Environment and Sustainability

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Use of macro synthetic fibres in shotcrete and concrete

Alert

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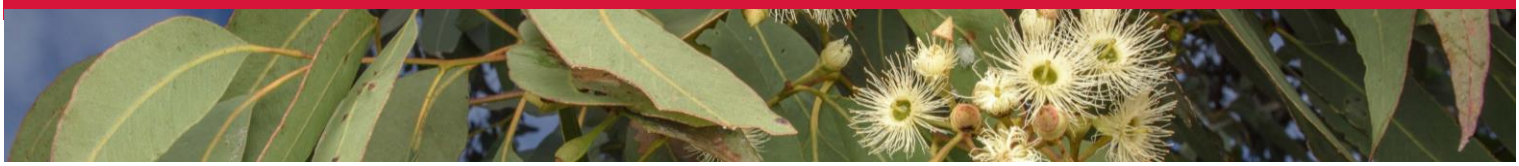

Audience

All staff working on TfNSW infrastructure where macro synthetic (large plastic) fibres have been or could be used in shotcrete or concrete.

Background

There are various products that can be used as reinforcement in shotcrete and concrete. Macro synthetic fibres are one such product (Figure 1). A major road project in south-eastern NSW, used shotcrete reinforced with macro synthetic fibres to line permanent table drains adjacent to the alignment (Figure 2). The application was left with a rough (un-screeded) finish with plastic fibres exposed on the surface.

Four years following installation, large volumes of the macro synthetic fibres have dislodged from the shotcrete (see Figures 3 & 4) and could be lost to the environment via wind, rainfall and drainage flows.

Macro synthetic fibres are also often used in shotcrete mixes in tunnels. Where used, macro synthetic fibres can end up in the tunnel spoil waste stream. If not appropriately disposed of or encapsulated at the spoil disposal location, these fibres can also be lost to the environment.

Key message

The suitability of macro synthetic fibres for application in outdoor environments is being reviewed by TfNSW Technical Services, and a Technical Direction is being prepared.

However, to minimise the risk of macro synthetic fibres dislodging and escaping to the environment, immediate measures that sites should consider are:

- screeding the surface for a smooth finish, ensuring all fibres are fully encased and secured in the shotcrete/concrete
- applying a durable cover layer over the shotcrete / concrete to ensure that all fibres are fully encapsulated
- using steel reinforcment fibres in highly sensitive environments (where urban design outcomes permit), which will degrade (rust) if accidentally lost to the environment.

Action required

If you have been involved in a project that has used shotcrete or concrete with macro synthetic fibre reinforcement in an outdoor area, inspect the shotcrete / concrete to determine its condition and any potential for fibres to become loose.

If macro synthetic fibres are used in tunnels, the contractor needs to identify the spoil disposal location and how they intend to dispose of fibres in a manner that ensures fibres cannot escape into the environment.

Carefully consider any proposals for the use of macro synthetic fibres in shotcrete / concrete in outdoor environments, in accordance with the information in this Alert.

Figure 1: Macro synthetic fibres.

Additional considerations

- Shotcrete/concrete with macro synthetic fibre reinforcment is susceptible to weather conditions and can be weakened / eroded due to rainfall (mildly acidic) and UV exposure. This should be considered when reviewing suitability for use in outdoor areas.
- End of life options should be considered wherever macro synthetic fibres are proposed for use in shotcrete/concrete, noting that there is currently no viable recycling option.

Contact and further information

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Environment & Sustainability Management Framework

Figure 2: Shotcrete with macro synthetic fibre reinforcement, shortly after application.

Figure 3: Shotcrete drain four years after application, showing dislodged macro synthetic fibres

Figure 4: Close up of weakened shotcrete with dislodged macro synthetic fibres

Figure 1: Concrete slab with protruding macro synthetic fibres.