

Waste not... when making new roads

The Science of Surfaces is a four-part weekly science series that looks at the surfaces we walk on so often but know so little about. In this third part, we look at the material used to make our roads anti-skid. Next week, we look at sand.

By MARIA ALMENOAR

WASTES from steel factories is what keeps a tight grip on car tyres in wet weather conditions.

Road pavers have found that steel slag, or a by-product from making steel, provides a better anti-skid property than conventional materials such as granite.

Increasingly, the Land Transport Authority (LTA), which oversees road paving, is adding recycled or waste materials into Singapore's roads.

The aim is to increase the composition of these recycled materials in roads to 70 per cent, up from the current 25 per cent.

LTA's acting manager for road infrastructure management, Mr Yoong Chin Chong, said: "In the old days, all four layers of the road were made from granite stones but nowadays, we are looking at using recycled material which can do the same or even a better job."

Recycled materials minimise Singapore's dependence on imports from neighbouring Indonesia and Malaysia, reduce the rate at which landfills pile up and save the authorities millions of dollars.

Steel slag is one waste material, for example, that is being used in the top layer of roads, called the asphalt wearing course.

Different sizes of granite stones and steel slag are heated at about 170 deg C to remove any moisture before being mixed with a dark sticky liquid called bitumen, or what is commonly known to motorists as tar.

The steel slag with its grooves gives the road surface a honeycomb texture and makes melding with the bitumen easier and, in turn, the surface stronger.

The use of steel slag also helps to reduce the price of the top layer, which with the quality of the granite aggregate being used is now about the same as that for the bottom layers - about \$11 per sq m - despite being about one-sixth the thickness.

On the top two layers, the LTA is testing the use of some of the "old roads" or roads dug up during resurfacing. "Old road" surfaces are processed into reclaimed asphalt, which is then crushed and screened into various sizes.

Said pavement specialist Kelvin Lee from Samwoh Corporation, one of the four asphalt production factories in Singapore: "The field test results of using asphalt with the reclaimed asphalt pavement have been encouraging and we envisage that it will be approved for usage in the near future."

For the bottom two layers, which need to be between 200mm and 300mm thick, the LTA is testing using processed incinerated waste from landfills.

This is made up of mostly discarded household items and contains mainly silica, glass, ceramic and metal.

The waste is exposed to weather for three months to dry before it is screened to remove unwanted materials.

It is then sieved to the required sizes before being treated by chemicals.

Already, for the bottom two layers, the LTA uses discarded blocks of concrete from construction sites when, for example, buildings are demolished.

The steel reinforcement rods are removed and the concrete is treated before it is used as road-building material. maria@spil.com.sg

Smooth drives

Roads are generally made of four layers. These layers vary in thickness depending on how heavily the roads are used. All roads also checked and resurfaced regularly.

HOW ROADS ARE RESURFACED

- 1 A truck brings the mix, then spreads it in hot asphalt mix to the area.
- 2 A paver machine receives the mix, then spreads it across the width of the asphalt paver. A tampering plate at the back of the paver compacts the mix to the required thickness.
- 3 A roller machine is used for the final compaction.



MATERIALS THAT GO INTO A ROAD

- Asphalt wearing course: Comprises bitumen and aggregates of granite stone, 19mm and below in size. Steel slag is also used.
- Asphalt base course: Comprises bitumen and aggregates of stone sized 25mm and below.
- Road base: Comprises aggregates of stone sized 38mm and below
- Sub-base: Comprises aggregates of stone sized 75mm and below. Crushed concrete (derived from demolished concrete structures) and milled asphalt waste (derived from asphalt road maintenance) can be used here.

DIFFERENT ROAD, DIFFERENT THICKNESS

(Figures in mm)

	Express-way	Major arterial	Primary access	Local access
Asphalt wearing course	50	50	40	25
Asphalt base course	120	120	90	75
Base course	250	250	200	200
Sub-course	300	300	300	200
Total	720	720	630	500

HOW ROADS ARE TESTED

- Expressways resurfaced EVERY THREE TO FIVE YEARS
- Major roads resurfaced EVERY FIVE TO 10 YEARS
- Minor and residential roads: Inspected EVERY TWO MONTHS and affected stretches resurfaced as needed.
- Typically, minor roads are resurfaced EVERY 10 TO 20 YEARS and residential roads EVERY 30 TO 40 YEARS



Road Profiler

It measures road profile parameters, such as the longitudinal and transverse road profile. Results are used to determine the road riding quality. **Testing Time:** Mostly during day **Speed:** Normal traffic speed



Scrim Machine

Measures wet-road skid resistance values. The machine moves at a speed that simulates usual vehicle movement. **Testing Time:** Mostly during the day **Speed:** 50kmh



Deflectograph

Measures road deflections and evaluates the lifespan of the road. **Testing Time:** Mostly during the night **Speed:** 2.5kmh

Source: LTA

GRAPHICS: TIEN CHING PING (PHOTOS: LTA)