8204 Hand placed fibre reinforced concrete paving

REVISION 07/02/2024

8204.1 Introduction

This supplementary specification refers to the supply and placement of polymer fibre reinforced concrete. (steel fibres are no permitted to be used in the concrete)

8204.2 Referenced Documents

This supplementary specification shall be read in conjunction with the following:

- MRS01 *"Introduction to Specifications"*;
- MRTS01 *"Introduction to Technical Specifications"*;
- MRS03 and MRTS03 *"Drainage Structures, Retaining Structures and Embankment Slope Protections"*; applicable to shotcrete works
- NRS04 and MRTS04 *"General Earthworks"*
- MRS70 and MRTS70 *"Concrete";*
- MRTS272 *'Shotcrete for Aboveground Application"*
- *ASTM C 1116 "Type III – Synthetic Fibre Reinforced Concrete or Shotcrete"*
- *EN 14889-2 – "Polymer Fibres";* and
- the project Drawings.

8204.3 Description of Work Items

Work items incorporated by this supplementary specification are identified in Section 8204.6 and 8204.7 with individual activities/tasks for measurement and payment sourced from the Bill of Quantities and listed in MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving Section 1

8204.4 Quality Systems Requirements

8204.4.1 Std Test Methods (Testing Regime)

Unless otherwise approved by the Superintendent the following minimum testing regime applies to this specification:

The minimum test frequencies and minimum numbers of tests shall be as follows:

- Concrete shall be tested in accordance with MRTS70 Concrete.
- Earthworks shall be tested in accordance with MRTS04 General Earthworks.

Where there are additional testing requirements these are included in Clause 2 of MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving

8204.4.2 Hold Points, Witness Points and Milestones

The following table represents the minimum inspection and milestone requirements for this specification;

Activity	Inspection Type	When
Construction Procedure and other required documents as per 8210.5	Milestone	4 Weeks prior to works commencing
Concrete Mix Design	Milestone	14 days prior to placing order for concrete
Inspection of delivered items	Hold Point	At delivery time for each item.
Final location of work extents	Hold Point	Prior to excavation commencing
Unsuitable material at excavated floor	Hold Point	Prior to trimming and compacting for floor
Floor compaction and inspection	Hold Point	Prior to formwork and concrete pour setup commencing
Prepour Inspection of formwork and reinforcing	Hold Point	Prior to concrete pour approval to proceed
Placing of compressible packing	Witness Point	Prior to concrete pour approval to proceed
Concrete pour process and procedure being followed	Witness Point	During concrete pour
Finish of concrete as per design drawings	Witness Point	Prior to concrete hardening
Curing of concrete slab to occur immediately after pouring	Witness Point	Immediately after pouring for 7 days
Stripping of formwork approval	Hold Point	No earlier than 72 hours after concrete pour finish, approval by Superintendent
Joints installed as per design drawings and sealed	Witness Point	After formwork is removed
Backfilling against concrete	Witness Point	After approval to remove formwork being granted by Superintendent
All disturbed areas cleaned, tidied, and returned to its natural state	Hold Point	At completion of works prior to Works as execute inspection.
Works as executed documentation submitted and accepted	Hold Point	4 weeks prior to Works as Executed inspection request
Erosion and sediment control measures in place	Hold Point	At completion at Works as Executed Inspection

8204.4.3 Construction Tolerances

Unless otherwise approved by the Superintendent the following construction tolerances shall apply to this Supplementary Specification;

The construction activity outcome shall not depart from the widths, lengths, heights, and shapes specified by the relevant specifications as applies to this specification;

- Concrete tolerances in accordance with MRTS70 Concrete.
- Earthworks tolerances in accordance with MRTS04 General Earthworks.
- Shotcrete tolerances in accordance with MRTS03 and MRTS272

Tolerances specific to the project are detailed on the design drawings and are included in Clause 2 of MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving

8204.5 Preliminary

The project design manager shall ensure that the required State government permits have been obtained and are current prior to the issuing of tender documents.

The Contractor is to submit the following documentation 4 weeks prior to commencing work or a prestart is conducted. (MILESTONE):

- Works procedure – all activities and order of construction
- Environmental Management Plan
- Concrete Mix design – 14 days prior to placing order for concrete

Other preliminary requirements unique to the project will be listed in the MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving (MILESTONE)

The contractor is to ensure their construction activities are based on the design drawing requirements.

8204.5.1 Materials

Supply of all materials to site is the responsibility of the Contractor at their cost, where items are Principal supplied the nominated storage site shall be obtained from MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving Section 3 and shall be the point of supply.

All items and materials shall be supplied in accordance with the design drawings and the relevant specification/s MRTS03, MRTS04, MRTS70, MRTS272, and other standards as referenced.

8204.5.1.1 Concrete Specification

The compressive strength of the concrete and the concentration of the fibre reinforcing to be used shall be in accordance with requirements of MRTS70, and as specified on the project Drawings.

The polythene sheet shall be supplied and placed in accordance with requirements of Clause 15.6 of MRTS70.

8204.5.1.2 Fibre Reinforcing Specification

Fibre reinforcing materials for use in this application shall have the following material properties and shall comply to the requirements of *ASTM C 1116 Type III – Synthetic Fibre Reinforced Concrete or Shotcrete* and *EN 14889-2 – Polymer Fibres*.

Property	**Macro Fibres**	**Micro Fibres**
Material: polypropylene	100% Polyolefin Polymer	virgin
Length	48 mm	19 mm
Equivalent / nominal diameter	0.71 mm	35 µm
Melting point	170°C	150°C - 170°C
E modulus	6.9 GPa	3.5 GPa
Density	0.92 g/ml	0.91 g/ml
Tensile strength	550+ MPa	450 - 560 MPa
Energy absorption rate	450+ Joules	not applicable
Fibre type	Continually embossed	Mono filament
Absorption	Nil	Nil
Alkali, acid and salt resistance	High	High
Thermal conductivity	Low	Low
Electrical conductivity	Low	Low
Fibres per kg	32,000	

8204.5.1.3 Mixing and Placing Concrete

Mixing and placement of the fibre reinforcing shall be executed in accordance with the following requirements:

1. Add fibre reinforcing as flexural and/or secondary reinforcement to concrete mixture in accordance with manufacturer's specifications before, during or after loading other concrete materials.
2. Add the synthetic fibre reinforcement at standard application rates as specified for the required dosage rate as indicated in the Project Drawings.
3. Mix for a minimum of three (3) minutes with full speed for uniform distribution of fibre through the concrete matrix.
4. Place, finish and cure concrete in accordance with manufacturer's instructions, MRS70 & MRTS70, MRS03 & MRTS03, and MRTS272.

8204.6 Construction

Carrying out all works associated with the supply and placement of the fibre reinforced concrete as specified on project drawings.

This section lays out the works operations with more detail based on specific requirements of this supplementary specification. Some activities may appear to include items which are stated within other specifications, the purpose is to reinforce that requirement specific to this supplementary specification.

8204.6.1 Work Operations

Work operations incorporated in this item will include:

a) Work operations included in Clause 2.1.5 of MRS01 "Introduction to Standard Specifications";

b) Supplying all materials;

All materials, plant, and labour required to carry out the works under this Specification is to be supplied by the Contractor, where materials are Principal supplied the designated storage site will be the point of supply for the purposes of this Specification.

All items shall be inspected at delivery to site prior to use. Any items which are damaged are not to be used and are to be returned to the supplier. (HOLD POINT)

c) Site layout with Superintendent

The final location of the works as required by the design drawings is to be marked out on site and shall be inspected and approved by the Superintendent prior to excavation commencing. (HOLD POINT)

d) Carrying out excavations (as required);

Excavation of material to level and grade as per design drawings, vertical tolerances shall not exceed +5mm/-10mm.

Excavated floor or surface is to be inspected for areas of unsuitable material (HOLD POINT)

If unsuitable material is identified this is to be removed and replaced with approved material as per the instructions of the Superintendent

e) Utilising or disposing of excavated material;

Excess excavated materials shall be disposed of by the contractor or utilised as per Superintendents instructions. Material stockpiled shall ensure that all Environmental ESC measures are in place and maintained.

f) Bottom of Excavations

All loose material is to be removed from the excavated floor or surface.

Compact the floor or surface as required by the design drawings and MRTS04, where there is a lack of detail the area shall be compacted to 97% SDD and tested at a frequency of 1/200m2

Floor or surface preparation is to be carried out as required by the design drawings and as per MRTS04 and is to be presented for inspection by the Superintendent with inspections, geotechnical testing and geometric requirements applying unless stated otherwise in MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving. (HOLD POINT)

Where the concrete is to be placed on the ground surface or foundation bedding a Polythene Sheeting is to be laid in accordance with MRTS03 and MRTS70.

g) Installation of formwork and reinforcing (as required);

All concrete works associated shall be carried out in accordance with MRTS70, MRC standard drawings, and the design drawings with inspections, geotechnical testing and geometric requirements applying unless otherwise in MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving.

Primary reinforcing in the case of shotcrete concrete shall be installed as required by the design drawings.

Formwork to be used has been approved by Superintendent and complies with MRTS70.

Installed formwork shall be installed to project drawings line, levels and shape, positional tolerance Horizontal +/-25mm's, Vertical +/-5mm's

Depth of excavation from excavated floor to design finished level complies with project drawings design depth of concrete +10/-3mm's (HOLD POINT)

h) Placing compressible packing or joints;

Where indicated on the design drawings compressible packing shall be installed prior to placement of the concrete. Where there is a lack of detail compressible packing shall be installed as per MRTS70 or as required by referenced MRC Standard Drawings. (WITNESS POINT)

All joints are to comply with the design drawings, where there is a lack of detail joints shall be installed as per MRTS70. (HOLD POINT)

i) Placing and compacting concrete;

Prior to approval for placing the concrete a prepour inspection of formwork and joints is to be carried out, all joints and dowels linking to adjacent section pours are to be installed as per the design drawings prior to the respective pours taking place. The Superintendent shall give approval to proceed with the respective pours. (HOLD POINT)

All concrete works (including formwork and reinforcing) associated with the Fibre reinforced concrete shall comply with the design drawings and be carried out in accordance with MRTS70, MRTS71, with inspections, geotechnical testing and geometric requirements applying unless otherwise in MRC Supplementary Specification Annexure 8204_1 Hand Placed Fibre Reinforced Concrete Paving. (WITNESS POINT)

The Superintendent shall give the approval to proceed with the placing of concrete.

Concrete delivered to site is as per the approved mix design, delivery dockets verify mix and target strength.

Concrete is to be placed with minimum drop height to minimise segregation. Compaction of concrete shall occur using a vibrating needle, with insertion directly perpendicular (up and down) to the finished surface and not more than 450mm apart for between 5-15 seconds at each location. No dragging of needle along surface is permitted. Care should be taken to ensure the fibres are not segregated from the concrete mix during compaction.

Vibrating against steel reinforcing should be avoided, no vibrating of formwork or tapping/hammering of formwork is to occur.

Depressions in the fresh concrete caused by foot traffic, or aluminium screeding tools, must be refilled with the concrete mix, not just surface slurry.

Care shall be taken to avoid uneven screeding that will cause 'screed-lines' of mortar and /or aggregate to become apparent when the surface has been washed. Over-screeding by an overlapping technique has been found to be an effective method to avoid this finishing problem.

Use placing methods that minimise plastic cracking. Closing plastic cracking by merely trowelling is not sufficient, as they will again be revealed after washing. If plastic cracking occurs during placement, they shall be closed by careful and efficient surface compaction before re-trowelling.

Construction and Contraction/Expansion Joints are to be incorporated as per the project plans or as per the Superintendents instructions.

j) Finishing and curing concrete;

Finishing of the concrete is to be in accordance with the design drawings. (WITNESS POINT)

Immediately after the initial set of the concrete, curing shall commence and continue for a minimum of seven days. Plastic sheeting shall not be used as part of the curing process. (WITNESS POINT)

k) Stripping of formwork

Formwork is not to be stripped for 72 hours and loading not to occur for 7 days or as per design drawings and approved by the Superintendent (HOLD POINT).

l) Clean up and backfilling against footing and/or slab;

Backfilling to slab is not to occur until after stripping has occurred. Where backfilling and turfing is required it shall be left 10mm below level of concrete finished level (HOLD POINT).

Site is to be cleaned of all debris, excavated material, and construction materials.

8204.6.2 Acceptance and Rejection of Concrete

8204.6.2.1 Rejection of Concrete (Plastic – Non Hardened)

Prior to concrete being placed it shall be visually checked and be rejected if the following apply

a) The slump is outside the limits specified on the project plans and/or MRTS70

b) The concrete contains significant lumps of unmixed material

c) Appearance, colour, cohesiveness is significantly different to other batches delivered and placed.

8204.6.2.2 Rejection of Concrete (Hardened)

Concrete may be rejected based on strength as per MRTS70

8204.6.2.3 Acceptance of Concrete

During the placing stage the consistency and workability of concrete shall be such that it can be handled and transported without segregation and can be placed, worked and compacted into all corners, angles and narrow sections of forms during the placing stage.

The strength of the concrete passes all compression tests and all test results are within the parameters of rejecting as laid out in MRTS70.

8204.6.2.4 Defects and Rectification

Where concrete does not comply with this specification the concrete shall be removed and replaced.

Where cracking has occurred rectification will be dependent on the size, type, and extent of cracking, and the cause. Any rectification method will be as per approval of the Superintendent.

8204.7 Post construction

a) **Collection and submission of all As Constructed data including QA data requirements.**

Contractor is to supply and submit Works as Executed documentation as required by *MRC D20 - Drawings and Documentation* for approval by the Superintendent 4 weeks prior to requesting a practical completion inspection.

Format of submitted "As Constructed" documentation shall be compliant with MRC Supplementary Specification 8919.

b) Erosion and sediment control plan

ESC measures are to be kept in place and maintained until the Superintendent approves of the removal of such measures. (HOLD POINT)

8204.8 Measurement and Payment

No separate payment will be made for the works specified in this Supplementary Specification or it's Annexure. Provision for these works shall be deemed to be included in the scheduled unit rates for the items shown at Clause 8204.3. The calculation of these quantities shall be in accordance with Clause 2.3 of MRS70.

Version Control:

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1.1	Review	R. Mogg	07.04.2022
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