TYRED ROAD LEADS TO ENVIRONMENTAL BENEFITS

A new system of road construction, using recycled tyres, has yielded a 15% reduction in project costs compared to the conventional approach.

The Tomago all-weather access road was a $4m project commissioned by Energy Australia as part of a larger $40-50m project to upgrade electricity supply from Tomago to the Tomaree Peninsula in New South Wales.

The Tomago road project called for a 16 km stretch of pavement which:

- required that there be no excavation, compaction or levelling of the ground so as to avoid exposure of acid sulphate soils, disturbance of heritage sites, flora and fauna, and impact on private land;
- created a load-bearing capacity of 60 tonnes for crane traffic during construction of an electricity transmission line;
- was permanent and required little maintenance;
- had a low profile to preserve visual amenity;
- was water permeable horizontally and vertically, to minimise impact on the ecosystem.

The value-based open tender selection process resulted in the contract being awarded to a team that used patented Ecoflex E-Pave Units in a recycled-tyre reinforced pavement design. This new method offered considerable benefits over conventional macadam pavement. The project was completed in October 2004, after a seven month construction program.

The client consulted the community for four years to determine the most acceptable alignment for the Tomago road. The community's favoured option traversed acid sulphate soils, wetland areas, 190 private properties, 10 archaeological sites and several national park sections. The project was thus environmentally, culturally and politically sensitive.

The winning tender offered an alternative design based on a proprietary construction process that better met the client's requirements and saved 15% over the conventional macadam design. In the bigger picture, the project also absorbed six per cent of NSW's annual waste tyre stream, which would otherwise have gone to landfill.

The innovation

The patented tyre-reinforced permeable pavement was developed specifically for water saturated conditions, where the ground has low load bearing capability. The method is one of the few in the world that uses robust engineering systems to take advantage of the structural value of recycled tyres in a quality controlled environment.

The inventor grew up on a cattle property where he often saw tyres being used to build roads which did not perform well. He later conceived that this performance could be improved by applying engineering principles and quality control processes. The pavement he developed is based on this early idea and his 30 years' experience in the civil construction industry. The pavement is built with Ecoflex units, which comprise:

- an approved recycled tyre;
- a sidewall;
- free-draining rock fill.

The recycled tyre consists of an approved tyre with the side-wall cut out at a precise location. An approved tyre is one that has a solid rubber tread with even thickness, passes strength and rigidity tests, has no exposed steel, and has not been stripped for re-treading.

The cost competitiveness of the technology is underpinned by the adaptation of a $10,000 machine that efficiently and effectively removes the sidewalls. The sidewall is then put inside the tyres on-site to improve their tensile strength.

The tyres are placed on geofabric laid directly on the ground, and arranged in a honeycomb pattern which helps minimise the gaps between the tyres, thus helping to maintain the pavement's structural integrity. Each tyre is butted up to adjoining tyres, again so that fill does not infiltrate gaps and weaken the pavement. A topping layer is then applied to interlock the fill material. When constructed according to quality control procedures, there is no need to fix adjoining tyres to maintain the pavement's trafficability over time. The Tomago road comprises 75,000 truck tyres processed and laid in this way.

On the Tomago project, the client considered alternative pavement methods. Conventional construction methods were rejected for reasons outlined below in the 'Benefits' section. Other new proprietary products from Australia and overseas were also considered. They all provided the fill-containment function offered by the recycled tyres, but the client found the costs much greater and the likely performance lacking.

Benefits

In the absence of Ecoflex, the Tomago project would probably have used a macadam pavement, which comprises layers of broken stone, compacted into a hard surface. Because much of the terrain is often water saturated, and because excavation was not an option, a macadam pavement would have had to have been very wide and high. To achieve a four metre wide trafficable surface, the pavement would have been seven metres wide and one metre high, while the proprietary pavement is only four metres wide and 300mm high.

The new approach is less costly, has less impact on the environment, and provides greater visual amenity. The recycled tyres contain the rock fill and prevent it from spreading, which is particularly advantageous on projects where excavation is problematic because of water-saturated or environmentally sensitive conditions, such as on the Tomago project.

The proprietary system cost approximately 15% less than the conventional approach, significantly reducing the project costs, while achieving environmental and social objectives.

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The technology supplier estimates that the cost of creating and operating an urban landfill facility in Australia is $100-$150 per tonne of waste. Applying the bottom end of this range, the Tomago project saved the community approximately $400,000 in land fill costs.

Environmental benefit was also provided because the recycled tyre approach required 60 per cent less fill material than a conventional pavement on the project. This meant a reduction in fuel consumption to mine and transport fill. According to the technology supplier, this saved 2,110 tonnes of greenhouse gas emissions.

The performance record of the proprietary recycled tyre approach, especially on the Tomago project, has impressed the client. This has contributed to their considering development of a 'period contract', which is expected to offer a negotiated fee for unique products used on specified small projects, for a given time period.

This arrangement avoids repeated open tendering for work where it is known that there is a unique product offering superior efficiency over available alternatives. For the technology supplier, this preferred status would be a reward for the considerable investment they have made in research and development (R&D), to develop a product that is apparently without peer.

- **This article is based on a case study prepared by the BRITE Project, which is an initiative of the CRC for Construction Innovation. For further information, please contact Dr Karen Manley, BRITE Project Leader, at the CRC for Construction Innovation, k.manley@qut.edu.au, www.brite.crcci.info or tel (07) 3864 1762.**