# Future travels down a GLASS HIGHWAY

## Mountains of waste glass that would otherwise go to landfill may soon find a home in Victoria's roads and footpaths

BY KARIN DERKLEY

**AUSTRALIANS** have become great recyclers of glass, even though not all glass is actually reusable. However, a purpose may just have been found for the growing stockpile of waste glass in many cities and towns.

Research at Swinburne University of Technology's Centre for Sustainable Infrastructure is looking at ways to make this glass suitable for use in road construction. In Victoria alone, about 250,000 tonnes of non-recyclable glass ends up in landfill, so it represents a sizeable resource to supplement materials used in roads and footpaths.

Recycled glass is already used in road construction in Europe and the US, but each region needs to set its own standards according to local conditions, materials and climate.

### Key points

**About 250,000 tonnes of waste glass are stockpiled each year in Victoria.**

**Laboratory testing at Swinburne has shown that the glass has the right qualities to be incorporated into road base material.**

**If road trials currently being conducted are successful, road base materials could in future include up to 30 per cent recycled glass, absorbing all waste glass produced in Victoria.**

In Victoria, VicRoads, which constructs state highways and freeways, and the Municipal Association of Victoria (MAV), which represents local councils that look after local roads, footpaths and bike paths, needed to be confident that the new materials would not compromise quality and durability. Currently, crushed glass is allowed, but only up to a maximum proportion of three per cent.

Roads generally have three levels: a sub-base pavement, a base pavement and an asphalt top. The sub-base is the main load-bearing layer of the pavement; its role is to spread the load evenly over the earth beneath. The quality of the sub-base is crucial – poor construction or use of the wrong materials can cause the upper surface to crack.

Materials used in a sub-base must comprise particles of a shape and size that interlock tightly when compacted to eliminate air gaps and movement.

Traditionally quarry rock has been used, with authorities such as VicRoads requiring proof that any new material like crushed glass can withstand at least 20 years of heavy traffic.

This is where Swinburne comes in. Dr Arul Arulrajah, an associate professor in Civil and Geotechnical Engineering has previously assessed the suitability of crushed brick as a road construction material.

Last year, supported by a consortium of government and industry groups including Sustainability Victoria, Visy, VicRoads, the MAV and the ARRB Group (formerly Australian Road Research Board), Dr Arulrajah led a team to compare different blends of recycled glass, crushed rock and concrete with traditional quarry materials.

Laboratory tests by Dr Arulrajah and his team, including PhD students Younus Ali and Mahdi Miri Disfani, assessed the mechanical properties of each blend, including the particle density, particle size, plasticity (ability to be shaped), compactability, permeability and load-bearing capacity.

The finding – that all the blends with up to 30 per cent glass matched or exceeded the VicRoads specifications – didn't actually come as a surprise to Professor Arulrajah, "given that crushed glass is really just like coarse sand".

Even so, it is one thing for a material to perform under the controlled conditions of a laboratory, and another for it to deal with real-world conditions. Associate Professor Binh Vuong, a senior research fellow with the Centre for Sustainable Infrastructure at Swinburne and a principal engineer at ARRB, has extensive experience in laboratory testing and field construction of recycled and quarry-produced materials. In his joint appointment with ARRB, Professor Vuong had already been involved in the

ILLUSTRATION: KEN UCHIDA

laboratory testing process for recycled glass. His role now is to oversee the field-testing of the blends.

Materials recycler, the Alex Fraser Group has offered the entrance to its Western Metropolitan Recycling Facility in Laverton, Victoria, as the site for a road trial. The road carries a large volume of heavy vehicles. Nine sections of road, each 80 metres long, were laid in November 2009, each using a different blend of recycled glass and recycled concrete or crushed rock, and designed and constructed to the specifications required for arterial and local roads.

After six months the test roads are showing no visible signs of rutting or cracking, the symptoms of a weakening sub-base.

In May 2011 the surface will be scrutinised in minute detail using an ARRB laser profiler. If the study shows the glass blends are as strong as virgin quarry rock, the consortium backing the research will submit a report to VicRoads recommending a change to its specification to allow higher percentages of crushed glass to be used.

David Birrell from the Alex Fraser Group believes glass mixes will be competitive options for road builders. "To take on a waste product it has to make commercial (as well as sustainable) sense for us, and we have no doubt that this product will be comparable or even competitive with other road-building materials." ■

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# SLOW LIFTS A LESSON IN step-change

STORY BY Karin Derkley

**SUSTAINABILITY** has become a buzzword for the early 21st century, evoking worthy ideals … but how are these transformed into reality when much about the way the world functions seems to make people inherently wasteful or destructive?

The ideal of sustainability, and the reality that confronts this, is the conundrum that Professor Frank Fisher is tackling after his appointment as Professor of Sustainability in the Faculty of Design at Swinburne University of Technology and as the convenor of a graduate sustainability program at Swinburne's National Centre for Sustainability.

An electrical engineer, Professor Fisher was previously an associate professor in the School of Geography and Environmental Science at Monash University. In his new positions at Swinburne 'design' takes on an added dimension – an instrument for modifying people's behaviour.

Good design, he says, makes it easier for people to do the right thing, and harder to do the wrong thing.

**Good design makes it easier for people to do the right thing, and harder to do the wrong thing.** Professor Frank Fisher

Design students are taught to understand that whatever they design – products, services or systems – will have environmental, cultural and social consequences. These days, sustainability is often as essential to a design brief as economics, function and aesthetics.

Taking this a step further, Swinburne has become the first educational institution to adopt a recently created international Designers Accord set up to establish a new universal standard for sustainability in design and innovation.

In parallel with this international benchmark, Swinburne has launched its own university-wide Sustainability Strategy. The strategy aims to make sustainability one of the key drivers in all future planning and service delivery at Swinburne itself. One of Professor Fisher's jobs is to put this into practice.

Once again, design of systems and structures can lead the way to behavioural change, he argues. Take the way buildings are designed. If you're trying to reduce the use of lifts, for example, and make stair-climbing the social norm, the stairway should be at the centre of any lobby. Invariably though, lifts occupy the centre, with stairs tucked away in a corner.

Although there's not much that can be done about existing lifts at the university, Professor Fisher is doing his best to discourage their use in another structural way – by slowing them to the point where the average able-bodied person would find it more convenient to use the stairs, cutting