Reinstatement repairs of flood damaged infrastructure on various roads AGRN 822

<table>
<thead>
<tr>
<th>Road No</th>
<th>Road Name</th>
<th>From</th>
<th>To</th>
<th>Damage</th>
<th>Repairs</th>
</tr>
</thead>
<tbody>
<tr>
<td>4211230</td>
<td>Almond Avenue</td>
<td>0.65</td>
<td>1.98</td>
<td>Lost material, drain scour, shoulders and rock pitching</td>
<td>Reinstall drains/shoulders and rock pitch</td>
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<tr>
<td>4211052</td>
<td>Jose Road</td>
<td>0.37</td>
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<td>Lost material, drain scour, shoulders and rock pitching</td>
<td>Reinstall drains/shoulders and rock pitch</td>
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<tr>
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<td>Greengage Place</td>
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<td>0.33</td>
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<td>Reinstall drains/shoulders and rock pitch</td>
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<tr>
<td>4211040</td>
<td>Warin Road</td>
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<td>3.42</td>
<td>Lost material, drain scour, shoulders</td>
<td>Resheeting and Heavy Formation Grading</td>
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<tr>
<td>4211045</td>
<td>Wootating Road</td>
<td>5.83</td>
<td>6.57</td>
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<td>Resheeting and Heavy Formation Grading</td>
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<tr>
<td>4212240</td>
<td>Woylie Rise</td>
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<tr>
<td>Reference</td>
<td>Location</td>
<td>Length</td>
<td>Width</td>
<td>Description</td>
<td>Lost Material</td>
</tr>
<tr>
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<td>--------</td>
<td>--------</td>
<td>-------------------------------------------------</td>
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<tr>
<td>4211035</td>
<td>Burma Road</td>
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<td>0.5</td>
<td>Formed Drains and shoulders</td>
<td>BM-1 Lost material, drain scour,</td>
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<tr>
<td>4211092</td>
<td>Carlin Road</td>
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<td>2.36</td>
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<tr>
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<td>Bach Street</td>
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<td>Bh-1 to Bh-2 Lost material, drain scour, shoulders and rock pitching</td>
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<td>4211237</td>
<td>Glenmore Drive Road</td>
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<td>0.68</td>
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<td>Yours Road</td>
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<td>KJ-1 to KJ-8 Lost material, drain scour, shoulders</td>
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<td>4213012</td>
<td>Shearing Rise</td>
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<td>O’Driscoll Street</td>
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<td>4211206</td>
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<td>Redcourte Road</td>
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<td>Ref No</td>
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<td>Length (m)</td>
<td>Diameter (m)</td>
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<td>1.02</td>
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<td>TMR-1 to TMR-8, TMD-1 to TMD-9 Lost material, drain scour, shoulders and rockpitching</td>
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<td>4211231</td>
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<td>Reinstall Drains, Shoulders</td>
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<tr>
<td></td>
<td></td>
<td></td>
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<td>Reinstall Drains, Shoulders</td>
</tr>
</tbody>
</table>

*For Photo reference please refer to Part 6 B of this document

**Contractors are encouraged to visit the sites prior to their submission which may be helpful understanding the scope and then pricing**
SCOPE OF WORK

The scope of work for reinstatement/repairs is based on ‘like-for-like’ purpose. Any proposal for improvement or modification of works or part of works shall be submit to Client with supporting documents for approval. No such works will be accepted which differs entirely in terms of materials, shape, design, purpose etc. from the original works. Brief scope of work is detailed below which is included but not limited to;

1 SITE CLEARING, MOBILIZATION & DEMOBILIZATION

All costs associated to site clearing, removal of vegetation and disposal should be included in Part 5 – Price Schedule of this document. Pricing shall be inclusive of any costs associated with mobilizing and demobilizing from the various sites.

Contractors must notify Client for clearing requirements at least 21 days prior to mobilizing at site.

2 PLANT, EQUIPMENT & MANPOWER

The Contractor is responsible to provide all the required plant, equipment and labour to complete the works. The Contractor shall utilise best practices for any part of work therein.

3 PROGRAM OF WORK

The Contractor shall submit a detailed program of work which shall be supported by detailed work methodology for each site.

4 TRAFFIC CONTROL & SURVEY

Traffic control to be supplied by Contractor, any road closures are to follow the Shire of Northam road closure process documented on the website, traffic management plan for lane/road closures is to be submitted for approval 21 days prior to possession of site has been granted.

The Contractor is to provide survey set out points, levels and markings as per work requirements. Contractor to arrange, as part of scope, any additional survey requirement for completion of works like profile survey, horizontal and vertical alignments, as con survey etc. The pricing of any such requirements shall be included as part of Part 5 - Price Schedule of this document.

5 DEWATERING

Contractor should make arrangements for dewatering, slush removal, temporary diversion and as such means approved by the client, and to provide all the requisite plant and equipment relevant to such activities which may be required for reinstatement/repair of drainage structures. The incurring cost for such arrangements should be included in the pricing of item for any of such site.
6 UTILITIES & SERVICES

The Contractor must locate and identify any services and utilities in close proximity of work area including but not limited to DBYD (Dial Before You Dig). The Contractor must follow procedures to obtain requisite permits and approvals for any such requirements.

The Contractor’s program of work shall accommodate time requirements for obtaining any of such permits while the costs associated with obtaining approvals shall be included in item rates of pricing schedule.

7 DISPOSAL OF SURPLUS/UNUSABLE MATERIAL

The quoted prices shall be inclusive of any costs associated with removal, disposal, tip fees etc. of any surplus or unusable materials from the site. Contractor must make necessary arrangements for disposal of such materials. This includes removal and disposal of any asbestos material or any such hazardous materials from site.

8 FULL ROAD WIDTH RECONSTRUCTION

Existing Surface must be Ripped with subgrade preparation Light rolling and Trimming complete before importation of 150mm Compacted Stabilised Gravel with 2% Cement content and final Trimming to Shire standards before Testing of the Gravel Material.

9 SHOULDER RECONSTRUCTION

Existing Surface must be Ripped with subgrade preparation Light rolling and Trimming complete before importation of 150mm Compacted Stabilised Gravel with 2% Cement content and final Trimming to Shire standards before Testing of the Gravel Material.

10 REINSTATE V-DRAINS

If shoulder reconstruction is not part of that works, then only the V-Drains need to be reinstated, but they should tie in with existing shoulders with standard gradients Please note that some v drains contain rock protection which should be allowed for in the reinstatement the drains should be completed as per the Shire of Northam drainage drawing ES-SD-DR-002.

All materials to be used for gravel re-sheeting or shoulder reconstruction should comply with materials specifications provided in this document under base course.

The sections to be gravel re-sheeting should be tie in with the existing pavement over minimum length of 20 m for smooth vehicular movement.

11 GUIDE POSTS & SIGNS

The Contractor has to reinstate any signs or guide posts damaged or removed of the site for works purpose. This includes but not limited to posts for culverts, bridges, crossings etc.

The Contractor must put in place the temporary signs for work to commence with tentative durations posted at least 14 days prior to commencement of works on each site.

12 INSPECTIONS AND TESTINGS
The Shire reserve the right to do inspection of works whenever required that includes but not limited
to uncover any part of works. Contractors must submit ITP (Inspection and Test plan) format for Client
approval before commencement of works. The approved ITP form should be submitted upon
completion of works and should give reasonable time for Client representative to inspect the
completed works. ITP must carry any test results required for compaction, density, PSD etc. – Hold
Point

13 COMPLETION AND CLAIMS

Completion of each road shall be reported with photographic evidence of completion comparing
to photographs in Part6B of this document as ‘Before works’ and photographs at completion as
‘After completion’. These both photographs for each part of work should be displayed next to each
other to assess the comparison. Care must be taken that photographs taken at completion of works
should be from the same location and at same angle and frame as of the ‘Before works’
photographs. It is better these photographs be taken in good light and time of the day to avoid
any confusion. – Hold Point

All invoices/claims shall carry photographic evidence as mentioned above for processing and
approval.

14 SPECIFICATIONS

PAVEMENTS

EARTHWARDS

The roads shall be cut to the grades and cross sections indicated on the approved drawings.

All fill shall be clean, granular material obtained from general and roadwork excavations and shall
not be contaminated with roots or other impurities. The fill shall be placed in oven layers not greater
than 300 mm thick and each layer shall be compacted to 95% of the modified maximum dry density
when tested in accordance with AS 1289: Methods of Testing Soils for Engineering Purposes.

The earthworks, shall be trimmed to a neat finish to a tolerance of ±50 mm so that the surface shall
be even and conform to the approved finished levels.

SUB-GRADE

The formation shall be excavated in conformity with the profiles dimensions, camber and depths
shown on the approved drawings or as specified.

The tolerance for sub-grade width shall be: 1: 100mm.

The finished levels of sub-grade shall be within: 1:20mm of the design levels.
The sub-grade shall be compacted to not less than 95% of the maximum dry density when tested in accordance with AS 1289: Methods of Testing Soils for Engineering Purposes.

The sub-grade shall be approved by the officer before any sub-base material is placed.

**BASE COURSE / GRAVEL RE-SHEETING**

**MATERIALS**
The base course shall consist laterite gravel or fine crushed rock (unless otherwise approved)

**Grading:**
The portion of the total sample retained on the 19mm AS sieve shall not exceed 5% of the total sample. The grading of the portion passing a 19mm AS sieve shall conform with the following:

<table>
<thead>
<tr>
<th>NOMINAL SIZE (mm)</th>
<th>PERCENTAGE PASSING (by mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0mm</td>
<td>100</td>
</tr>
<tr>
<td>9.5mm</td>
<td>70 - 80</td>
</tr>
<tr>
<td>4.75mm</td>
<td>40 - 65</td>
</tr>
<tr>
<td>2.36mm</td>
<td>30 - 50</td>
</tr>
<tr>
<td>425mm</td>
<td>12 - 30</td>
</tr>
<tr>
<td>75mm</td>
<td>3 - 12</td>
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</tbody>
</table>

The ratio of the portion passing the 75μm sieve to the portion passing the 425μm sieve shall fall within the range 40 - 60%.

**Soil Constants:**
The portion of the sample which passes the 425μm sieve (Soil Mortar) shall conform to the following requirements:

- The plastic limit shall not exceed 20
- The liquid limit shall not exceed 25
- The Plasticity Index shall not exceed 5
- The Linear Shrinkage shall not exceed 1%
- The Dry Compressive Strength shall not be less than 1.75 Mpa.
- Dust ratio shall not exceed 0.67

Notwithstanding this specification, any sample which in the opinion of the Shire, is composed of unsuitable material, or is composed of material which would break down with aging or weathering to such an extent that it would then fall outside the limits of this Specification, shall be rejected.
SPREADING

The base material shall be placed so that the sub-base material is not disturbed or broken up and an even thickness as specified is obtained.

The base material shall be spread to the required compacted thickness by means of an approved mechanical spreader or by grading from continuous stacks deposited on the sub-base.

COMPACTION

The base course material shall be watered, compacted and cut to grade and crossfall as specified in the approved drawings. Each course shall be rolled until it is compacted to a firm, even surface by appropriate self-propelled steel-wheel and pneumatic tyred rollers. The use of the pneumatic tyred roller is essential for the final passes to achieve the compaction of the immediate surface material. Where damage to adjoining properties may result, the use of vibrating rollers will not be permitted.

Grading of loose material over a hard surface and/or compaction in a thin layer is not permitted.

The base course shall be compacted to not less than 98% of the maximum dry density when tested in accordance with AS 1289: Method of Testing Soils for Engineering Purposes.

The thickness of the base course after compaction shall be as specified on the approved drawings with a tolerance of + 10mm -0mm.

ACCEPTANCE

The surface course shall be tested for shape and level and any irregularities greater than 10 mm when tested with a straight edge 3m long shall be made good by addition or removal of material and further rolling until the specified cross section is obtained.

Any imperfections or failures detected in the surface of the base course shall be corrected in an approved manner. Unsatisfactory material shall be removed from site and replaced with material as specified.

The base construction shall be approved by the officer prior to the application of a primer seal.

Bitumen Products

General

The materials shall comply with the following relevant standards:

- AS1160 Bitumen Emulsions for Construction and Maintenance of Pavements
- AS2008 Residual Bitumen for Pavements
- AS2150 Hot Mix Asphalt
- AS2157 Cut Back Bitumen
- AS2357 Mineral Filler for Asphalt
- AS2734 Asphalt (Hot-mixed) Paving - Guide to Good Practice
Hot bitumen

Hot bitumen shall be straight run class 170 residual bitumen suitable for road sealing purposes.

Additives for various conditions may be specified by the Shire.

For spray work the temperature of the bitumen shall be not greater than 180°C and not less than 160°C.

Bitumen emulsions

The emulsions shall be prepared from class 50 residual bitumen and an approved emulsifier.

The type and grade of emulsion may be specified by the Shire. The bitumen content shall be a minimum of 60%.

Cut-back bitumen

The cut-back bitumen shall consist of straight run class 170 residual bitumen mixed with medium curing cutter and slow curing cutter.

The grade and proportions of each cutter may be specified by the Shire.

For spray work the temperature of the cut-back shall be in accordance with the relevant range recommended in NAASRA, "Bituminous Surfacing - Sprayed Work", 1989.

Spraying Equipment

The spraying unit shall have a current test certificate issued by Main Roads Western Australia and shall comply with the requirements specified in NAASRA "Bitumen Sprayers", 1989.

Unless otherwise permitted, the sprayer shall have a minimum tank capacity of 2000 litres.

Adhesion Agents

Adhesion Agents shall be compatible with the Sealing Aggregate being used.

Precoating

Precoating for aggregates shall be slow curing cutter. The application rate shall be 2l/loose m².

Spraying

The binder shall be sprayed directly from a spraying unit having a current test certificate issued by Main Roads Western Australia.

Before and after each spray run the contents of the spraying unit shall be dipped on level ground and the application rate checked. This shall be within +/- 5% of the specified rate.
The aggregate spreading trucks, rolling and brooming equipment shall be ready to follow the spraying unit prior to the commencement of each spray run.

The width and length of each spray run shall not be greater than that which can be adequately covered by the material and equipment on hand immediately prior to the commencement of the spray run.

The laps of each run shall be free of loose aggregate prior to the commencement of an adjoining run. Stop/start trays or cut-off sheets shall be available for use if required by the Shire.

Spraying of hot bituminous binders shall not be carried out when the pavement temperature is below 26ºC and spraying in general shall be not carried out in inclement weather or if the Shire has advised that conditions are unsuitable.

**Aggregate Spreading**

Trucks used for aggregate spreading shall be in good mechanical condition and fitted with bodies and aggregate spreaders from which the material cannot spill.

The aggregate spreader shall be operated only by persons competent and experienced in similar types of work.

At the completion of each spreading run the quantities used shall be recorded and the application rate checked.

The aggregate shall be spread immediately following the commencement of each spray run and continue as close as practicable behind the spraying unit.

**Rolling and Brooming**

Prior to rolling, any areas under covered shall be corrected and any spillage heaps shall be removed or uniformly distributed over the work.

If the aggregate is wet the rolling operation shall be delayed until it is almost dry.

Initial rolling shall be effected by a 6/8t smooth steel wheeled roller completing two passes over the total sealed area.

After the initial rolling the seal shall be broomed with a drag broom to ensure uniform distribution of the aggregate and final rolled with a 6/8t smooth steel wheeled roller or 8/10t pneumatic rubber tyred multi-wheeled roller.

The rolling shall continue in conjunction with the brooming to achieve 1 hour of rolling per 500m² of seal. The wheels of the roller shall be kept clean.

If there is any evidence of aggregate crushing, the steel roller shall be removed from the work and the rolling continued with a rubber tyred roller.

Finish
The completed seal shall produce a well bonded uniform surface free from over-sprayed, under-sprayed or under-covered areas and an excessive quantity of loose aggregate.

The completed seal may be inspected by the Shire and no sealing plant shall be removed from the site until the work has been approved.

**ASPHALT SEAL**

**GENERAL**

The material for the wearing course shall be asphalt consisting of a combination of course aggregate, fine aggregate and mineral filler, uniformly coated and mixed with bituminous binder. The course shall be composed of the materials to the specification detailed in Section 5.7 Asphalt and laid in accordance with AS 2734: Asphalt (Hotmixed) Paving - A Guide to Good Practice.

**PREPARATION OF SURFACE**

Surface preparation, which includes sweeping, chipping and the burning off of all rich fat areas, shall be carried out immediately before applying the tack coat. No asphalt shall be placed upon any area which contains an excess of binder in such quantity that there is any possibility of the binder coming to the surface of the new work.

**TACK COAT**

The tack coat shall be laid in accordance with AS 2734: Asphalt (Hot-mixed) Paving Guide to Good Practice. The bituminous emulsion shall comply with the requirements of AS 1160: Bituminous Emulsions for Construction and Maintenance of Pavements. Anionic or cationic bitumen may be used depending on the site conditions and the time of the year. The application rate shall generally be sufficient to fully coat the surface with a residual binder content of 0.1 litres per square metre. The application rate may be varied or even omitted to satisfy particular conditions.

No asphalt shall be laid on the tack coat until the emulsion has broken and the water has substantially evaporated.

Any pools of tack coat which may have formed in surface depressions shall be brushed out. No traffic other than trucks delivering the asphalt shall be permitted to travel over the tack coat.

**PLACING THE ASPHALT**

The asphalt shall be laid upon a base which is clean and dry and in dry weather conditions with the atmospheric temperature above 100 degrees.

Prior to the delivery of asphalt to the construction site, the prepared base shall be cleaned of all loose or foreign material. The mixture shall be delivered on site in accordance with the requirements of AS 2150 - Hot Mix Asphalt and AS 2734 Asphalt (Hot-mixed) Paving - Guide to Good Practice, unless otherwise approved.

The mixture shall be spread to such line, level and camber detailed in the approved drawings in a single layer and compacted to give the average compacted thickness.
The tolerance on thickness shall be + 5 mm -2 mm.

Spreading shall be by an approved self-propelled paver unless otherwise approved.

Mixing and placing asphalt will not be permitted when the surface of the road is wet or cold winds chill the mix to an extent that spreading and compaction are adversely affected. The surface on which the asphalt is to be laid shall be free from ponding water.

The temperature of the mix when it is tipped into the spreader shall not be less than 1350°C. Spreading shall proceed without undue delay and initial rolling of the mix shall commence at a temperature of not less than 1200°C.

Uniform compaction to the required density shall be achieved before the temperature of the mix fails to 800°C.

The contractor shall ensure that the complete operation from mixing to final compaction is maintained within the specified temperature ranges.

**JOINTS**

Asphalt shall be spread in such a manner as to minimise the number of joints in the surface, and unless otherwise specified, the layout of joints shall conform to the following requirements:

**Transverse Joints**

In any individual layer, transverse joints in adjoining paver runs shall be displaced longitudinally by not less than 2m.

Transverse joints in any layer shall be longitudinally displaced from any joints in the underlying layer by not less than 2m.

Transverse joints shall be at right angles to the direction of spreading and cut to a straight vertical face for the full depth of the layer.

**Longitudinal Joints**

Longitudinal joints shall be continuous, parallel and coincident within 150 mm of line of change of crossfall.

Longitudinal joints shall be offset by at least 150mm from joints in underlying layers and located away from traffic wheel paths. Where feasible, longitudinal joints should be located beneath proposed traffic line markings.

Special care shall be taken in the forming of longitudinal joints at all intersections to avoid joint layouts and an appearance that would tend to misdirect traffic from the design travel paths.

Longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed. Joints between old and new pavements, or between successive paver runs, shall be carefully made to ensure a thorough and continuous bond between the old and new surfaces. The edge of the previously laid course shall be cut back to its full depth so as to expose a fresh surface, after which
the hot mixture shall be placed in contact with it and raked to the specified depth and grade. Hot smoothers or tampers shall be employed to heat up the old pavement sufficiently without burning to ensure an effective bond.

Before placing the mixture against surfaces of longitudinal joints, kerbs, gutters, headers, junction pits or other surfaces, the contact surfaces shall be painted with a thin uniform coating of hot or cutback bitumen.

Where asphalt is required to match an existing surface, road or other fixture, the contractor shall place the material in such a manner as to provide a smooth riding surface across the junction.

**COMPACATION OF ASPHALT**

The density of the asphalt as specified in Section 4.11.7 shall be achieved using approved equipment and techniques and in accordance with AS 2734: Asphalt (Hotmixed) paving - Guide to Good Practice.

The surface of the finished course shall be free from depressions exceeding 5 mm as measured with a 3m straight edge.

In the case of 35 blow mixes where the asphaltic mat voids is greater than or equal to 2.5 and less than or equal to 10.0, it shall be deemed as conforming.

In the case of 50 blow mixes where the asphaltic mat voids is greater than or equal to 3.5 and less than or equal to 10.0, it shall be deemed as conforming.

In the case of 75 blow mixes where the asphaltic mat voids is greater than or equal to 3.5 and less than or equal to 11.0, it shall be deemed as conforming.

Where for any individual core the asphaltic mat voids is less than 3.0 for 75 blow mix or 2.5 for 50 blow or 2.0 for 35 blow mixes, additional testing shall be carried out to determine the extent of unstable asphalt. This asphalt shall be removed and replaced at the contractor’s expense.

**Thickness**

When tested for thickness any test tot of a minimum 6 core samples shall be deemed to be conforming if the mean core thickness is greater than the minimum specified thickness less 15%.

Should any 1 of the 6 core samples be less than the minimum thickness specified by greater than 20% then additional cores may be taken at the contractor’s expense to establish that an area of thin pavement exists. Cores shall be taken at locations halfway between existing random cores and/or additional thickness determining cores to determine the extent of the thin pavement.

The contractor shall arrange, at the contractor’s expense, to have the area of thin pavement overlaid, or removed and replaced with fresh asphalt, and retested. Where it is necessary to overlay or remove and replace asphalt. The minimum overlay or layer thickness shall not be less than 20mm. Removal shall be carried out so as not to damage the underlying layers or any road fixtures, such as gully gratings. Any such damage shall be repaired at the contractor’s expense.

**Shape**
Where the base pavement conforms with the appropriate standard, the shape shall conform to the values for freeways and highways as detailed in Table 9.1 of AS.2734: Asphalt (Hot-mixed) Paving - Guide to Good Practice.

**ASPHALT - (HOTMIXED)**

<table>
<thead>
<tr>
<th>Standard Mix</th>
<th>AC 14</th>
<th>AC 10</th>
<th>AC 10 Intersections</th>
<th>AC 7</th>
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<tr>
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<tr>
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<td>10mm</td>
<td>10mm</td>
<td>7mm</td>
</tr>
<tr>
<td>Marshall Blows</td>
<td>50</td>
<td>50</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>Minimum Marshall Stability of Compacted Mix</td>
<td>6.5 kN</td>
<td>6.5 kN</td>
<td>8 kN</td>
<td>5.5kN</td>
</tr>
<tr>
<td>Marshall Flow Value</td>
<td>2 - 4mm</td>
<td>2 - 4mm</td>
<td>2 - 4mm</td>
<td>2 - 4mm</td>
</tr>
<tr>
<td>Range of Voids Content Compacted Mix</td>
<td>4 - 6%</td>
<td>4 - 6%</td>
<td>4 - 6%</td>
<td>3 - 5%</td>
</tr>
<tr>
<td>Bitumen Binder</td>
<td>Class 170</td>
<td>Class 170</td>
<td>Class 320</td>
<td>Class 170</td>
</tr>
<tr>
<td>Marshall Quotient</td>
<td>1.7 kN/mm</td>
<td>1.7 kN/mm</td>
<td>2.0 kN/mm</td>
<td>1.7 kN/mm</td>
</tr>
<tr>
<td>Binder Content</td>
<td>4.5 - 6.5%</td>
<td>5.0 - 7.0%</td>
<td>5.0 - 7.0%</td>
<td>5.0 - 7.0%</td>
</tr>
</tbody>
</table>

**AGGREGATE GRADING LIMITS**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Range Percentage of Mineral Aggregate Passing Sieve (by mass)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size 14</td>
</tr>
<tr>
<td>19.0mm</td>
<td>100</td>
</tr>
<tr>
<td>13.2mm</td>
<td>85 - 100</td>
</tr>
<tr>
<td>9.50mm</td>
<td>70 - 85</td>
</tr>
<tr>
<td>6.70mm</td>
<td>62 - 75</td>
</tr>
<tr>
<td>4.75mm</td>
<td>53 - 70</td>
</tr>
<tr>
<td>2.36mm</td>
<td>35 - 72</td>
</tr>
<tr>
<td>1.18mm</td>
<td>24 - 40</td>
</tr>
</tbody>
</table>
DRAINAGE

GENERAL

Stormwater drains and subsoil drains shall be constructed in accordance with the drainage layout.

Pile and keel or bearers will be required in soft ground and where drains cross existing services.

Drain construction shall take place in dry conditions and where necessary the Contractor shall provide dewatering equipment to ensure such suitable conditions exist.

TOLERANCES

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>TOLERANCE</th>
<th>ALIGNMENT</th>
<th>GRADE</th>
<th>LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIPES</td>
<td>+/- 25mm</td>
<td>+ 10mm</td>
<td>- 20mm</td>
<td>+/- 10mm</td>
</tr>
<tr>
<td>STRUCTURES</td>
<td>+/- 20mm</td>
<td>-</td>
<td></td>
<td>+/- 10mm</td>
</tr>
</tbody>
</table>

MATERIALS

Cement

Cement shall be of Western Australian manufacture and in accordance with AS3972. Cement shall be contained in 40 kilogram bags bearing the stamp of a NATA registered testing Authority. Any bag showing signs of “age caking” shall be rejected.

WATER

Water used in concrete or mortar shall be of potable quality, free from suspended material, organic matter, alkali, salts and other impurities.

Fine Aggregate

The term “Fine Aggregate” is used to designate aggregate in which the maximum nominal size of particles is 4.75mm. Fine aggregate for concrete and mortar shall be natural sand which shall consist of hard, angular, durable grains free from dust, soft particles, alkali, organic matter, loam and other deleterious substances.

Fine aggregate shall be in accordance with AS2758.
Coarse Aggregate

The term "Coarse Aggregate" is used to designate aggregate that is in the range of sizes of 4.75mm to 19.0mm. The coarse aggregate shall be free from clay lumps, dust, organic material or other deleterious substances and in accordance with AS2758.

In order to obtain a reasonable grading, the coarse aggregate shall be batched in two size designations or graded as 19.0mm "all in". All grading shall be to the approval of the Shire.

Reinforcing Steel

Reinforcing steel shall be structural grade and shall be in accordance with AS1302 and AS1304.

Concrete

All concrete work shall be carried out in accordance with AS3600. No concrete shall be placed before the shire has checked the base, formwork and reinforcement. All materials shall be weighed and the proportions for each mix shall be approved by the Shire before concrete is made.

Concrete Proportions

Concrete for kerbs and manholes shall contain not less than 213 kg of cement per cubic metre and the water/cement ratio shall not exceed 0.60.

Concrete for other works shall not contain less than 171 kg of cement per cubic metre and the water/cement ratio shall not exceed 0.60.

Timber

All timber shall be of the best quality cut from well matured trees, seasoned, sound, straight, and free from decay, large and loose knots, gum veins, shakes, wanes, pipes, holes and other defects, and shall hold fully the sizes shown on the drawings.

Unless otherwise shown, all timber to be used shall be jarrah.

Steel

All steel shall comply with the requirements of AS3679.

All steel shall be new and each member free of any welding or other form of splice.

Galvanising

Miscellaneous steel fittings and fixings shall be hot dip galvanising to requirements of AS1214 and ASB193.

Zinc coating shall be not less than 600 gm/m² of surface area.
Bricks

All bricks to be used for construction shall be solid burnt clay bricks and shall comply with AS1225 and be of quality appropriate to the class of brickwork.

Cement Mortar

Cement mortar shall consist of cement and sand gauged by volume in the following proportions: one part by volume of Portland cement to 3 parts of sand. This shall be employed for all instances unless otherwise directed by the Shire.

The ingredients shall be mixed in an approved mechanical mixer or shall be mixed together dry on a clean wooden stage until the mix is homogeneous in colour. Water shall then be added in sufficient quantity to give more than stiff workability. The whole shall then be turned until perfectly mixed.

Mortar shall be used within 2 hours of mixing and shall not be remixed or worked up again after it has stiffened. Any mortar that has commenced to set shall be removed from the works.

HEADWALLS AND ENDWALLS

Where a piped drain interfaces with an open drain, a suitable headwall structure shall be provided to prevent the entry of loose material into the pipe and the erosion of surrounding ground. In the case of pipes exceeding 600mm diameter, suitable structures shall be fitted to the inlet of the pipe drainage system to prevent access.

All headwalls shall be constructed using either concrete with 20MPa compressive strength, mortared stonework or brickwork.

For mortared stonework each stone shall weigh in excess of 10kg and the greatest dimension of any stone shall not exceed 1.5 times its least dimension.

Headwalls located on outlet pipes exceeding 300 mm diameter shall include suitable erosion protection in the form of aprons and edge beams.

PIPES

Stormwater pipes shall be reinforced concrete, rubber ring jointed, Class 2 drainage pipes manufactured to AS4058 unless otherwise specified on the drawings.

EXCAVATION

The Contractor shall excavate trenches on the alignments and to the widths shown on the Drawings and shall keep to the minimum width reasonably necessary to construct the Works.

No more than 300m of trench shall be open at any particular time and at no time shall excavation lead pipe laying be more than 100m without approval by the Shire.
The Contractor shall provide all intermediate benches, side-lacings, shorings, frames, timbers and other materials to ensure that the trench sides are maintained at all times in a safe condition.

Care shall be exercised when excavating near existing services, structures or other items likely to be damaged by the Contractor's activities, in particular, machinery causing vibration shall be operated only at a safe distance in such areas and the Contractor shall allow for use of alternative methods of construction where machines of this nature cannot be used.

Where over excavation has occurred, the Contractor shall make good such over excavation with clean well graded sand. Compacted to a minimum dry density ratio of 95% when tested in accordance with AS 1289 E2.1 or other approved remedial actions.

The Contractor shall at all times maintain excavation free from water regardless of source or method of entry to the excavation. The Contractor shall provide cut-off drains, well points, bores, drain diversions, pumps and any other means necessary to keep excavations dry and in a safe condition and shall repair or reinstate any damage caused by failure to keep the excavation free from water.

**PIPE INSTALLATION**

Pipes shall be laid on the prepared bedding to the line level and grade shown on the approved drawings. No pipes shall be laid on filled ground until such ground has been compacted to a minimum dry density ratio of 95% when tested in accordance with AS1289 E2.1.

Hip holes shall be dug to ensure the pipe bears uniformly along its barrel and does not bridge between supports at the sockets.

Rubber ring joints shall be installed in accordance with the manufacturer’s recommendations.

Pipes shall be in straight alignment before the joint is closed and after the joint is home any necessary angular adjustment may be made.

Pipes laid in wet conditions shall be laid on coarse aggregate bedding for the full width of the bottom of the trench.

**BACKFILLING**

Initial backfill to the top of the pipeline shall be carried out by hand placing approved fill material, free from rock, soil lumps or other unsuitable material.

The fill shall be placed uniformly on both sides of the pipe and compacted as firmly as can be managed by hand tamping.

Care should be taken to avoid damaging the pipe by direct impact.

Final backfill above the pipe shall be placed in uniform layers along the total length of pipeline to prevent overload or displacement and compacted at optimum moisture content by mechanical methods to achieve a compacted density not less than that of the same material in an undisturbed state.
Surplus material from excavations shall be graded out over the Site and any unsuitable materials removed from the site.

No excavation shall be backfilled until the pipeline or structure has been inspected and approved by the Shire.

Should any section of pipe be disturbed or damaged during backfill it shall be removed and re-laid at the Contractors expense to the satisfaction of the Shire.

MANHOLES AND GULLY PITS

Manholes and gully pits shall be constructed of reinforced concrete segments, at the locations and to the detail shown on the drawings.

Top of manholes and gully pits shall finish flush with the final level of the surrounding ground, footpath, road or kerb.

All covers shall be aligned to be parallel to the adjacent kerb, road or path.

Step irons shall be installed to the Controlling Authority requirements.

FILL AGAINST STRUCTURES

Filling shall not be placed against structures until the structure has been inspected and approved for filling.

Fill materials shall be placed in horizontal uniform layers not exceeding 150mm thickness and shall be compacted to a minimum dry density ratio of 98% when tested in accordance with AS1289 E2.1 or E3.3.

Backfilling over and around structures shall avoid unbalanced loading or create movement.

The Contractor shall be responsible for any damage to existing structures as a result of filling and compacting operations.

OPEN DRAINS, BASINS AND BERM

Open drains, basins and berms shall be constructed at the locations and to the details shown on the drawings at the earthwork stage.

All batters shall be trimmed and stabilized.

Where it is specified, surfaces shall be protected by hand placed pitching stones. Stones shall be hard, sound and durable and generally weigh in excess of 10kg each. The greatest dimension of any stone shall not exceed 1.5 times its least dimension.

Stones shall be set on a sand bed in a close fitting pattern, watered and rammed into
Where specified as mortared stone pitching, the joints between stones shall be raked for their full depth and grouted with 3 parts sand to one part Portland Cement mortar.

**SUBSOIL DRAINS**

Subsoil drains shall be installed in the locations shown on the drawings.

Subsoil drains shall consist of slotted pipes fitted with a geofabric filter sock and screened by graded aggregate.

The aggregate shall be clean and uniformly graded from 2mm to 10mm.

The aggregate shall have a minimum thickness of 150mm all round pipe.

Subsoil pipes shall be PVC with 300mm by 5mm slots cut through the pipe on alternate sides, separated by one third the circumference with a combined length of approximately half that of the pipe.

Subsoil pipes shall be laid with the slots on either side of the centre line of the pipe and with the slots in the lower half.

The Contractor shall undertake a particle size distribution analysis of the soil prior to selection of the filter fabric and shall forward the results to the shire.

The geofabric filter sock shall be non-woven and have the following filtration requirements in relation to the soil being drained;

\[
\begin{align*}
  \text{D50S} & < 75 \Phi m \\
  \text{EOS} & < \text{D85S} \\
  \text{EOS} & < 2.5 \times \text{D50S} \\
  \text{EOS} & > \text{D15S} \\
  \text{Generally} & \quad \text{EOS} < 200 \Phi m \\
  \text{G} & > 900 \\
  \text{(EOS equivalent open size of fabric)}
\end{align*}
\]