'-time performing the as-built calculations of the bridge geometry to ensure that the structure had the correct profile and cable tensioning.

The tower legs were each cast in 31 lifts using jump-forms. "It made sense to programme a natural progression of equipment through the job to save money by using the formwork twice," explains Magnusson. The contractor programmed the work so that the south tower would be

constructed first and the formwork would then be relocated to the legs just above the lower crossbeam of the north tower. This not only saved money on forms but also on personnel; less training and no extra teams were required. With the repetition the contractor found that the north tower cut 40% off the time taken to build the south tower. The lower portion of the north tower was constructed using conventional formwork.

"We built the north tower high enough so that we could strand-jack the lower crossbeam into position, and this lift became the critical activity," explains Magnusson. "We had to complete these activities in time for the removal of the jump-form and transportation from the south tower," he says. Programming so that the bridge was built in two halves also saved resources in the construction of the deck; only two steel form travellers had to be fabricated rather than four.

There is no requirement for Australian materials to be used on this job, a factor which has contributed to cost savings. Reinforcement has come from various sources in Europe and Asia; all the sands and Aggregate are from Vietnam. Stay cables were imported, but all heavy steel components such as anchorages and form travellers for the deck construction were designed overseas made in Vietnam. Supervision, as part of the technology transfer, included quality control of the steel manufacturing and assembly process. Most of the steel products were made in Ho Chi Minh by two or three local steel fabricators.

The coloured cable-stay sheath was imported from France, as it is not available in Vietnam or Australia. The process of colouring the HDPE to include ultra-violet protection is now well developed. "Black is very stable to UV, but in the last five years Freyssinet has developed other colours which are UV stable," says Paul McBarron of Austress Freyssinet. In some light and from some angles My Thuan's blue cable-stays disappear from sight against the sky.

AF has supplied and installed the cables, and has also provided post-tensioning in the towers and decks. In addition to this, the company has used its strand-jacking technology, capable of lifting up to 900t.

"The contractor assumed heavy lifting and used a Freyssinet system in its tender submission," says Marchese, but AF also offered the idea of precasting the lower crossbeam on the pile cap as it had done on the second Tagus Bridge. The heavy lift equipment was maximised on site; by using strand-jacking on an isolated site like My Thuan it eliminates the need to hire a big crane, which could be prohibitively expensive.

The very slender deck is partly a function of the abundance of post-tensioning within it, says Marchese. Each segment in each cross girder has a tendon and as many as six tendons can be found in the edge beams which were stressed after the main span 7m stitch closure. There is a lot of post-tensioning, both longitudinally and transversely, in the tie-down pier tables and also in the piers. To avoid reinforcement congestion and keep the towers as slim as possible, the two crossbeams are also post-tensioned. In total there is about 160t of post-tensioning strand in the concrete of the bridge.

Freyssinet's Iso-tensioning system of cable erection also eliminates the need for large cranes as the stay cable is not prefabricated as a complete element. This method also speeds erection.

The consultant made a variation order for an anti-vibration system on the cable-stays which would be designed in advance and put in place with the initial intention of restricting vibration of the cable-stays to an acceptable amount. The cable-stays are designed to meet certain limits of vibration: ± 110mm in a wind speed of up to 15m/s and ± 520mm in wind speeds from 15m/s to 30m/s.

To resist wind and rain excitation, two systems are provided: a helical spiral on the HDPE duct and Freyssinet's damping guide deviators. The deviators are located just below the anchorages in the tower and above the anchorages on the deck. Hydraulic and elastomeric damping shock absorbers are placed inside the guide tubes. The deviators clamp the strands into a compact group, filtering vibrations in the strands and damping vibrations in the stay cables.

Mekong masters

CLIENT:
Ministry of Transport & Communications, Australian Aid Agency for International Development

OPERATOR:
Vietnamese Road Authority No.7

CONSULTANT:
Maunsell McIntryre

CONTRACTOR:
Baulderstone Hornibrook

PILING SUBCONTRACTOR:
Bilfinger & Berger

SPECIAL SUBCONTRACTOR:
Austress Freysinet

INDEPENDENT CHECKING ENGINEER:
McMillan Britton & Kelly

CONSTRUCTION ENGINEERING CONSULTANT:
TY Lin International/DRC