8901 Segmental Paving

REVISION 16/02/2024

8901.1 Introduction

This Supplementary Specification covers the construction of both clay and concrete segmental paving for road pavements in residential and commercial areas (excluding industrial areas), medians, traffic islands, driveways, cycleways, footpaths and other trafficable areas.

The work to be executed under this Specification consists of the supply, placement and compaction of segmental pavers, including the provision of a sand bedding course and joint filling sand over concrete, bound or unbound base and/or subbase pavement layer/s. This specification does not cover concrete or pavement works required to prepare a working platform to lay the pavers on.

8901.1.1 Terminology

Concrete segmental pavers are units of not more than 0.10m^2 in gross plan area, manufactured from concrete, with plain or dentate sides, with top and bottom faces parallel and with or without chamfered edges. Concrete pavers are identified by shape as being one of the following types:

Shape Type A

Dentated chamfered units key into each other on four sides and can be laid in herringbone bond or by their plan geometry. When interlocked, resist the spread of joints parallel to both the longitudinal and transverse axes of the units.

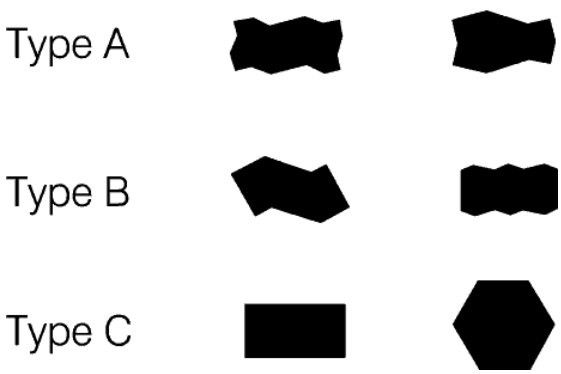
Shape Type B

Dentated units key into each other on two sides and are preferably laid by their plan geometry and not (usually) laid in herringbone bond. When keyed together, resist the spread of joints parallel to the longitudinal axes of the units, and rely on their dimensional accuracy and accuracy of laying, to interlock on the other faces.

Shape Type C

Units which do not key together and which rely on their dimensional accuracy and accuracy of laying to develop interlock.

The following are examples of the shape types;



Clay pavers are manufactured from clay, shale or argillaceous materials which may be mixed with additives. Clay pavers may have square, bevelled (chamfered), rounded or rumbled edges. They are generally rectangular in shape, with the length twice the width, plus 2mm.

Clay pavers are classified as either Class 1, 2, 3 or 4 according to their intended application, with increasing performance requirements (and thickness) from Class 1 to Class 4.

8901.2 Referenced Documents

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

- MRS01 and MRTS01 *"Introduction to Technical Specifications"*;
- MRS03 and MRTS03 *"Drainage, Retaining Structures and Embankment Slope Protections"*;
- MRS04 and MRTS04 *"General Earthworks"*;
- MRS05 and MRTS05 *"Unbound Pavements"*;
- MRS70 and MRTS70 *"Concrete"*
- AS 1141.11 *"Particle size distribution by dry sieving"*;
- AS/NZS 4455 *"Masonry units and segmental pavers"*;
- AS/NZS 4456.0 *"Masonry units and segmental pavers – Methods of test – General Introduction and list of methods"*;
- AS/NZS 4456.3 *"Determining dimensions"*
- AS/NZS 4456.5 *"Determining breaking load of segmental paving units"*;
- AS/NZS 4456.9 *"Determining abrasion resistance"*;
- AS/NZS 4586 *"Slip resistance classification of new pedestrian surface materials"*
- Concrete Masonry Association of Australia Specifications:
    - PA01 *"Concrete Segmental Pavements – Detailing Guide"*;
    - PA02 *"Concrete Segmental Pavements – Design Guide for Residential Access Ways and Roads"*;
    - PA03 *"Concrete Segmental Pavements – Specifying Guide"*;
- Clay Brick and Paver Institute Specifications Paver Note 1 *"Specifying and Laying Clay Pavers"*; and
- the project Drawings.

8901.3 Description of Work

Work items incorporated by this supplementary specification are identified in Section 8901.6 and 8901.7 with individual activities/tasks for measurement and payment sourced from the Bill of Quantities and listed in MRC Supplementary Specification Annexure 8901_1 Segmental Pavers Section 1

8901.4 Quality systems requirements

8901.4.1 Std Test Methods (Testing Regime)

The following minimum testing applies to this specification:

Civil works activities associated with the subgrade/floor of excavation, concrete pours, drainage installation, subbase and base courses, shall be tested as per the relevant MRTS specification MRTS03, MRTS04, MRTS05, and MRTS70 unless otherwise approved by the Superintendent.

Paver testing and associated bedding sand and joint filling sand shall be tested as per 8901.5 and results submitted 4 weeks prior to works commencing.

Pavers shall also be tested for slip resistance once laid and bedded as per AS/NZS 4586 for the Wet Pendulum Test.

Survey of the geometrics of the paved area shall be carried out to verify compliance with the design drawings and the works are within the tolerances set out in Table 8901.4.3

8901.4.2 Hold Points, Witness Points and Milestones

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

Activity	Inspection Type	When
Preliminary Documentation as described in 8901.5	Milestone	4 weeks prior to works commencing
Subgrade Preparation including testing and proof roll	Hold Point	Prior to pavement works commencing
Sub Base preparation including testing and proof roll	Hold Point	Prior to base course layer commencing.
Base preparation including testing and proof roll	Hold Point	Prior to paving bedding commencing
Edge Restraints (prepour)	Hold Point	Prior to placement works for the edge restraints commencing
Approval to strip any formwork and carry out Survey of area internally to the edge restraints	Hold Point	No earlier than 3 days after concrete hardening
Concrete or kerb curing	Witness Point	Immediately after laying has occurred for 7 days
Backfilling behind edge restraints	Hold Point	Minimum 3 days after placing of edge restraint/s
Sand bedding layer	Witness Point	During laying and screeding process
Laying of pavers with joint widths	Witness Point	During paver laying operations
Compaction of laid pavers and bedding to design levels and tolerances	Hold Point	Prior to filling joints
Joint Filling with approved dry sand	Witness Point	During joint filling operations
Protection of works	Hold Point	At completion of works prior to approval for opening to traffic
Approval to open to traffic	Hold Point	At completion of all works and after excess joint sand has been removed

Works as Executed documentation including certification of utilities	Hold Point	4 weeks prior to practical completion being requested.

8901.4.3 Construction Tolerances

The limits and tolerances applicable to the various clauses in this Supplementary Specification are summarised in Table 8901.4.3 below unless otherwise approved by the Superintendent.

Table 8901.4.3 – Summary of Limits and Tolerances

Activity	Limits / Tolerances	Clause Reference
Base		
Surface Level	Finished level of base for road pavements to be within +10mm or -0mm of design levels	8901.6.4
	Finished level of base other than for road pavements, to be within ±10mm of design levels.	8901.6.4
	The top surface of the base for all segmental paving shall not deviate from a 3m straight edge, laid in any direction, by more than 10mm.	8901.6.4
Laying Paving Units		
Joint widths	Within the range 2-4mm	8901.6.7
Completed Segmental Paving		
Surface Level	Finished surface level of pavers shall not vary from design levels by more than ±6mm for road pavements and ±8mm for other than road pavements.	8901.6.8
	Finished surface of pavers shall not deviate from a 3m straight edge, laid in any direction by more than 6mm for road pavements and 8mm for other than road pavements.	8901.6.8
Level adjacent to drainage inlets	Invert level of channels between abutting chamfered units shall be not less than 5mm and not more than 10mm above the level of adjacent drainage inlets.	8901.6.8
Difference in level of adjacent pavers	≤2mm	8901.6.8

Other construction activity outcomes 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.
- Pavement tolerances in accordance with MRTS05 Unbound Pavement
- Drainage tolerances in accordance with MRTS03 Drainage Structures, Retaining Structures and Embankment Slope Protections

Tolerances specific to the project are detailed on the design drawings and are included in Clause 2 of MRC Supplementary Specification Annexure 8924_1 Segmental Paving

8901.5 Preliminary

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

- Type of pavers and test results for all materials (pavers, bedding sand, joint filling sand)
- Works procedure
- Erosion and Sediment Plan (as required for site/s)
- Traffic Management Plan and TGS's
- Workplace Health and Safety Plan including specific to the work and site/s
- Quality management Plan outlining requirements of 8901.4 as a minimum

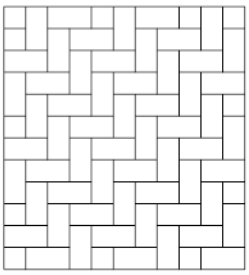
Other requirements unique to the project will be listed in the MRC Supplementary Specification Annexure 8901_1 Segmental Paving (MILESTONE)

The choice of concrete or clay segmental pavers, the paver class (for clay pavers), shape type (for concrete pavers), shape name, colour, thickness and laying pattern shall be as detailed on Project Drawings for each area of application.

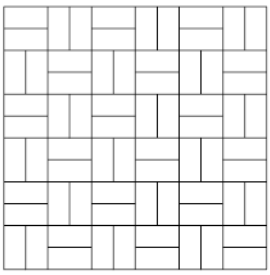
Unless otherwise specified, concrete pavers for road pavements shall be placed in herringbone laying pattern and shall be in accordance with the requirements for the appropriate road application shown in PA03, Table 1: Minimum Requirements for Dimensions, Breaking Load and Abrasion Resistance.

Unless otherwise specified, clay pavers for road pavements shall be Class 4, minimum 65mm nominal thickness, and placed in a herringbone laying pattern.

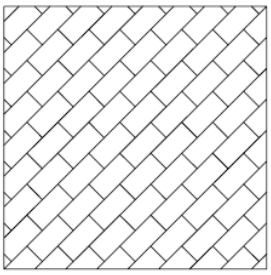
Laying patterns of pavers are identified as being either Herringbone, Basket weave, or Stretcher, as shown below. Each of these may be laid at either 90° or 45° to the line of edge restraints. A variation of the Stretcher is the Zig Zag Running Bond, also shown below.



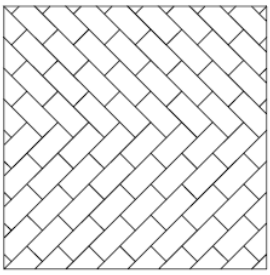
Herringbone



Basketweave



Stretcher



Zig Zag Running Bond

8901.5.1 Materials

Supply of 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 8901_1 Segmental Paving Section 3 and shall be the point of supply.

Where the Contractor is to supply all materials, the details of all proposed segmental paving materials, including bedding sand and joint filling sand shall be submitted to the Superintendent for approval supported with test results from a nominated NATA registered laboratory, confirming that the constituents comply with the requirements of this Specification.

The contractor is to consider lead time in procuring and delivery of materials when submitting test results for approval. Council is not responsible for costs associated with the pre ordering of materials which are not approved for use.

No pavers shall be delivered until the Superintendent has approved the type and quality of the pavers and noted the source of supply as compliant to the requirements of this Specification.

All pavers shall have suitable “slip resistance” for pedestrian traffic and vehicular traffic with a classification “W” according to AS/NZS 4586 for the Wet Pendulum Test. Where specific localities or levels of usage require a higher slip resistance classification, this classification shall be indicated on the Drawings. Such approval shall not relieve the Contractor of any responsibility for supplying materials that comply with this Specification.

8901.5.1.1 Concrete Segmental Pavers

Concrete segmental pavers shall comply with the requirements of PA01, PA02, PA03, and AS/NZS 4455 for each area of application. The material requirements for concrete pavers shall comply with PA03, Table 1: Minimum Requirements for Dimensions, Breaking Load and Abrasion Resistance.

8901.5.1.2 Clay Segmental Pavers

Clay segmental pavers shall comply with the requirements of Part 1 – Specifying Clay Pavers of Paver Note 1 – 'Specifying and Laying Clay Pavers' and with the requirements of AS/NZS 4455.

Clay pavers shall be classified as Class 1, 2, 3 or 4 in accordance with Paver Note 1 – Specifying and Laying Clay Pavers. Unless otherwise indicated, Class 4 pavers shall be used for all road and driveway pavements, medians and traffic islands. Class 2 or 3 pavers may be used for footpaths, cycleways and other pedestrian areas, except where they are subject to vehicular traffic with axle loads greater than 2.7 tonnes, in which case Class 4 pavers shall be used. Class 1 pavers shall only be permitted for low-volume pedestrian applications not subject to any vehicular traffic.

The abrasion resistance as determined by the SCC Abrasion Test (Paver Note 1) shall conform to the recommended characteristic abrasion losses contained in Paver Note 1.

8901.5.1.3 Bedding Sand

The bedding sand shall be a well-graded sand, consisting of clean, hard, uncoated grains uniform in quality, generally passing a 4.75mm sieve. The bedding sand shall be from a single source or blended to achieve, when tested in accordance with AS 1141.11, the following grading:

Table 8901.1 – Bedding Sand Grading

AS Sieve	% Passing
9.52 mm	100
4.75	95 – 100
2.36	80 – 100
1.18	50 – 85
600 µm	25 – 60
300	10 – 30
150	5 – 15
75	0 - 10

The sand shall be of uniform moisture content when spread. It shall be covered when stored on site to protect it from rain penetration.

The bedding sand shall be free of deleterious soluble salts or other contaminants which may cause, or contribute to, efflorescence.

8901.5.1.4 Joint Filling Sand

The joint filling sand shall be well graded passing a 2.36mm sieve, and when tested in accordance with AS 1141.11, having the following grading:

Table 8901.2 – Joint Filling Sand Grading

AS Sieve	% Passing

2.36 mm	100
1.18	90 – 100
600 µm	60 – 90
300	30 – 60
150	15 – 30
75	5 - 10

The sand shall be dry when spread. It shall be covered when stored on site to protect it from rain penetration. The sand shall be free of deleterious soluble salts or other contaminants.

Sand used for bedding is not suitable for joint filling.

8901.5.1.5 Concrete for Edge Restraints

Concrete supplied and placed for the construction of edge strips shall comply with the specifications MRS70 & MRTS70, and MRS03 & MRTS03.

Unless otherwise indicated on the Drawings, or where the edge restraint is provided by kerb and/or channel, the concrete used for edge restraints shall have a minimum 28-day characteristic compressive strength of 32MPa for edge restraints to pavers on road pavements, and 32MPa for edge restraints to pavers on footpaths, cycleways, medians and driveways.

8901.6 Construction

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.

Specific construction requirements associated with these works is detailed in MRC Supplementary Specification Annexure 8901_1 Segmental Paving Section 5

8901.6.1 Work Operations

8901.6.1.1 Item 8901 *Segmental pavers, take up and stack existing*

Work operations included in these items include:

a) Work Operations included in Clause 2.1.5 of MRS01 “Introduction to Specifications”;

b) Taking up and stacking of pavers, ensuring there is no damage to existing kerb and channel or adjacent existing surfaces or asset; and

c) Loading, hauling and disposing of pavers, where they are not required for relaying.

8901.6.1.2 Item 8902 *Segmental pavers, lay existing*

Work operations included in these items include:

a) Work Operations included in Clause 2.1.5 of MRS01 “Introduction to Specifications”;

b) Supplying all materials and equipment;

c) Testing of existing segmental pavers for conformity with this Specification;

d) Disposing of any non-conforming pavers;

e) Laying and compaction of bedding sand;

f) Laying and compaction of segmental pavers, including any cutting of unit joints;

g) Laying and compaction of joint filling sand; and

h) Survey conformance of finished surface levels.

8901.6.1.3 Item 8903 *Segmental pavers, supply and lay new*

Work operations included in these items include:

a) Work Operations included in Clause 2.1.5 of MRS "Introduction to Specifications";

b) Supplying all materials and equipment;

c) Laying and compaction of bedding sand;

d) Laying and compaction of segmental pavers, including any cutting of unit joints;

e) Laying and compaction of joint filling sand; and

f) Survey conformance of finished surface levels.

8901.6.1.4 Item 8904 *Supply, place and compact stabilised bedding*

Work operations included in these items include:

a) Work Operations included in Clause 2.1.5 of MRS "Introduction to Specifications";

b) Supplying all materials and equipment; and

c) Placement and compaction of stabilised bedding.

8901.6.2 Subgrade Preparation (as required)

The subgrade shall be formed to the required depth below finished surface level as shown on the Drawings in accordance with MRS04 and MRTS04. The finished subgrade foundation for the provision of subbase and/or base shall be subject to the approval of the Superintendent. (HOLD POINT)

8901.6.3 Subbase (as required)

Where shown on the Drawings, a subbase or working platform shall be constructed in accordance with MRS05 and MRTS05. The subbase shall be constructed to the specified thickness, compaction, and depth below finished surface level, and to the design grade and crossfalls of the finished surface. The finished subbase shall be subject to the approval of the Superintendent. (HOLD POINT)

8901.6.4 Base

The base shall be constructed to the specified thickness and depth below finished surface level, and to the design grade and crossfalls of the finished surface, as shown on the Drawings, in accordance with MRS05 and MRTS05. The base course shall extend in width to at least the rear face of all new edge restraints.

Notwithstanding the finished level tolerances contained within MRTS05, for base of ±10mm of design levels, the level on the finished surface of the base course for road pavements to be overlain with segmental paving shall be trimmed to within +10mm or -0mm of design levels. The deviation from a 3m long straight edge placed anywhere and laid in any direction on the top surface of the base course for all segmental paving shall not exceed 10mm. Sand bedding material shall not be used as a levelling material to compensate for base finishing outside the above tolerances.

The finished surface of the base shall drain freely without ponding. The finished base shall be subject to the approval of the Superintendent. (HOLD POINT)

8901.6.5 Edge Restraints

Edge restraints in the form of kerb and/or channel or edge strips shall be constructed along the perimeter of all segmental paving as shown on the Drawings. Concrete kerb and/or channel and edge strips shall be constructed in accordance with MRS03 and MRTS03. Prior to pouring the edge restraints set up shall be inspected by the Superintendent (HOLD POINT)

and the Internal area between the edge restraints shall be surveyed to ensure the paving area compliance with design drawings (HOLD POINT)

Faces of edge restraints abutting pavers shall be vertical.

Edge restraints shall be supported on compacted base and/or subbase of the thickness as shown on the Drawings. Where not otherwise specified or indicated, the minimum thickness of compacted base beneath the edge restraints shall be 100mm adjacent to road pavements and medians, and 50mm adjacent to footpaths, cycleways and driveways.

Unless otherwise shown on the Drawings, contraction joints, 20mm depth shall be formed every 5m of edge restraint length.

After concrete hardening, approval for stripping of formwork (where used) shall not occur earlier than 3 days unless otherwise approved by the Superintendent, the final Internal area between the edge restraints shall be surveyed to ensure the paving area compliance with design drawings (HOLD POINT)After the concrete has hardened curing will commence and continue for 7 days (WITNESS POINT),

Unless otherwise directed by the Superintendent, backfilling shall not commence for a minimum 3 days after placing, the spaces at the back of the edge restraint shall be backfilled with earth, compacted in layers not greater than 150mm thick, then topsoiled to meet surrounding design levels. (HOLD POINT)

8901.6.65 Sand Bedding Course

The sand bedding course shall be spread in a single uniform layer and screeded in a loose condition to the nominated design profile and levels plus that necessary to achieve a uniformly thick nominal 20-25mm layer following final compaction of the segmental paving.

Any depressions in the screeding sand exceeding 5mm shall be loosened, raked and re-screeded before laying pavers.

For the manual placing of paving units, the bedding sand shall be maintained at a uniform loose density. For mechanised laying, the bedding sand shall be uniformly and firmly, but not fully, compacted.

Screeded sand left overnight, subject to rain, shall be checked for level and re-screeded where necessary before pavers are placed. The sand shall not be screeded more than two metres in advance of the laying face at the completion of work on any day. (WITNESS POINT)

8901.6.7 Laying Pavers

Pavers shall be uniformly placed on the screeded sand bedding to the nominated laying pattern. Pavers shall be placed so that they are not in direct contact with each other and shall have uniform 3mm nominal joint widths. The pavers shall be mixed between various pallets to ensure that any colour variation from one pallet of pavers to the next is evenly distributed over the entire paved area. (WITNESS POINT)

The first row shall be located next to an edge restraint or an established straight line and laid at a suitable angle to achieve the required orientation of pavers in the completed pavement.

In each row, full units shall be laid first. Edge or closer units shall be neatly cut using a paver scour, or mechanical or hydraulic guillotine, and fitted subsequently. Cut pieces of pavers which are smaller in size than one quarter of a full block shall not be used.

Access chambers, drainage gullies and similar penetrations through the pavement shall be finished against the paving with a concrete surround or apron designed to suit and fit the laying pattern, otherwise complying with the requirements for edge restraints.

Where pavers are placed over an isolation, contraction or expansion joint in an underlying concrete pavement, a joint is to be provided in the pavers. The joint shall consist of 10mm thick preformed jointing material of bituminous fibreboard.

Any foot or barrow traffic shall use boards overlaying paving to prevent disturbance of units prior to compaction. No other construction traffic shall be allowed on the pavement prior to compaction and provision of joint filling sand.

On completion of subsequent bedding compaction and joint filling operations, all joints shall have widths within the range 2-4mm.

8901.6.8 Bedding Compaction

After laying pavers, the sand bedding shall be fully compacted and the surface brought to design levels and surface profiles by not less than two passes of a high frequency low amplitude plate compactor which covers at least 12 units. Compaction shall continue until all pavers from a smooth surface with adjacent paver edges matching. The level difference between adjoining edges of any two pavers shall be a maximum of 2mm, to avoid trip hazards, unless approved otherwise by the Superintendent for roughly textured pavers.

Compactor plate shall have a rubber attachment to the steel plate to ensure pavers are not scuffed or damaged.

Any units which are structurally damaged during bedding compaction shall be removed and replaced. The pavement shall then be re-compacted for at least one metre surrounding each replacement unit.

The paving operations shall be arranged so that the use of the plate compactor proceeds progressively behind the laying face without undue delay, and such that compaction is completed prior to cessation of construction activity on any day. Compaction shall not be attempted within one metre of the laying face except on completion of the pavement against an edge restraint.

The finished surface level shall not vary from the design level at any point laid in any direction by more than 6mm for all areas with Class 4 segmental pavement sand 8mm for all other areas of segmental paving. Notwithstanding this, the finished surface of the segmental paving, including where the paving abuts an edge restraint other than a drainage inlet, shall not deviate from the bottom of a 3m straight edge laid in any direction, except at grade changes, by more than 6mm for road pavements and 8mm for all other areas of segmental paving.

The channels formed between abutting chamfered units shall finish with their inverts not less than 5mm, nor more than 10mm above adjacent drainage inlets.

All compaction shall be complete and the pavement shall be brought to design profiles before spreading or placing sand filling in the joints. (HOLD POINT)

8901.6.98 Filling Joints

As soon as practicable after bedding compaction, and in any case prior to termination of work on any day, dry sand for joint filling shall be spread over the pavement and the joints filled by brooming.

To ensure complete filling of the joints, both the filling sand and pavers shall be as dry as practicable when sand is spread and broomed into the joints.

The pavement shall then receive one or more passes of a plate compactor and the joints then refilled with sand, with the process then repeated sufficiently to ensure that the joints are completely filled. (WITNESS POINT)

8901.7 Post Construction

Items which close out the project, and readies the project for Practical Completion inspection

a) **Protection of Work**.

Other than wheeled trolleys, forklifts and cluster-clamp vehicles, construction and other traffic shall not use the pavement until bedding compaction and joint filling operations have been completed. (HOLD POINT)

b) Opening to Traffic

As soon as practicable after the filling of joints, construction vehicles may use the pavement, and should be encouraged to traverse the greatest possible area of pavement to assist in the development of 'lock-up'.

Excess joint filling sand shall be removed prior to opening to traffic.

The pavements shall be inspected by the Contractor and Superintendent prior to opening to traffic. (HOLD POINT)

The pavements shall then be inspected by the Contractor at regular intervals up until the expiration of the Defects Liability Period to ensure that all joints remain completely filled.

c) **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. (HOLD POINT)

Certification of works shall be submitted with the "Works as Executed" Plans and documentation, these include electrical certification, plumbing and drainage certification, and building certification.

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

8901.8 Measurement and Payment

For segmental paving, the unit of measurement shall be the square metre surface of segmental paving as shown on the Drawings, or as directed by the Superintendent. A lump sum price for any of these items shall not be accepted.

Provision for these works shall be included in the scheduled unit rate for items shown in Clause 8901.3 of the supplementary specification and annexure. No separate payment will be made for the works specified within this Supplementary specification or it's annexure

Excavation and preparation of subgrade is measured and paid in accordance with MRS04 and MRTS04. Subbase and base are measured and paid in accordance with MRS05 and MRTS05. Kerb and/or channel, and any miscellaneous concrete work is measured and paid in accordance with MRS03 and MRTS03 and/or MRS70 and MRTS70.

Version Control:

Version	Description	Reviewed / Endorsed	Date
1.0	Original issue		20.01.2022
2.0	Review of Specification	C. Sultana	16.02.2024