

Guideline: Quarry assessment of “manufactured sand” crushed fine aggregate sources

1 Introduction

In accordance with Engineering Policy EP108, TMR concrete technical standards MRTS39, MRTS40 and MRTS70 and asphalt technical standards MRTS30 and MRTS31 require quarry assessment and registration of all fine aggregate sources.

This guideline describes minimum assessment requirements to be met before a quarry will be given TMR registration for "manufactured sand" crushed fine aggregate products for use in concrete and asphalt.

It should be noted that the guide does not provide a comprehensive specification for manufactured sand. Its purpose is to provide guidance on desirable source rock quality and production processes a quarry must have to make a consistent manufactured sand product.

The following two documents have been referenced in the development of this guideline:

Australian Standard AS 2758.1 - Aggregates and Rock for Engineering Purposes – Part 1: Concrete Aggregates (1998). It provides guidance on the specification and use of both crushed and uncrushed fine aggregates for concrete.

"Guide to the Specification and Use of Manufactured Sand in Concrete", released by Cement Concrete and Aggregates Australia (CCAA) (2008). The guide was based on their own research.

2 Definition of manufactured sand

Manufactured sand is a purpose-made, fine crushed aggregate produced under controlled conditions from a suitable sound source rock. It is designed for use in concrete, asphalt and other specific products.

General crusher fines (dust) and sand resulting from lightly crushing (disaggregating) decomposed granite or weakly cemented sandstone rocks are not considered to be manufactured sand. The latter are usually classified as natural sands of residual origin.

3 Site details

To be provided as per Section 5.2.

4 Geology

To be provided as per Section 5.3.

5 Production processes

To be provided as per Section 5.4, but the assessment shall verify the following additional requirements are met:

- The manufactured sand production circuit includes crushing and screening. It may also include washing and possible separation into discrete fractions then recombining and blending.

- A process is used (e.g. impact crusher) to improve particle shape and minimise flakiness.
- Crushing of multiple source rocks into a single fine aggregate stockpile is not being carried out unless it can be demonstrated that such a process is under blend control and produces a consistent product.
- Manufactured sand stockpiles are uniform in composition and not contaminated by highly weathered rock or clay.

6 Source rock quality

To be provided as per Section 5.5, but with the following specific requirements:

- any manufactured sand fraction must be crushed from sound and durable rock complying with rock property requirements for coarse aggregate as listed in the concrete or asphalt specifications. The source quarry must hold current TMR registration for coarse concrete or asphalt aggregate products
- source rocks which have a tendency to produce flaky chips should be avoided for manufactured sand production
- The source rock shall be of uniform composition (in order to guarantee the uniformity of the manufactured sand product), and
- the source rock shall not be alkali silica reactive to an extent that may result in excessive expansion in the concrete. (This requirement might not be relevant if flyash is to be used in the concrete mix).

7 Product quality

7.1 Concrete

The current TMR approach is to require manufactured sand to generally conform to Australian Standard AS 2758.1 – Part 1 Fine Concrete Aggregate requirements, unless specified otherwise in the TMR technical standards or project-specific technical specifications. However, specific product properties required will be dependent on its usage for either structural concrete or road pavements, where the effects on water demand, shrinkage and workability of concrete mixes need to be taken into consideration.

Current TMR concrete specification product quality requirements applicable to manufactured sand for use in concrete are outlined in the relevant departmental technical standards MRTS39 (concrete sub-base), MRTS40 (concrete base) and MRTS70 (concrete).

It should also be noted that additional project specific product quality requirements might also be specified for special purpose concrete.

7.2 Asphalt

Current TMR asphalt specification product quality requirements applicable to manufactured sand for use in asphalt are limited to source rock properties. These are listed in the relevant department technical standards, MRTS30 and MRTS31.