



Engineering and Works Services Standards and Specifications

Section 3

Construction Earthworks, Storm Water Drainage, Roads and Other Pavements

These Standards and Specifications have been adopted by the City, and are required to be applied in the City of Busselton for all subdivisions, developments and City construction works. These Standards and Specifications will be maintained by the Director, Engineering and Works Services.

Revision No	Date	Section Amended	Prepared	Reviewed
A	December 2009	All	Community Infrastructure	Infrastructure Development
B	June 2012	All	Engineering and Works Services	Development Control
C	January 2015	Section 13.2	Engineering and Works Services	Development Control
D	February 2016	Section 10.7 Asphalt	Engineering and Works Services	Development Control
E	April 2018	Section 11.2 Material & Construction	Engineering and Works Services	Design Team

Index

1	GENERAL	3
1.1	GLOSSARY	4
2	CONTRACTOR RESPONSIBILITIES AND WORK PRACTICES	6
2.1	SUPERVISION	6
2.2	EXTENT OF LIABILITY	7
2.3	FAILURE TO MAKE GOOD SETTLEMENTS OR DEFECTS	7
2.4	PUBLIC RELATIONS.....	7
2.5	NOTICES TO BE GIVEN BY CONTRACTOR	9
2.6	PUBLIC UTILITIES	9
2.7	WORKPLACE ACCESS.....	10
2.8	OSH ACT AND REGULATIONS.....	11
2.9	TRAFFIC MANAGEMENT.....	11
2.10	SETTING OUT OF WORKS	11
2.11	SUB-SURFACE INVESTIGATIONS	12
2.12	TREES TO BE MAINTAINED.....	12
2.13	RESTORATION OF THE SITE	12
2.14	DEFECT PERIOD.....	13
2.15	CONNECTION TO EXISTING WORK.....	13
2.16	WORK IN ROAD RESERVES.....	13
2.17	ROAD OPENINGS	14
3	TESTING OF MATERIALS AND WORKS	15
3.1	MATERIALS	15
3.2	NON COMPLIANCE.....	16
4	SITE STABILISATION - DUST AND SAND DRIFT	18
4.1	CONDITIONS	18
4.2	HYDROMULCHING	18
4.3	SEEDING	19
4.4	MAINTENANCE	20
5	EARTHWORKS.....	21
5.1	GENERAL	21
5.2	DECLARED RARE FLORA REQUIREMENTS	21
5.3	GREENWASTE	21
5.4	EXCAVATION.....	21
5.5	COMPACTION OF EARTHWORKS	22
5.6	SOFT SPOTS.....	23
5.7	SURPLUS SPOIL	23
5.8	FILLING ON ALLOTMENTS	23
6	CLEARING AND GRUBBING	24
6.1	CLEARING.....	24
6.2	FIRES.....	24
6.3	STRIPPING OF TOPSOIL	24
6.4	FILLING AND EMBANKMENTS	25
6.5	FINISHING	25
7	DIEBACK REQUIREMENTS	27
7.1	DISEASE.....	27
7.2	PRINCIPLES OF DIEBACK CONTROL	27
7.3	INITIAL PROCEDURES	27
7.4	DIEBACK HANDLING PROCREFUNDEDURES	28

Section 3 – Construction Standards and Specifications ...

8	STORM WATER DRAINAGE	31
8.1	DRAINAGE CONSTRUCTION.....	31
8.2	METHODS.....	32
8.3	MANHOLES AND STRUCTURES.....	37
9	BACKFILLING OF TRENCHES.....	46
9.1	BACKFILL.....	46
9.2	SURFACE RESTORATION	46
9.3	PAVEMENT CROSSINGS.....	46
10	ROAD CONSTRUCTION STANDARDS	49
10.1	GENERAL	49
10.2	SUB-GRADE PREPARATION	49
10.3	SUB-BASE CONSTRUCTION	51
10.4	BASE COURSE - LATERITE GRAVEL.....	52
10.5	BITUMEN WORKS.....	54
10.6	SINGLE AND TWO COAT SEALS	59
10.7	ASPHALT.....	64
11	EXTRUDED KERBING	78
11.1	CROSS SECTIONS	78
11.2	MATERIALS & CONSTRUCTION	78
11.3	TRAFFIC ISLANDS/PEDESTRIAN RAMPS	84
11.4	CLEANING UP	86
11.5	NON-COMPLIANCE	86
12	LINE MARKING.....	87
13	FOOTPATHS, DUAL-USE PATHS AND CYCLEWAYS.....	88
13.1	GENERAL	88
13.2	BITUMEN PATH CONSTRUCTION.....	92
13.3	PEDESTRIAN ACCESS WAY CONSTRUCTION.....	92
13.4	PATH TOLERANCES	93
14	BRICK OR BLOCK PAVEMENT	101
14.1	GENERAL	102
14.2	ROAD PAVING BRICKS	104
	PLANT & EQUIPMENT SPECIFICATION	107
	MATERIALS SPECIFICATION - CRUSHED LIMESTONE SUB BASE MATERIAL.....	110
	MATERIALS SPECIFICATION - PRE-MIXED BITUMEN EMULSION STABILISED LIMESTONE	111
	MATERIALS SPECIFICATION - LATERITE GRAVEL.....	112
	MATERIALS SPECIFICATION - TYPICAL SAND (FINE AGGREGATE) GRADING SPECIFICATION FOR PRIMER SEALING	114
	MATERIAL SPECIFICATION - AGGREGATE (FINE CRUSHED ROCK)	115
	MATERIALS SPECIFICATION - BITUMEN	117
	MATERIALS SPECIFICATION - SEALING AGGREGATE.....	118
	MATERIALS SPECIFICATION - AGGREGATES	120
	MATERIALS SPECIFICATION - CHARACTERISTICS OF THE ASPHALT MIXTURE	122

1 General

These standards and specifications have been developed for all civil engineering construction works undertaken in the City of Busselton (i.e. earthworks, storm water drainage, footpaths, cycleway, roads and other pavements) for use by City staff, Developers and Contractors on City land, developments and subdivisions.

The information contained within this document does not represent “absolute minimum” standards for design and construction, nor is it intended to be a comprehensive construction specification. These standards and specifications should be read in conjunction with *Section 2 - Designs and Plans for Roads, Earthworks, Paths and Storm Water Drainage*.

The information contained herein represents a set of standards, specifications, guidelines and practices for supervision and construction works, adopted by the City. Variations from these standards and specifications will be considered on a case by case basis.

It is acknowledged that accepted industry standards will change over time. In order to accommodate such changes, the contents of this document will be reviewed on a regular basis.

1.1 Glossary

TERM	MEANING
Approved Plans	The drawings/plans or particular revision of a drawing/plan approved by the Director, Engineering and Works Services.
Base Course	That layer of material in a pavement immediately beneath the seal coat.
DEC	Department of Environment and Conservation.
Contractor	That party holding a contract issued or approved (in the case of works for subdivisions) by the Busselton City The City, other written authority of The City or Consultants, to undertake development. Insofar as is applicable, the City’s own workforce is to comply with clauses referring to the Contractor. The Contractor is responsible for sub-Contractor activities, actions and personnel. In the case of a subdivisional contractor working for a developer, the word “Contractor” is deemed to be as for Superintendent for the purpose of instruction or direction by the Director, Engineering and Works Services.
CEO	Chief Executive Officer, City of Busselton.
Consulting Engineer	Means any professionally qualified engineer or an engineering firm which, either directly or indirectly, renders any advice, consultancy or technical assistance in any manner to a client in one or more disciplines of engineering.
Developer	The owner or developer of a property who, by virtue of his/her own acts or through a consulting engineer (superintendent) builder or Contractor; constructs, extends, upgrades or modifies a property for which earthworks, drainage and/or pavement works are required.
Director, Engineering and Works Services	The City’s delegated Officer, Director; Engineering and Works Services may be represented by an authorised Officer.
Finished Design Level	The finished level of the bitumen or otherwise paved surfacing as shown on the approved plans.
Maximum Dry Density (MDD)	The MDD is obtained by the method of Test 12A of AS 1289 (the “heavier” test described in the Standard).
Pavement	Includes the prime, the complete road structure and the bituminous surfacing, base course, sub-base (if provided) and

Section 3 – Construction Standards and Specifications ...

TERM	MEANING
	prepared sub-grade.
City	The municipality of the City of Busselton
City's Representative	<p>City's delegated officer authorised to instruct and supervise civil construction works on behalf of the City I, under the direction of the Director, Engineering and Works Services for the purposes of this Specification.</p> <p>In the case of private subdivision, "The City's Representative" may be taken as being the Superintendent/Consulting Engineer who is required to ensure that approved standards and specifications are achieved to the satisfaction of the Director, Engineering and Works Services.</p>
Sub-base	That layer of material in a pavement immediately beneath the base course. In some construction works a separate sub-base layer may be omitted.
Sub-grade	The surface of natural material or filling upon which the pavement is to be constructed.
Superintendent	Qualified, experienced, practising civil engineer appointed to supervise the standards and specifications and quality of the works. The Superintendent may also be referred to as "The Engineer".

2 Contractor Responsibilities and Work Practices

2.1 Supervision

The Director, Engineering and Works Services or an authorised delegate of the City of Busselton, shall have free and unrestricted access to the site at all times and the Contractor shall co-operate fully and afford all reasonable assistance to such personnel when required.

All works are to be carried out under the direction of a Superintendent and supervised by suitably experienced Supervisors or Managers approved by the Director, Engineering and Works Services.

Contractors (and any sub-Contractors) will comply with all reasonable requests normally issued through the Superintendent, or in extra-ordinary circumstances - City staff. Any disputes will be referred in the first instance to the City's Representative.

City's authorised Officers, for the purposes of safety, supervision of works and inspection of plant and equipment under a contract and its conditions are the Construction Supervisor and/or the Maintenance Supervisor, when works are carried out in a public place.

City's Representative reserves the right to dismiss any operator he considers to be unfit, inexperienced or working in an inefficient manner where work is being performed for the City or on City property, or to so recommend to the Superintendent if on private land.

The Director, Engineering and Works Services may, by notice to the Superintendent either in writing or verbally, delegate authority to inspect or approve the works or parts thereof to any Officer of the City of Busselton, and the Contractor shall comply with the directions of the delegate. The Superintendent shall be in attendance.

It is essential that adequate notice be given to the Director, Engineering and Works Services or the delegated officer for all inspections or approvals for any stage of the works. No inspections will be undertaken without at least 24 hours prior notice being given by the Superintendent or the contractor with the knowledge of the Superintendent.

2.2 Extent of Liability

The Contractor must comply with the provisions of the “Worker’s Compensation Act”, and before signing his/her contract, must furnish to the satisfaction of the Director, Engineering and Works Services, a certificate from his/her Insurance Company stating that all his/her employees are protected under the said Act, and that such policy shall remain current for the full period of the contract; and that he is covered against all claims.

The Contractor shall take all precautions for the care of the public, all existing public and private services, or property encountered during the carrying out of the work; and shall be held responsible for any damage done to services or property during the time of carrying out the contract including the maintenance period of the contract.

The Contractor shall take out an Insurance Policy covering liability for the risks outlined in Clause 0, and before signing the contract, must furnish evidence to the satisfaction of the Director, Engineering and Works Services, of cover for the period of the contract. The minimum amount of indemnity covered by the public risk policy shall be \$10,000,000.

The Contractor shall accept all risks and liability for damage to the works and to any plant, equipment and stored materials during the progress of the works, including the maintenance period as here-in-after specified, and shall make good any damage to the satisfaction of the Director, Engineering and Works Services.

Temporary gangways shall be provided for the safety of the public, where required.

Any damage caused to structures, paving, retaining walls or other structures in which underground drains are to be placed shall be repaired or reinstated to the satisfaction of the Director, Engineering and Works Services and revegetation replaced and/or rehabilitated.

2.3 Failure to Make Good Settlements or Defects

If any settlement or subsidence of fill or backfill occurs during the contract period including the defect period, in any road or verge, footpath, or elsewhere in the works, the Contractor shall at his/her own expense, make it good immediately as it appears.

In the event of the Contractor's failure to make good such settlement or defect, the Director, Engineering and Works Services shall give notice to the Contractor in writing and in the event of the Contractor's continued negligence, refusal or inability to remedy the settlement or defect the Director, Engineering and Works Services may, at the end of fourteen (14) days after such notice, or sooner, arrange for the necessary repairs and works to be executed at the Contractor's expense.

Any such costs not previously paid by the Contractor shall be deducted from the payments that may become due to the Contractor.

2.4 Public Relations

The work shall be so arranged as to cause minimum inconvenience to property owners or occupiers and to the public. Interference with persons or property shall be restricted to that which cannot reasonably be avoided and to the minimum time necessary for the satisfactory execution of the work involved.

Section 3 – Construction Standards and Specifications ...

The Contractor may issue his/her own press releases or public notices, information or signage as necessary to inform the public of site activities or he/she may request the City to do so at his/her own cost. Information issued to the public shall quote a contact name and telephone number for enquiries and requests.

Work hours are restricted to 7:00am - 7:00pm Monday - Saturday. No Sunday work is allowed. Contractors are to comply with the Environmental Protection Noise Regulations (1997).

2.5 Notices to be given by Contractor

The Contractor shall give the following notices in writing to City's Representative and comply with the following requirements.

NOTICE TYPE	COMMENTS
Preliminary	Seven (7) days notice of intention to commence work.
Clearing	Seven (7) clear days notice of clearing or burning any section of the work. The Contractor must obtain all permits to clear and any necessary permit to burn off and comply with the conditions of same. The clearing limits are to be inspected before clearing. The City has a policy requiring major developments to mulch and chip for reuse, on-site vegetative materials from clearing.
Kerbing	Two (2) clear days notice shall be given prior to the placing of concrete, to allow to checking of lines and levels.
Pipe, Drainage and Conduits	(i) Notice is to be given when trenches are to be opened. (ii) Notice is to be given when pipes are laid and jointed. Trenches are not to be filled until approval has been obtained from the City's Representative or the consulting engineer appointed to the works. A minimum of two days notice will be given to enable inspections to be made.
Sub-grade	Notice is to be given when the sub-grade is ready for inspection and conduits have been laid. Pavement construction must not commence until approval has been given. A minimum of one day's notice shall be given to enable inspections to be made.
Pavement Construction	Two (2) days' notice shall be given when the pavement course is ready for inspection. Sealing shall not be commenced until the pavement has been tested and approved.
Pavement Sealing	Two (2) clear days notice shall be given to the actual day that bituminous sealing and/or priming will be undertaken. If weather conditions necessitate any alteration City's Representative is to be advised, if necessary by telephone, of the new day and time, giving as much notice as possible. Spray records are to be submitted for inspection within seven (7) days of spraying.

2.6 Public Utilities

Prior to commencing the works of the contract, the Contractor shall notify all public service authorities of the intention to commence work and the Contractor shall ascertain the location of any respective services.

Section 3 – Construction Standards and Specifications ...

The Contractor shall protect any mains, cables, conduits, poles, water pipes, gas pipes or other installations under the control of any public service authority; and shall advise such authorities when the work could endanger any such installation. The Contractor shall take such other action as is necessary to protect such installations and shall be held responsible and bear all costs to make good any damage caused to any such installation.

Any damage caused in the execution of works under this contract to any water or service pipes, drainage lines, sewers, electric conduits, telephone installations or other existing works or services, shall be repaired at once and the Contractor shall arrange for the necessary work to be executed at his/her own expense to the satisfaction of the Director, Engineering and Works Services.

Where it is found necessary to remove, divert or cut into any existing drain, or water main, service pipe, drainage line, sewer, electric conduit, telephone installations or other existing work or service beyond the control of the Director, Engineering and Works Services, the Contractor shall give at least seven (7) days notice of his/her requirements to the Superintendent of the works, who will then, where necessary, arrange for the removal or deviation of such existing works.

When required, the Contractor shall lay bare and clear round the said mains, pipes, lines, sewers, conduits, installations or other existing works when and as directed. The removal, diversion or relaying shall be performed only by the Authorities respectively interested. Any excavation or other work performed by the Contractor at the order of the Director, Engineering and Works Services in writing related to the unplanned removal or diversion or relaying of existing services will be regarded as an extra to the Contract.

No claim for damage or loss will be entrained on account of delays associated with works on public authority assets.

The cost of any necessary alterations to levels or alignments of water or gas mains, underground cables, telephone or electric light poles, shall be at the expense of the Contractor.

2.7 Workplace Access

Access tracks, borrow areas, storage areas and the like shall be kept in a stable condition against wind and water, acceptable to the Director, Engineering and Works Services. Access tracks shall follow roads where possible and the Director, Engineering and Works Services shall be consulted before tracks are created which may remove or damage vegetation.

Any excavation which is carried out in public or private roads shall be arranged so that pedestrian and vehicle access is maintained at all times unless this is considered highly impractical, in which case work shall be arranged to cause the minimum disruption possible.

The Contractor shall at all times make provision for access to the private properties which abut the work. Special arrangements must be made with the Director, Engineering and Works Services for the temporary closing of the road if necessary. The Contractor is to inform all affected parties well prior to changing the status of any private access.

Good management of vehicles at the work site will ensure that vehicles are restricted to the work site, damage to vegetation is minimal and good relations are maintained with adjoining property owners.

2.8 OSH Act and Regulations

The Contractor (and any sub-Contractors) shall observe all requirements of the Occupational Safety and Health Act and Regulations with respect to providing a safe workplace. This includes plant and equipment, employee protective equipment and clothing, safety training for supervisors and employees and protection of the public.

Contractors to the City (and any sub-Contractors) shall observe all requirements the City Policies, Guidelines and Procedures (contained within City's Safety Manual - copy of relevant sections available upon request).

The City has a Contractor's Safety Policy. This policy includes provision for appointment of a specific Safety Inspector for the purposes of over-seeing safety of the contract held with the City.

Contractors (and any sub-Contractors) are reminded that it is their responsibility to conform to all road traffic laws and that the City is in no way liable in respect of breaches of any state laws. All equipment used on the job shall comply with the Road Traffic Act.

The Contractor shall be responsible for and to supply all road signs and safety equipment as necessary to the satisfaction of the City's Representative. Contractors working on unattended sites are to replace and maintain all traffic signs, lights and hazard lights as directed.

Breaches of safety will be reported to Worksafe. This includes personal protective clothing and equipment, road signage, plant and equipment.

Vehicles used on the road for the execution of the contract shall be fitted with flashing hazard lamps, be appropriately marked, licensed and roadworthy.

2.9 Traffic Management

Before any works are commenced, where required and which will in any way obstruct, endanger or inconvenience the traffic including pedestrians normally using the roadway or roadways adjacent to the works, the Contractor shall provide a suitable Traffic Management Plan to the City for checking.

Signs, lights and any other necessary roadworks warning equipment shall be erected and maintained in good working order for the entire duration of the project, including when works are not proceeding.

2.10 Setting Out of Works

All work is to be constructed to the levels shown on the approved drawings or to City's satisfaction. Before commencement of work, the Contractor shall request official bench marks to be indicated on the site of the contract.

It shall be the Contractor's responsibility to set out accurately all work according to the approved drawings or figured dimensions thereon.

It shall be the Contractor's responsibility to re-establish, recover or transfer any setting out pegs which are disturbed in the course of construction.

Section 3 – Construction Standards and Specifications ...

Under no circumstances shall any interference with any official standard survey bench mark be permitted. Before commencing work, all such bench marks in the area covered by the contract shall be protected.

Where survey or other checking is required by the Director, Engineering and Works Services the Contractor shall, “through” the Superintendent, promptly and at City’s convenience arrange such checking as considered necessary by the City. The Contractor shall provide reasonable assistance to City’s Representative.

Approval to proceed may be withheld by the Director, Engineering and Works Services where, levels, lines, geometric or any features require survey checking.

2.11 Sub-Surface Investigations

It is the responsibility of the Contractor to ascertain as far as possible, the physical conditions upon and below the surface of the site, including climatic conditions, and to obtain all necessary information as to risks, contingencies and other circumstances which could have an effect upon the cost of executing the works.

2.12 Trees to be Maintained

The Contractor shall carry out all works so as to absolutely minimise damage to trees and shrubs.

Trees that have been identified to be retained are to be protected at all times and not be removed unless approved by the City’s Representative.

Tree roots are not to be cut and tunnelling methods for excavation are to be used in the vicinity of existing trees to place pipes to the approved design.

Any pruning or cutting of roots must first be approved by the Director, Engineering and Works Services. The Contractor shall especially nurture and water at least once a week all trees which have had their roots disturbed or cut.

2.13 Restoration of the Site

The Contractor shall leave the whole of the site in a clean and tidy state, and shall restore the natural surface to a condition as specified or similar to that existing prior to the commencement of operations (refer to page 18 for information on site stabilisation and dust control). The requirements of this Specification and Specification 9 - *Landscaping, Revegetation and Stabilisation* will not be deemed to have been fulfilled until the Director, Engineering and Works Services has indicated acceptance of the restoration of the site by the Contractor.

Care shall be taken to preserve grasses on the site to ensure maximum regrowth on eventual re-spreading of topsoil.

The Contractor shall ensure that all areas covered by the contract are finished to uniform grades, free of depressions and that all surfaces make smooth junctions with existing work. The Contractor shall remove from the site all rubbish and debris including all salvaged material, unless directed otherwise.

2.14 Defect Period

The Contractor shall satisfactorily maintain the whole of the works of the contract for a period of twelve (12) months (twenty four (24) months where a seal coat is required) after the completion of the works. Certain outstanding works may be bonded for the initial maintenance period subject to approval by the Director, Engineering and Works Services.

In the event of outstanding works being bonded, the 12 months maintenance period for these works may commence after the completion of the works to the satisfaction of the City's Representative. This requirement indicates retaining the second coat seal bond for a period of at least one summer after application.

2.15 Connection to Existing Work

Where new work is to be matched in with existing construction, sections of the existing work may be required to be removed and replaced where directed by the City's Representative to provide satisfactory connection.

2.16 Work in Road Reserves

The Contractor shall not obstruct any road way without the approval of the Director, Engineering and Works Services and will be held responsible for the safety of traffic and shall provide all flagmen, lights, barriers, signs and fences necessary to prevent any accident or public or private damage or loss and shall regulate traffic during the process of the work. When necessary, signs, lights, barricades and fences shall be provided in accordance with the requirements of Australian Standards. Temporary signs shall be in accordance with the AS 4100 but these shall be deemed to be minimum requirements and the Contractor shall erect such further signs, lights, barricades and fences as may be necessary or as may be directed by the Director, Engineering and Works Services to provide for both the safety and convenience of the traffic at a particular location.

The Contractor shall not by his/her operations obstruct any side road, branch track, crossover, footpath, drain or watercourse without the approval of the Director, Engineering and Works Services. When such obstruction cannot be entirely avoided they shall be kept to an absolute minimum and adequate provision shall be made for vehicular and pedestrian traffic. On roadways there shall be no greater obstruction than is reasonably necessary and operations shall be carried out to ensure free and safe movement of traffic at all times.

Applications for permission to carry out works in roadways together with details of proposals for traffic signs, flagmen and any other temporary works required for the safety and convenience of the public, shall be forwarded to the Busselton of City for approval at least 10 days prior to the work commencing. The City will make any necessary Press Release at the cost of the contractor.

Notification in writing shall be given at least 48 hours prior to the work commencing, and such notification shall also be forwarded to the Police, local Fire Brigade and the St John Ambulance Association, where any such work involves obstruction or temporary closure of the street/road.

Section 3 – Construction Standards and Specifications ...

Stockpiling of any excavated materials other than immediately adjacent to the excavation shall be only on sites approved by the Director, Engineering and Works Services.

Excavations are to be backfilled, compacted, brought up to level with base course in pavements, and made trafficable immediately after pipe laying and testing is completed.

Where a trench crosses an existing trafficked road, the carriageway shall be open, where practicable, to traffic over a width of at least 3.5m at all times. Flagmen shall be provided where traffic exceeds 800 vehicles per day. Where a trench is within the road reserve, the carriageway shall be unobstructed over a width of at least 4.5m at all times. During the time any road or footpath is obstructed in anyway it shall be adequately fenced and during the hours of darkness it shall be adequately illuminated for the safety of the public and in accordance with the requirements of the City.

The Contractor shall accept all liability in connection with works specified and shall provide evidence of insurance cover to indemnify the Principal and the City of Busselton against all actions, claims and demands made by any person of non compliance or non observance of the conditions and precautions contained herein.

The Contractor shall maintain continuous free passage for rainwater off all surfaces to roadside gullies and the storm water system and shall so position excavated material as to prevent materials being carried by runoff water into drains and gullies. The Contractor shall bear the cost of the removal from the drainage system of any material which may be deposited in gullies or pipes from any cause during his/her operations.

Contractors are responsible for clean-ups and reinstatement of verges (including lawns, reticulation, landscaping and kerbing, etc.) after completion of the works.

2.17 Road Openings

Where excavation is required through or across a road pavement, a road opening permit and bond payment to the City is required. Underground boring requires a reduced bond.

The Contractor shall ensure that the pavement is re-instated to conform in all respects to this specification. Reinstatements shall be carried out promptly. Backfilled trenches shall be kept maintained until the seal is applied to the satisfaction of the Director, Engineering and Works Services.

When reinstatement is not done promptly or fails, the City will carry out the necessary works using the bond money.

3 Testing of Materials and Works

3.1 Materials

Materials and workmanship shall be the best of their respective kinds and unless otherwise specified, shall conform to such standard specifications issued by the Australian Standards Association as may be held to apply. Where no Australian Standard has been issued, other appropriate Standards shall apply.

Approval to proceed may be withheld by the Director, Engineering and Works Services where, in his opinion, test results on material quality or compaction standards specified herein are required.

Where the Director, Engineering and Works Services, requires materials, quality or compaction standards to be evidenced by testing, the Contractor shall, at his/her own expense, arrange such testing at the locations or frequency indicated by the Director, Engineering and Works Services to be undertaken by a NATA registered laboratory and shall deliver the test results to the Director, Engineering and Works Services.

Where materials quality or compaction standards fail to meet the requirements specified herein, or levels, lines or other geometric features fail to comply with the City's approved drawings or requirements, then the Director, Engineering and Works Services may direct the replacement, repair, reconstruction or modification of the works or any section thereof, and the Contractor shall comply with such directions. Further approval to proceed shall be withheld until such directions are complied with to the full satisfaction of the Director, Engineering and Works Services. Any re-testing required by the Director, Engineering and Works Services shall be at the Contractor's own cost.

All tests shall be carried out to the relevant Australian Standard.

The materials quality and compaction standards specified herein are limited to those in connection with pavement construction and storm water drainage only, and do not apply to pads beneath buildings or other structures. Such requirements shall be directed and issued by the Director, Building Services Division.

Samples of each kind shall be submitted for the approval of the Director, Engineering and Works Services and on approval being obtained, the materials shall be delivered to the works ready for use, as per sample.

Sufficient notice shall be given by the Contractor to the Director, Engineering and Works Services to enable any materials that are brought on the ground to be examined and all materials are to be suitably stacked to facilitate examination.

In the event of the Contractor supplying materials of a mixed description and quality, the Director, Engineering and Works Services shall have the power to require the Contractor to pick out and stack, where directed those materials which in his/her opinion are suitable for the Works. In the event of the Contractor refusing or failing to comply with such request within twenty-four (24) hours from the time it has been made, the Director, Engineering and Works Services shall have the power to reject the whole of the materials so delivered by the Contractor.

Section 3 – Construction Standards and Specifications ...

Whenever ordered by the Director, Engineering and Works Services, samples of materials of the required size, number and description shall be supplied by the Contractor at the place where tests are to be made as directed and submitted to be tested as specified or to such additional tests as may be prescribed from time to time by the Director, Engineering and Works Services. The cost of supplying such samples for testing is included in the Schedule Rates generally.

If any of the materials tested do not fully come up to the standards herein indicated for specified and show a lack of uniformity in result of the materials from which the samples have been taken and all materials of similar manufacture and all articles made there from, may be rejected in which case they shall be at once removed from the works by the Contractor upon receipt of instructions from the Director, Engineering and Works Services and replaced by new and sound materials or articles which shall be again tested, if required.

Imported materials shall bear the manufacturer's brand and country of origin.

Manufactured articles will be inspected at the works if possible during manufacture but such inspection will not prevent the ultimate rejection of any work in which defects or errors may be found previous to the completion of the contract.

Copies of covering notices of deliveries of materials for testing shall be forwarded to the Director, Engineering and Works Services.

3.2 Non Compliance

The City's Representative may vary the materials specification to suit the nature of the work being carried out.

Notwithstanding the above paragraph, the City's Representative may reject any material or work which is not in accordance with the Contract and may direct its replacement, correction or removal whether it has been the subject of a payment or not and whether it has been incorporated in or used in other works or not, and such rejection or direction shall be made or given as soon as practicable after the discovery of its non-compliance with the Contract.

If The City's Representative directs the Contractor to replace or correct any material or work, the Contractor shall commence the work of replacement or correction within seven (7) days after the receipt of the direction and shall complete the work promptly and to the satisfaction of the City's Representative.

If the Contractor fails to comply with the preceding paragraphs of this sub-section, the City may have the work of replacement, correction or removal carried out by itself or other person and the cost incurred by the City in having the work so carried out shall be a debt from the Contractor to the City which may be deducted from any moneys due to the Contractor or recovered from the Contractor as a lawful debt.

Should the City's Representative find that material not complying with this Specification has been incorporated in the works, then the Contractor may be required to pay all costs with the removal, rectification, reconstruction, replacement or any other such actions deemed necessary by the City's Representative to correct the defect. Alternatively, the

Section 3 – Construction Standards and Specifications ...

City's Representative may advise the Contractor of such reduced payment considered appropriate for the material so incorporated.

The extent of defective material, rectification necessary or reduced payment considered appropriate shall be at the sole discretion of the City's Representative.

4 Site Stabilisation - Dust and Sand Drift

4.1 Conditions

Developers or landowners shall develop and implement dust management plans for land development and subdivision projects to ensure that identified contingency measures are implemented to prevent adverse impacts from dust and smoke arising from their development site.

The City requires the developer to provide a dust management plan prior to ground disturbing activities. Developers often contract this obligation to their engineer or construction contractor. Developers should ensure that contractual arrangements complement the standard requirements of this template and any other requirements specific to the site. Developers remain liable for pollution or dust nuisance from their sites regardless of any contractual arrangement that imposes similar obligations on their engineers and contractors.

In addition to meeting contractual obligations, engineers and contractors in the course of their work shall not cause dust nuisance or pollution in breach of relevant Acts, regulations and bylaws.

Details of dust and sand drift control measures to be adopted during the construction of the subdivision shall be included in the specification and shown on the drawings. The measures are to be in accordance with the document “A Guideline for Managing the Impacts of Dust and Associated Contaminants from land Development Sites, Contaminated sites Remediation and other Related Activities” by the Department of Environment Regulation March 2011. WAPC does not normally require a dust management plan as a condition of subdivision, as developers are required to comply with separate health and environmental legislation, including the DEC guidelines. Where dust control creates a problem for adjacent residents and developments the local government can implement Schedule 9.1 of the Local Government Act 1995 dust control and sand drift.

The City of Busselton assesses and approves engineering plans for development projects under section 295 of the Local Government (Miscellaneous Provisions) Act 1960. This Act empowers the City to require submission of and compliance with dust management plans.

Performance bonds are normally required by the City as a condition of approval to be used to secure performance of site dust control and stabilisation obligations by the developer. Bond amount is equal to \$0.25 / m² of the disturbed area.

The City also normally requires a legal agreement at the cost of the developer to record the terms and conditions in relation to performance bonds and to ensure all associated engineering requirements are suitably addressed.

The City may take action where a Contractor fails to act and recover costs.

4.2 Hydromulching

Hydromulching shall consist of the application of a mixture of water, seed, fertiliser, binding agent and bio-degradable filler to the surface of the ground.

Hydromulch which does not incorporate seed and fertiliser will not be accepted as a permanent dust control measure.

Hydromulching shall be applied by an experienced Contractor approved by the City. The designated areas shall be hydromulched with seed and to be specified according to site requirements, fertiliser, mulch and stabiliser applied by mechanical spray by an approved operator. Stabiliser shall be Ecologel 42 or Curasol AG 45 or equivalent product applied at 250 l/ha. Mulch shall be of a paper-mache type.

Prior to hydromulching all areas to be treated shall be graded so as to present a smooth even surface on completion of the hydromulch application.

Hydromulching using seeded hydromulch shall take place between the months of April - August inclusive to enable germination and growth of grasses. Either side of these months plain hydromulch should be used to stabilise surfaces.

Vehicle and pedestrian movement along the treated areas shall be prevented where practicable to reduce failures as a result of erosion.

4.3 Seeding

One proposed method of stabilisation is the sowing of cereal rye together with the redistribution of topsoil containing native grasses. Gravel surfacing may be directed in special problem areas. Additional grasses will be sown in the public open space area.

The City's Representative shall approve the proposed seed/fertiliser mix to be used prior to commencement of the process.

All seed shall be pre-packed commercially prepared mixture and a Certificate of Germination shall be submitted to the City's Representative prior to any seeding taking place.

Seed quality shall be of minimum purity 98%, minimum germination 90% and fungicide dusted to resist rotting in the ground and damping off during establishment.

A mixture of Cereal Rye Grass, Wimmera Rye Grass and Harbinger Medic shall be sown using an approved seed drill attached to a tractor. The ratio of mixing shall be:

- 90 kg of Cereal Rye.
- 15 kg of Wimmera Rye.
- 15 kg of Harbinger Medic.

Cereal Rye shall be spread at a rate of 70kg/ha. Fertiliser to be used shall be a Superphosphate, Copper, Zinc, Molybdenum No. 1 mix fertiliser and shall be added to the seed mixture in such quantities as to provide an application of 200kg/hectare.

The rows of seeds shall, wherever practicable, run parallel to the contours of the ground surface. The whole area shall, upon completion of the seeding, be lightly raked to remove wheel tracts, etc., and present a smooth even surface.

Vehicle movement along the sown areas shall be kept to the bare minimum to reduce damage to the environmentally sensitive site.

Section 3 – Construction Standards and Specifications ...

In specified area of future public open space a mixture of Kikuyu at nine (9)kg/ha and inoculated Esperance sub-clover at 12kg/ha shall also be sown.

Sowing will be by combine sower with follow up harrowing such that cereal rye is planted at 50 millimetres depth with Kikuyu and sub-clover at 12 millimetres.

Alternatively, seed for the areas designated as Public Open Space shall consist of the following species:

- 90 kg/ha of Cereal Rye.
- 15 kg/ha of Wimmera Rye.
- 15kg/ha of Harbinger Medic.
- 40 kg/ha of Hulled Couch.
- 40 kg/ha of Unhulled Couch.

The City has bulk coarse mulch for sale from the tip if this is required for stabilisation, rehabilitation or landscaping of developments or subdivision. Purchase may be organised through the City's Waste Facilities at either the Rendezvous Road or Vidler Road sites.

Where germination does not occur within the maintenance period, to the satisfaction of the Director, Engineering and Works Services, the City may require reseeding prior to releasing the maintenance retention.

4.4 Maintenance

The Contractor shall have maintenance of the area for 12 months from the date of practical completion.

The seed bed shall be kept moist until germination is completed and irrigated at intervals necessary until satisfactory turf is established. Top dressing of the public open space shall be carried out within 3 weeks of germination using Agras No. 2 fertiliser at a rate of 200kg/ha. The Contractor shall allow for making over and reseeding all areas where the grass seed fails to germinate within one month from the date of original seeding.

Depending on growth, the Contractor may be required to slash the cereal rye in October/November to address fire hazards.

5 Earthworks

5.1 General

Please refer to the section *“Trees to be Maintained”* on page 12 for information regarding the retention and protection of trees and shrubs; and the section below for *“Declared Rare Flora”* requirements.

Every precaution shall be taken to prevent timber or other materials falling on or being deposited on private property, and the Contractor shall remove, at his/her own cost, any timber or other materials so fallen or deposited.

All damage of every kind including damage to fencing, caused by the execution of the work, shall be made good by the Contractor at his/her own expense, and carried out to the satisfaction of the Director, Engineering and Works Services.

The Department of Water has produced flood studies for the Vasse River and the Vasse River Diversion Drain, Toby Inlet and the New River / Broadwater. The implications of these studies with regard to fill levels and drainage for subdivisions should be discussed with officers of the City’s Engineering and Works Services Division on a case by case basis. The City will issue approvals regarding fill and finished floor levels on the basis of the advice of the Department.

5.2 Declared Rare Flora Requirements

Prior to the commencement of any new road works or clearing activities, information must be obtained from the Department of Environment and Conservation (DEC) regarding the location of any *“Declared Rare Flora”*.

If any declared rare flora is found on site, procedures outlined by the DEC must be followed.

5.3 Greenwaste

The City prefers all vegetation material cleared from subdivisions or developments be recycled and used on-site. This prevents smoke nuisance to neighbouring residents.

Plans and specifications relating to subdivision and developments submitted to the City for approval should reflect the City’s requirements. No engineering plans for subdivisions or developments will be approved by the City unless specifications address the above criteria.

Tipping fees apply to clean green waste free of non-organic/non-vegetative material. Such clean greenwaste may be taken to approved tip sites designated stockpile areas to be mulched by the City.

5.4 Excavation

The Contractor shall carry out only as much earthworks as is necessary to bring the road bed, kerb bed, kerb, channel bed and footpath bed true to lines, levels, cross sections and gradients as shown on design drawings.

The sub-grade for the kerbs, kerb and channel and base course, etc., shall be accurately trimmed and compacted to template and before any bedding or base course is placed.

No claim additional to the contract will be entertained on account of any rock or any other materials met within the excavation as the Contractor's price for excavation shall be binding.

No excavation shall be taken out below the level of the sub-grade, and should the foundation for any channel, drain or roadway be taken out below the required level, the Contractor shall reinstate and consolidate same with crushed rock as may be ordered by the City's Representative; at the Contractor's expense.

The Contractor shall be responsible for the cost of all works such as alterations to any private services, the lifting of any existing asphalt or concrete work, the taking up and carting of materials found on the job to such place as the City's Representative may direct, and the grubbing and clearing of obstructing trees.

All trees, approved for removal, shall be grubbed out to a depth of 450mm below the natural surface or finished surface of the road, whichever is the lower, and removed from the site of the works by the Contractor. All stump holes shall be carefully backfilled with selected material to the satisfaction of the City's Representative. Should any trees require felling, the work shall be carried out in a competent and satisfactory manner, taking particular care to avoid damage to private property, overhead wires or underground services. No trees or rubbish shall be burned or placed on private property without the consent of the City.

5.5 Compaction of Earthworks

Construction equipment and traffic shall not be allowed on the sub-grade while it is in a wet condition. Material which has become excessively wet shall be dried or removed from the site and replaced by material of suitable moisture content for compaction at the Contractor's expense.

COHESIVE MATERIAL

Cohesive material (material having a plasticity index of six (6) or more) shall be compacted to a dry density equal to 90% of the maximum dry density, unless stated otherwise.

Where owing to the presence of stone or for other reasons the City's Representative considers the on-site test not to be applicable to the material being used, the material may:

- (a) Be compacted with up to eight (8) passes of a sheepsfoot or 16 passes with a pneumatic tyred roller of approved width and type; or
- (b) The above rollers be used in succession in such order up to a total of 16 passes in all.
- (c) The moisture content of the material may required to be controlled, adjusted or modified.

NON-COHESIVE MATERIAL

Non-cohesive material (material having a plasticity index less than six (6) shall be compacted to a dry density equal to 95% of the maximum value obtained in the standard compaction test.

5.6 Soft Spots

Soft, wet or unstable areas which occur in the pavement or sub-grade shall be removed by the Contractor and replaced with stable compacted material at the Contractor's expense to the satisfaction of the City's Representative.

Where soft spots are greater than 300mm below the top of the sub-grade, the Contractor will require written authorisation from the City's Representative before proceeding.

5.7 Surplus Spoil

For City roadworks all surplus spoil shall remain the property of the City (or Principal) and the Contractor shall cart all spoil, not able to be disposed of on-site to the City's satisfaction, to locations approved or nominated by the City's Representative.

All clay that has been tipped by the Contractor in approved places within the area of the works shall be evenly spread to the satisfaction of the City's Representative and covered to a depth of at least 150mm with selected topsoil from the excavation site.

On no account shall any surplus spoil be deposited on vacant land or carted onto private property without the written authorisation of the City.

5.8 Filling on Allotments

Before any approved filling is placed on an allotment, the area to be filled shall be cleared and stripped of all organic material and rubbish. Approved filling is to be placed in 225mm layers and compacted to a dry density equal to 95% of the maximum dry density for building purposes. The standard of fill is to meet the following criteria:

- No greater than 5% by weight of soil fractions passing the 75 micron sieve.
- All fill is to be clean sand with less than 1% clay content.

No topsoil shall be replaced on filled areas until the area has been tested and certified/classified for building purposes by a qualified practising geo-technical consultant.

6 Clearing and Grubbing

6.1 Clearing

All vegetation proposed for clearing shall be inspected and approved by the City's Representative before clearing works commence.

Please refer to "*Trees to be Maintained*" on page 12 for information regarding the retention and protection of trees and shrubs; and page 21 for "*Declared Rare Flora*" requirements.

The area approved for the proposed earthworks shall be cleared of all trees, roots, heavy clay, rock and other deleterious material to at least 400 mm below the natural surface or sub-grade level. Stumps must be completely removed. Requirements established by geo-technical investigation shall be addressed at this stage and consequent requirements.

All holes and depressions resulting from clearing and grubbing shall be backfilled with approved material and compacted to at least the compaction of the surrounding insitu material (i.e. approximately 85% of the dry density ratio - when determined in accordance with AS 1289).

Material from clearing is NOT to be pushed beyond the limits of the site.

6.2 Fires

The City requires that all vegetation material cleared from major subdivisions or developments be recycled and used on-site (refer to page 21). It is the City's preference that all cleared material on major development sites be disposed by chipping and mulching. Burning may be considered in other circumstances but not in urban areas. Approval must be obtained from the City's Representative before proceeding with burning.

All burning off must be strictly to the requirements of the Bush Fires Act, be carried out in accordance with the Environmental Protection Authority Dust Control Guidelines (Sept 1990) and approved by the City prior to commencement of burning.

The Contractor shall be responsible for all damage to fences, grass, cultivation, buildings or other property occasioned by fires (including damage caused by smoke or ash) lit for any purpose in connection with the works. The Contractor shall also be responsible for obtaining from the relevant authority any permit necessary for the lighting of fires in the open.

6.3 Stripping of Topsoil

Topsoil shall be stripped 80mm - 150mm in thickness from areas to be affected by earthworks and such other areas as may be defined. The topsoil shall be stockpiled in approved locations for later re-spreading. Stockpiles shall not exceed 2.5m in height and be kept in a stable condition against wind and water erosion.

Grass shall be stripped off together with the topsoil. Care shall be taken to avoid contamination by any other material. Compression of the topsoil during stockpiling must be avoided.

Section 3 – Construction Standards and Specifications ...

Where earthworks have been completed, the topsoil shall be respread to a minimum depth of 80 mm over all areas of earthworks or excavation to agree with the finished surface levels shown on the approved drawings and/or as required by the City’s Representative.

The finished site shall be evenly graded in accordance with the approved drawings, as hereinafter specified with allowance being made for settlement of embankments.

6.4 Filling and Embankments

All filling shall be carried up in horizontal layers, on a development site, of not greater than 300mm in thickness, loose measurement, and each layer shall be well compacted by suitable compaction plant. Each layer shall be consolidated to a uniform density of not less than the percentage specified below as determined by the Modified Compaction Test:

- (a) Road Sub-grade 95% Max. Dry Density
- (b) Residential Areas..... 90% Max. Dry Density
- (c) Public Open Space.....85% Max. Dry Density

The superintendent may at his/her discretion accept the adequacy of compaction using the results of dynamic penetrometer soundings.

Subject to calibration on site the acceptance criteria for land fill and natural soils only, will be as below (with a standard of nine (9) kilograms sand penetrometer):

- (a) Road Sub-grade10 blows/300mm
- (b) Residential areas 7 blows/300mm
- (c) Public Open Space..... 7 blows/300mm

No fill material shall be placed until the City’s Representative has inspected and approved the surface preparation of that part of the site. Fill shall be clean, i.e. not containing vegetation, timber, rocks greater than 100mm or clay lumps.

Compaction shall proceed in an orderly fashion such that the whole of the fill lift has sustained an equal number of passes.

All cuts through limestone shall be excavated to a depth of 100mm below sub-grade level and 200mm below the finished level of verges.

Work shall be so planned that limestone excavated will be placed at the bottom of fills. No stone larger than 300mm maximum dimension shall be placed in compacted fill. Large cap stone pieces shall be placed where directed in stock piles for use in stone pitching, culverts, forming outlet aprons, other purposes or disposal off-site.

Any surplus material may be spread as directed by the City’s Representative.

6.5 Finishing

Excavated and filled areas shall be finished to the lines, grades, batter slopes and levels shown on the drawings and/or as required by the City’s Representative. A tolerance of ± 50mm in level will be permitted. The finished surface shall be neatly and evenly trimmed to the profiles shown on the drawings and/or as required by the City’s Representative. The Contractor shall make allowance for settlement and compaction and any rates tendered for earthworks shall include full compensation for such allowances. Where areas are

Section 3 – Construction Standards and Specifications ...

specified to be finished with topsoil, the bulk formation shall be finished at the depth of topsoil below design levels as shown on the drawings and/or as required by the City's Representative.

Unless otherwise shown, the bulk earthworks for all newly formed areas free of paving or other structures, within the limits of earthworks, shall be trimmed to a level below the finished surface level, as calculated by the volume of topsoil available. Topsoil shall then be placed and firmed with a light roller, so that the finished surface of the topsoil conforms to the design levels.

7 Dieback Requirements

7.1 Disease

Dieback is a disease affecting certain native species of vegetation, including Jarrah and Banksia and is caused by the root fungus “Phytophthora Cinnamoni”. The fungi can easily be spread through direct transportation of affected soil, the passage of water and indirectly (or inadvertently) through any machinery or equipment or even vehicular movement traversing through the affected areas. The disease does not manifest itself in limestone areas.

7.2 Principles of Dieback Control

All sites which have potential to further the spread of dieback must be surveyed to ascertain dieback status. The status is to be registered with the City.

All applications for extractive industries, rural subdivisions consisting of road constructions and other major developments proposed for rural locations consisting of remnant bushland, are required to be accompanied with a dieback management plan approved by DEC and the City.

In the event that a construction site is infected with dieback then there will be no restriction of the dieback status of material used for construction purposes except in managing the risk of spread from the site to another site by machinery or water erosion.

In the event that a construction site is confirmed as dieback free then only gravel, sand and other materials from dieback free quarries may be imported to the construction site. Care is to be taken not to introduce dieback by machinery.

The responsibility for determining dieback status and material importation controls will rest with the Supervising Engineer (the City or private) responsible for the particular work site.

7.3 Initial Procedures

In quarries where part of the quarry has dieback and part not, then those areas are to be segregated and fenced and dieback hygiene regimes are to be implemented for the dieback free area.

Signs are to be posted at all dieback infected gravel or sand pits, showing disease status and the date.

The dieback status of a quarry site is to be determined by experts using visual, sampling and laboratory tests if required, from the Department of Environment and Conservation and the Department of Agriculture, at cost to the applicant.

With all sites proposed for excavation/development and those sites which have been assessed as **dieback free**, it is essential that the following measures are taken:

- (a) All machines working the site are to be washed clean prior to entering using water derived from the site or mains water.

- (b) The access track is to be routed so that it is lower in the profile than the pit (does not drain into the pit) and does not cross any future section of the pit.
- (c) An excavation plan should be drawn up showing how the pit face will be kept “clean” (worked on a face from the lowest point to the highest with the loader always up-slope of the trucks).
- (d) Top soil is to be stockpiled and used as soon as possible for rehabilitation purposes.
- (e) The site or access to the site is to be fenced off to prevent illegal removal of material and possible compromise of disease status.

GRIT PITS

If the pit is to be used solely for brick making, then no dieback assessment is required if the pit is to be used for a purpose other than brick making, then if possible the site should be left undisturbed for assessment purposes. A much more accurate assessment can be made if the site still has a native bush covering.

When test holes are to be dug then the machine must be free of any soil and root material, and should be cleaned between holes.

If samples are required, no more than five (5) are required per pit.

SAND/GRAVEL PITS

The most accurate assessment can be made with the native bush still intact.

When test holes are required the machine must be clean of all soil and root material and be cleaned between each hole.

If the site is all pasture then a maximum of five (5) samples may be taken. Each site is to be assessed on its own merits.

7.4 Dieback Handling Procedures

If dieback management is required on-site, the following methods (as outlined by the Department of Environment and Conservation) are recommended:

- (a) Operations are to be undertaken in dry soil conditions only. This is particularly important for such activities as drain cleaning and batter grading.
- (b) Utilisation of vehicles that do not readily pick up soil and that can be cleaned readily.
- (c) Consider using slashing and/or herbicide for vegetation control and firebreaks (methods which do not disturb the soil are always preferable).
- (d) Upgrade the drainage system so it requires less maintenance and is less likely to flood (dieback is a water-borne pathogen and travels with the water flow).

Section 3 – Construction Standards and Specifications ...

- (e) In any earth moving activity, boundaries must be pegged to indicate to machine operators the areas of dieback, dieback-free and uninterpretable areas.
- (f) Minimise the area put at risk by segmenting the operation into small areas separated by a hygiene barrier.
- (g) Wash down all vehicles at the designated areas. These must be hard, well-drained surfaces within dieback areas.
- (h) Treat water in tankers with fungicide sodium hypochlorite (two (2) litres per 1000 litres water. This dosage needs to be renewed every 24 hours.
- (i) When cleaning vehicles, use a brush, bar or spade to remove compacted soil where necessary. Vehicle must be cleaned before commencement of work, before moving to the next job and when moving between dieback and dieback-free areas.
- (j) Construct roads and firebreaks to shed water and dry quickly. Avoid ponding.
- (k) Use dieback-free materials on dieback-free areas, use dieback-infected materials on designated dieback areas.
- (l) A nominal 80mm - 150mm of topsoil is to be stockpiled for resurfacing of the site in the rehabilitation process. Subsoil below the 150mm depth must be stored separately. Manage topsoil resources so that they are identified, separated and replaced in appropriate positions.
- (m) Remove vegetation and stumps from the pit before operations commence.
- (n) Restrict operation to a maximum of two (2) hectares at a time.
- (o) If possible restrict entry into dieback-free areas.
- (p) Gravel should be won from the front of the pit first and progress to the back of the pit if possible. Gravel winning should be carried out by a bulldozer fitted with rippers in preference to a wheeled loader.
- (q) No oil changes in the pit are permitted. Remove any soil that has been contaminated by spilt oil and fuel.
- (r) Before any of the above methods are implemented on site, the Department of Environment and Conservation can inspect the site and advise on the appropriate method as per the type and scale of the activity. New methods are currently under review by the Department of Environment and Conservation and if the applicant is willing should liaise with the Department of Environment and Conservation regarding the use of these methods if appropriate.

Section 3 – Construction Standards and Specifications ...

- (s) Rehabilitation of the site plays a necessary part in controlling dieback. The Department of Environment and Conservation can also advise on the necessary steps in this process.

8 Storm water Drainage

8.1 Drainage Construction

Drainage shall be constructed in accordance with the approved design plans and profiles and any variation from these must be approved by the City's Representative. The completed drainage network shall be surveyed by a suitably qualified person and "as constructed" information supplied to the City's Representative.

PIPES

All pre-cast reinforced concrete pipes shall conform to the requirements of AS 4058 for classes S 2, 3 and 4. Concrete pipes shall be of a spigot and socket, rubber ring joint type. Strength class shall be Class 2 unless otherwise approved on the approved drawings and/or as required by the City's Representative.

SUBSOIL DRAINAGE

Subsoil pipes shall be uPVC to AS/NZS 1260, minimum class SN8, unless otherwise specified by the City's Representative. Sub-soil drainage shall be generally provided as a complimentary system and enter the stormwater drainage system through a junction pit.

Sub-soil drainage lines may consist of perforated, slotted or open-jointed pipes of minimum diameter 150mm or other system as may be approved. The sub-soil drainage shall be laid to control the water table to suit the requirements of the site.

Calibrated aggregate filter material to sub-soil pipes shall be placed to a minimum thickness of 100mm around the full circumference of the pipe. Trench widths shall be designed to allow for the effective compaction of backfill material around the pipe and/or the placement of subsoil drainage filter material.

QUALITY OF PIPES

The Director, Engineering and Works Services or the City's Representative reserves the right at any time to arrange for any or all the specified tests, i.e., load, hydrostatic, porosity or absorption to be carried out on each size and consignment of pipes prior to the pipes being used in the work. Any pipe or pipes may be selected for tests and if any pipes do not comply with the test requirement they shall be replaced with satisfactory pipes by the Contractor at his/her/hers own expense. Pipes are not to be placed in position in the work until passes for this purpose by the City's Representative either with or without testing at this own discretion. This clause shall also apply to pipes visibly damaged. Supply is to include jointing materials and rubber rings as required.

CONCRETE, CEMENT & AGGREGATE

Concrete used for insitu work shall conform to AS 6300 and be provided by a premix concrete supplier conforming with AS 1379 or mixed on-site using materials and plant as specified to the approval of the City's Representative.

Section 3 – Construction Standards and Specifications ...

Concrete for manholes, headwalls, end-walls and keels shall have a minimum compressive strength of 25 Mpa after 28 days. The slump shall not exceed 70mm or be less than 30mm. The maximum size of the aggregate shall be 20mm.

All cement used shall be Portland Cement in accordance with AS 3972 and obtained from an approved manufacturer.

Cement shall be delivered to the site fresh in sealed bags and stored on-site in a weatherproof shed until such time that it is to be used. Any bag showing sign of deterioration or setting is to be rejected.

Aggregate shall be well graded, clean, sharp and free from clay and organic impurities in accordance with AS 1141.

WATER & SAND

Water for use in concrete and mortar shall be potable quality, free from any impurities harmful to concrete, mortar or steel.

Sand for mortar will be crushed stone or natural sand free from all deleterious substances and have a uniform grading.

Sand for bedding or backfilling shall be clean, free from roots, clay and/or deleterious material.

STEEL

Steel reinforcing fabric and steel reinforcing bars for concrete shall comply with the requirements of AS 1302, AS 1303 and AS 1304 and be free from loose rust or matter likely to impair the bond with concrete.

Structural steel shall comply with the requirements of AS 3878 & 3879.

BRICKS

Bricks shall be hard, well burnt, pressed or wire cut clay brick in accordance with AS 3700 for Class A bricks, having a minimum ultimate strength of 30 Mpa and absorbing when saturated, not more than 10% of its weight.

Bricks shall be of uniform shape and size, carefully conveyed and unloaded at the site. No chipped or broken bricks shall be used, and no pieces of brick to be used except where necessary as closures. Closures shall not be less than 30% of a full brick.

8.2 Methods

Drainage pipes and pits beneath paved areas shall be installed after preparation of the sub-grade and prior to any pavement construction.

EXCAVATION

Note that the Code of Practice for Excavation (WorkSafe) is to be observed.

Section 3 – Construction Standards and Specifications ...

The excavation for main drains, easements drains, junction pits, side entry pits, gullies and open drains, shall be taken out to the exact lines, levels and gradings and sections shown on the approved plans or as may be directed by the City's Representative.

Materials to be excavated and required for re-use such as road base and sub-base, turf, topsoil of fields, verges and gardens, slabs, etc., shall be excavated, stored and protected separately.

All excavated material that is not required for backfilling shall be spread and compacted on nominated areas. The material shall be compacted to equal the state of compaction of adjacent natural surrounding material. Excavated material shall be deposited in such a way so as not to interfere with vegetation, fencing, buildings, etc, required to be protected.

If any pipe trench is excavated deeper than required, the extra depth shall be filled with sand and compacted to a density exceeding that of the natural surrounding material.

Cut each trench to the minimum width necessary to lay and bed the pipe and to a maximum width, as measured at the top of the pipe, of 300mm greater than the external diameter of the pipe barrel.

The width of the trench shall be kept to the minimum consistent with bed width requirements and the need for adequate working space and timbering if necessary. Each trench shall be of sufficient width to allow for backfilling firmly around pipe; and the width of the trench at the pipe shall be sufficient to provide clearance on each side of pipe equal to at least one sixth (1/6) the internal diameter of pipe but not less than 150mm.

Where no invert levels have been determined, the minimum depth to overt of class 2 pipes at road crossings shall be 600mm below the channel level of the road and at a grade of not less than 1 in 150. No pipes shall be laid on filled ground until such ground has been compacted to a minimum of 95% MDD - AS 1289. Inlets and outlets are to be constructed to provide an effective and an erosion and siltation free system.

The excavation for manholes and gullies and the like shall be completed to the correct depth and to dimensions allowing for the use of adequate timbering or battered sides where necessary.

Free water and ground water in excavations shall be controlled to a level sufficiently low so as not to interfere with the construction works or cause trench wall collapse. Such control shall be exercised by pumps, well point dewatering system or other form of drainage.

Prior to excavation taking place, all underground services shall be located and exposed. Protective measures satisfactory to the public utilities shall be practised.

DEWATERING AND STORM WATER DIVERSION

The Contractor shall make proper provision and take all necessary precautions for the diversion of flood, drainage waters and dewatering discharge to approved outlets during the progress of the works. Site erosion measures must be adopted at all times to the satisfaction of the City's Representative in accordance with the Soil Conservation Authority Guidelines "Control of Erosion on Construction Sites" and in strict accordance with the approved plans.

Section 3 – Construction Standards and Specifications ...

Irrespective of the sources of water, all excavations shall be kept dry during the entire excavation process by approved dewatering methods, and in accordance with good engineering practices and proper construction procedures. The dry condition shall be maintained continuously under all conditions including the following:

- (a) Until all testing of any section has been successfully completed and approval is given.
- (b) The items of work placed in the trench are able to withstand the effects of water.
- (c) Backfilling and compaction to a minimum of 600mm above the normal water table level has been completed.
- (d) Sufficient backfill has been placed to prevent flotation of the pipeline.

Application of the conditions and cessation of dewatering shall be subject to approval from the City's Representative. In the context of this clause the term "dry" shall not preclude the presence of dampness contained in the earth as distinct from "free water" being present. Disposal water shall not be discharged on any land without the land owner's permission, nor shall any water be discharged into storm water drains without the permission of the relevant authority. Any water discharged to a storm water drain shall pass through a settling tank prior to discharge. Any damage caused by the disposal of water shall be rectified at the Contractor's expense.

Noise levels of dewatering equipment in urban areas (outside working areas) shall be reduced by the use of electrical equipment, the shielding of motors by sound attenuating screens or the shut down of motors overnight (7:00pm - 7:00am).

METHOD OF LAYING

Pipes shall be laid in trenches in solid ground. Pipes shall be laid true to grade and alignment on a firm well rammed and consolidated foundation. Any soft or yielding material shall be removed and replaced with sound material and well consolidated. Rock shall be excavated to a depth not less than 150mm below bottom of pipe and the excavation refilled with sound earth which is well consolidated; alternatively on rock foundation and at the discretion of the City's Representative, the pipe may be bedded for at least one third of its circumference in an approved crushed stone or sand cradle. The space between abutting ends of pipes shall not exceed one half ($\frac{1}{2}$) per cent of the diameter of the pipe. Where socket pipes are to be used small recesses shall be left under pipe joints to allow the barrels to bear evenly on foundations for their full length. Where two or more lines of pipe are to be laid side by side and space between lines of pipe shall be a width of not less than one third ($\frac{1}{3}$) of the diameter of the pipe or 300mm whichever is the greatest.

Any pipe which is not in true alignment or grade or which shows any settlement after laying or which is damaged during the operation of rolling, the formation shall be taken up by the Contractor and replaced at his/her own expense.

BEDDING

Pipes shall be laid on a minimum of 75 mm of suitable granular material which shall also support the pipes completely for a minimum width of half the outside diameter of the pipe.

The bedding material shall consist of sand, metal dust or other approved granular material with a plasticity index of less than 1.0 and a liquid limit not greater than 35; which shall be uniformly spread to fill the trench to the depth required to support the pipes as above and shall be well packed at the sides of the pipes after they have been laid. 20 mm “all in” aggregate may be used for wet trenches. The thickness of aggregate bedding shall be a minimum of 150 mm.

See drawing STD-DR06 on page 39 for further bedding details.

LAYING AND JOINTING OF PIPES

The Contractor shall lay and joint accurately all pipe lines shown on the plan, true to line, level and gradient.

Care must be taken to see that the inverts of each pipe length at the joints fit accurately with one another.

(a) 300mm diameter - 1200mm diameter

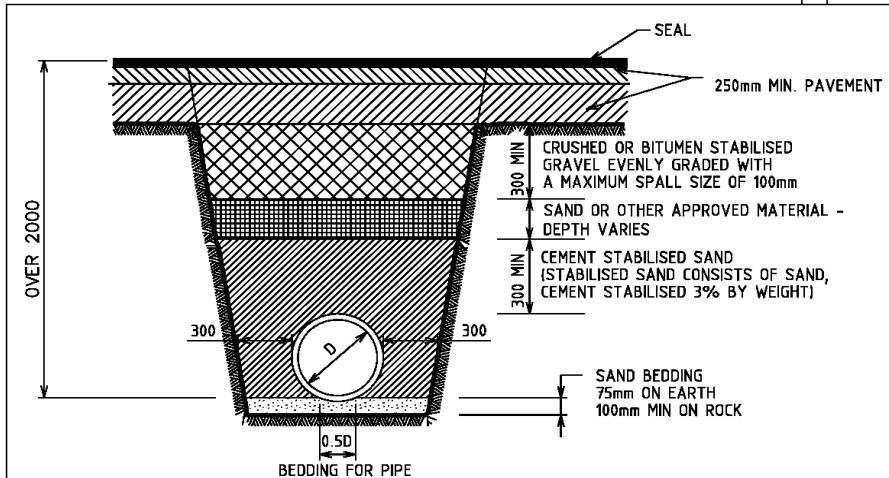
The joints of reinforced concrete pipes are to be spigot and faucet jointed with a natural rubber ring (black in colour).

(b) 100mm diameter and 150 mm diameter

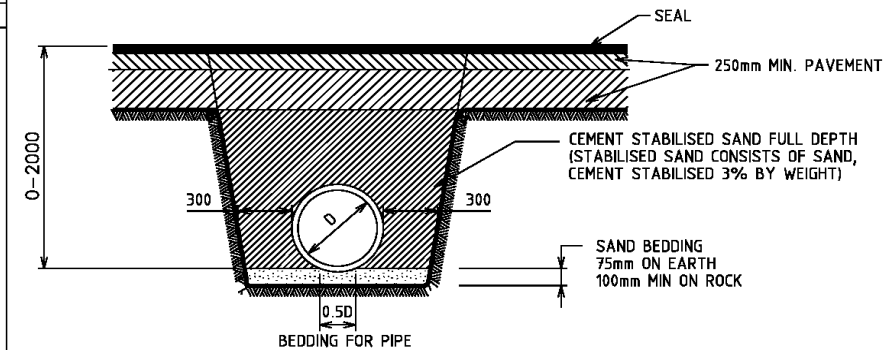
Unplasticized PVC pipes are to be jointed in accordance AS 2032.

All pipes and pits which are located in allotments must be placed within limits of the easements provided on the subdivision. The alignment of all easements must be defined by a Licensed Land Surveyor prior to any pipes being laid.

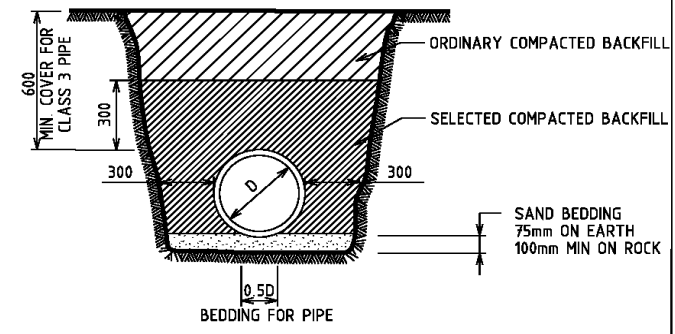
Section 3 – Construction Standards and Specifications ...



TRENCH DETAIL AT ROAD CROSSING OVER 2000 DEEP



TRENCH DETAIL AT ROAD CROSSING 0-2000 DEEP



TRENCH DETAIL AT VERGE

NOTES:

1. PRIOR TO BACKFILLING THE TRENCH THE AREA SURROUNDING SERVICES SHALL BE CAREFULLY COMPACTED WITH HAND RAMMERS. THE MINIMUM DEPTH OF HAND COMPACTION ABOVE THE TOP OF PIPE SHALL BE NO LESS THAN 150MM.
2. COMPACTION OF THE REMAINING BACKFILL SHALL BE IN 150MM LAYERS. COMPACTION SHALL BE ACHIEVED BY MECHANICAL MEANS WITH WATER TO A DENSITY OF NOT LESS THAN 95% MDD WHEN TESTED IN ACCORDANCE WITH AS1289.5.2.1 OR AT LEAST EQUAL TO THAT OF THE SURROUNDING UNDISTURBED ROAD MATERIAL. CRUSHED LIMESTONE PAVEMENT SHALL BE COMPACTED TO 95% MDD WHEN TESTED IN ACCORDANCE WITH AS1289.5.2.1
3. ALL DIMENSIONS IN MILLIMETRES
4. CLASS 3 PIPE TO BE USED IN ALL CROSSINGS

DES CKD	SCALE: 1 : 25	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS TRENCH BACKFILL SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE	JOB No	PLAN	A4
DRN DRN		APPROVED		STD DR06	STANDARD	STD DR06	
		APP				MF	

8.3 Manholes and Structures

GENERAL

Manholes, gullies, headwalls and overflow structures shall be constructed in the positions and to the details shown on the drawings and/or as required by the City's Representative, and shall be adhered to strictly, irrespective of the distances between manholes shown on the drawing. Refer to Standards and Specifications 2 for design and detail. All structures shall be constructed with the tops of the covers laid to the slope of the surface, flush with the finished level. Manholes may be of brick, precast lime or cast insitu concrete.

Where shown on plans, connections and alterations to existing sumps and manholes are to be carried out by the Contractor as part of the Contract and to the satisfaction of the Director, Engineering and Works Services.

MANHOLES

Drainage inlets to manholes shall be set in the wall of the manhole at the invert level shown on the drawings or as directed by the City's Representative.

The minimum size hole shall be formed in the manhole to receive the pipe and the remaining hole neatly packed and sealed with mortar both inside and outside the manhole.

The specified depth of manholes has been calculated as the difference in level from the top of the cover and the lowest pipe invert.

The concrete shall be batched by weight or volume as directed by the City's Representative.

Standard rectangular or circular reinforced concrete manhole covers for use on all manholes not under road pavements shall be of an approved type. All drainage infrastructure located within the road reserve is to be trafficable for heavy vehicles.

Manholes under road pavements shall be fitted with Class B 900mm x 600mm two part approved "Gatic" type covers for heavy pavement type loadings.

Manhole lines shall be trimmed to level and built up with radially maced brickwork so that the manhole cover is set flush with road or ground levels.

All brickwork shall be carried out by experienced and competent tradesman. The bricks shall be properly bedded and bonded true to line level.

All joints shall be struck smooth. Mortar for underground brickwork shall be one part cement, to three parts sand batched by weight.

See drawing STD-DR01 on page 43 for further details.

STEP IRONS

Pits greater than 1.0 m deep shall be fitted with step irons as shown on the drawings. Steps shall be so located that they do not obstruct openings other than subsurface drainage openings and that water does not discharge onto them. Step irons shall be installed at a minimum vertical spacing of 300mm and shall be set into a wall which has no openings, or near an opening, or across a corner of the pit.

Step irons of an approved proprietary type shall be installed in accordance with the manufacturer's instructions.

CONCRETE STRUCTURES

Where formed concrete is specified the Contractor shall construct all storm water gully pits, junction pits, headwalls, inlet sumps, dish crossings, flood ways and similar structures in the position shown on the drawings and/or as required by the City's Representative, true to the dimensions shown. The Contractor shall excavate as required and shall furnish all necessary sheeting, supports and bracing to support the excavations and all formwork and supports to mould concrete. Forms shall be so designed and constructed that they can be removed without injury and the concrete shall be built true to line and braced in a substantial and unyielding manner. They shall be mortar and interior surface tight and if necessary shall be thoroughly soaked with water to close cracks due to shrinkage. The interior surface shall be thoroughly cleared adequately oiled, greased or soaped to ensure the non-adhesion of the concrete. The materials used for forms for exposed surfaces shall be sized softwood timber, dressed on one side and both edges. Sawn timber may be used for backing to unexposed surfaces. At the corners of forms, where required, suitable moulding shall be placed so that all exposed edges of concrete shall be neatly bevelled to 25mm width.

Where shown on drawings and/or as required by the City's Representative, steel reinforcement shall be provided. Steel shall be mild steel conforming to the Australian Standard Specification. It shall be free from millscale, loose rust, tar, paint, oil, mud, mortar or other foreign substance and must be true to size.

If the steel has more than a thin film of rust, this shall be removed. The Contractor, if so requested, shall provide at his/her expense, samples of the steel cut to a suitable length for testing purposes. All reinforcements shall be bent and hooked cold where required and shall be placed accurately to the pitches and positions shown on the drawings and/or as required by the City's Representative. Reinforcements shall be secured against displacement due to the flow or workings of the concrete and shall be tied with suitable wire at all crossings of bars.

See drawing STD-DR19 on page 44 for universal side entry pit details

ROCK STRUCTURES

Any rock to be used for the construction of rock or stone work should be sourced locally and should be sufficiently hard enough to be suitable for use in rock structures. Rock types used are predominantly laterite or limestone, approval should be sought if alternative materials are to be used.

Rocks should be nominally 150 mm to 300 mm in size but on average 150 mm.

All rock work should be finished such that the surface is made up of rocks interlocking together roughly evenly spaced and sized to give a good appearance. The rock work may be mortared or dry pitched depending on the application.

Rock pitching or protection should be used wherever erosion is likely to occur and may include locations such as at the end of kerbs where runoff is concentrated. All rock works should be located in such a manner that a traffic or pedestrian hazard is avoided.

HEADWALLS

Mortared headwalls should be constructed around any pipe or box culvert at the inlet and outlet, with an apron of mortared rock pitching between the ends of the wingwalls. The headwall and wingwalls are to be finished with a cap of 25mm thick mortar and finished smooth. A cut off wall is to be constructed at the edge of the apron to prevent undermining. Refer to attachment for standard layout of mortared rock pitched headwall and wingwalls.

See drawing STD-CR09 on page 45 for headwall details

DRAINS

Table drains and constructed drainage lines should be protected where longitudinal grades exceed 2% or where erosion is evident or likely to occur. This may be done by construction of rock pitched open drains. Rock spalls (rocks of approximately 150 - 300mm size) are to be spread along the length and width of the drain to protect the drain and side batters from erosion.

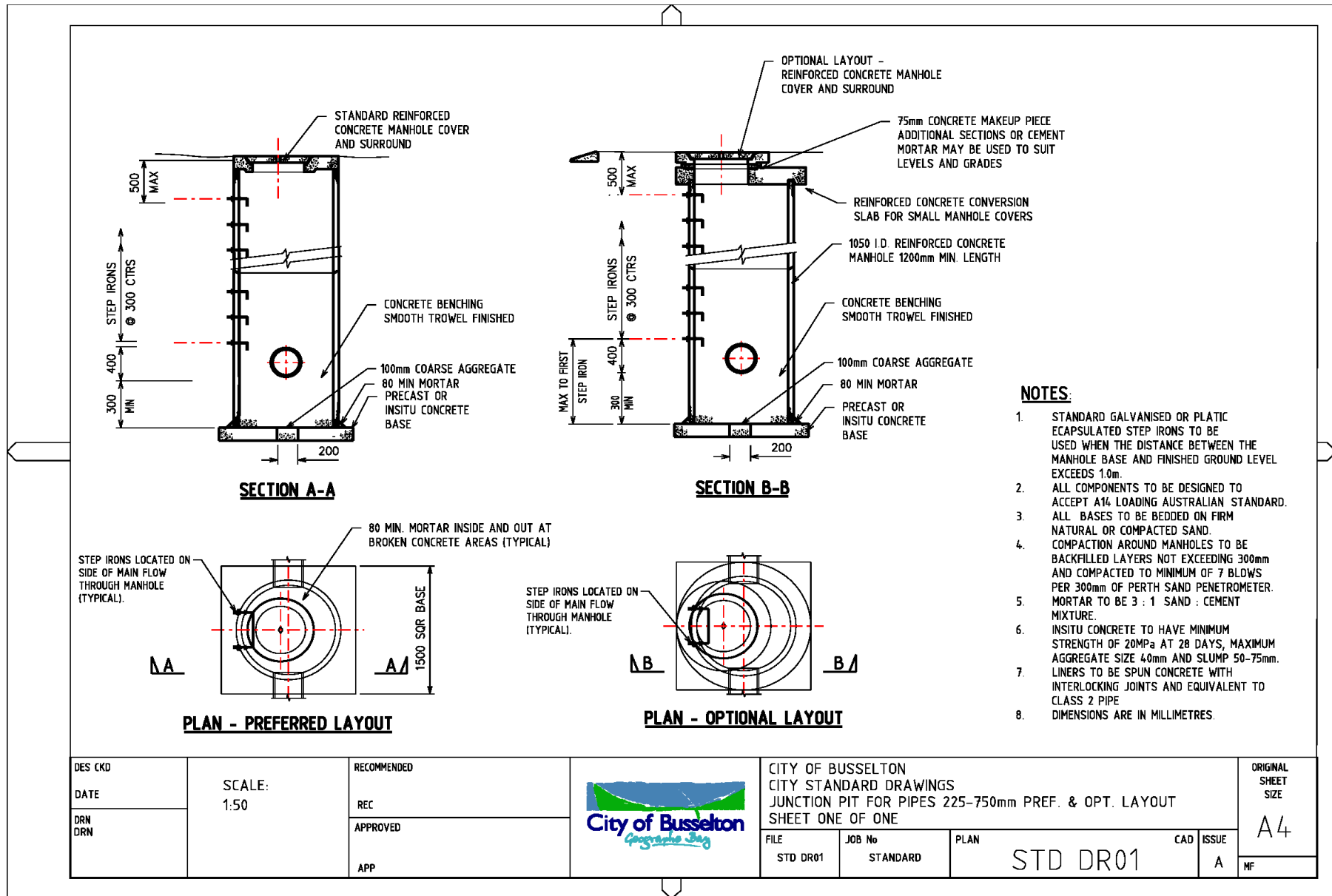
Rock lining (dry pitching) of table drains is to be used where infiltration is possible and rock spalls are insufficient to prevent erosion, such as on batters. An interlocking matrix of rocks should be constructed to allow water flow yet prevent soil erosion around the rocks.

DROP STRUCTURES

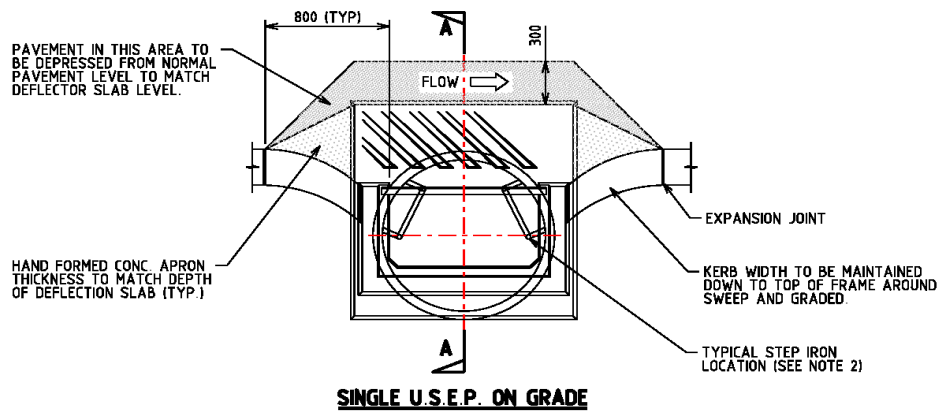
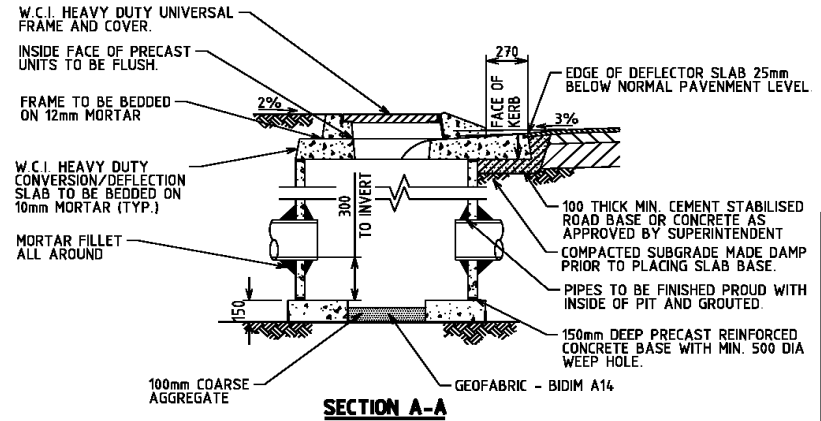
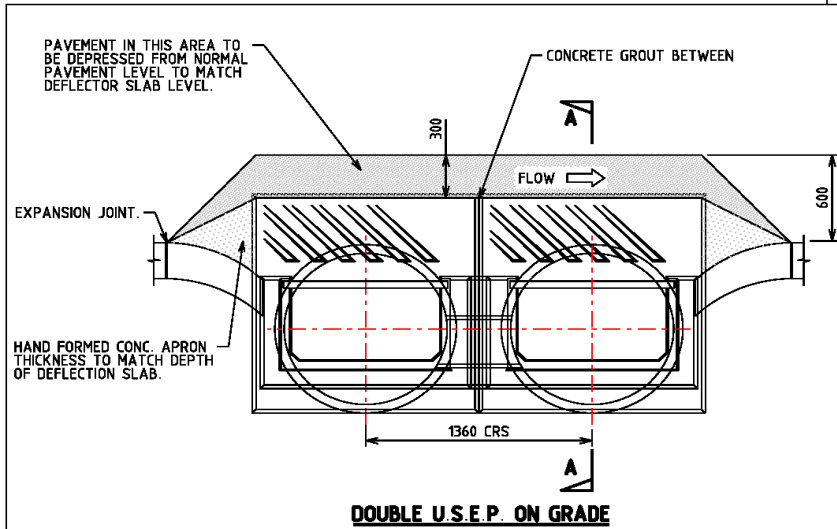
A drop structure or a series of drop structures may be necessary to prevent the longitudinal velocity of the water in the drain becoming uncontrolled. The use of drop structures may be positioned at regular intervals (as with the weirs above) or at strategic points such as at an inlet or outlet of a culvert. *Discuss with Engineering and Works Services Division staff for recommendations for applications in your situation.*

See drawing STD-DR25 on page 46 for vegetated swale details.

Section 3 - Construction Standards and Specifications ...



Section 3 - Construction Standards and Specifications ...

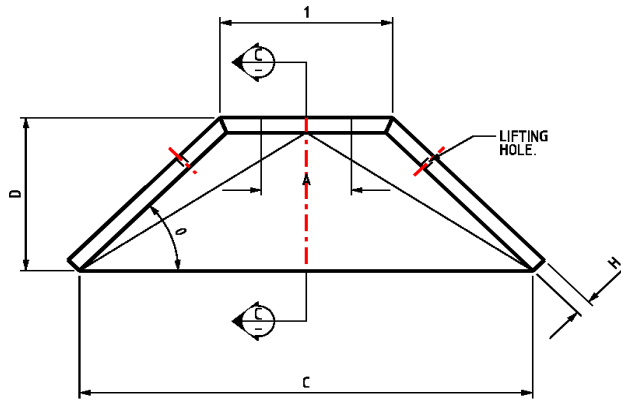


NOTES:

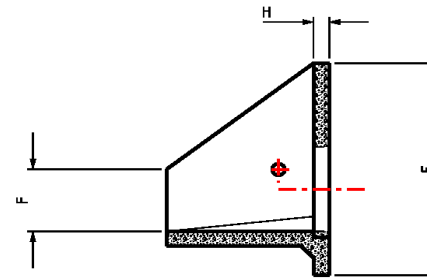
1. CONCRETE TO BE 20mm NOM. AGGREGATE AND HAVE A MINIMUM STRENGTH AT 28 DAYS OF:
INSITU BASE : 25MPa
PRECAST BASE : 40MPa
2. ALL STEP IRONS TO BE HOT DIP GALVANISED AFTER FABRICATION. STEP IRONS ARE TO BE PROVIDED WHEN DEPTH TO INVERT EXCEEDS 1.0m.
3. PIPE JOINTS WITHIN ONE METRE OF PIT TO BE SEALED.
4. SUBGRADE TO BASE TO BE COMPACTED TO 95% MMDD BEFORE PLACING BASE.
5. BACKFILL TO PIT TO BE COMPACTED TO 95% MMDD.
6. DIMENSIONS ARE IN MILLIMETRES.
7. KERBS OTHER THAN MOUNTABLE SHOWN TO BE SIMILARLY TREATED BY MAINTAINING WIDTH AROUND SWEEPS AND GRADING DOWN TO COVER TOP OF FRAME.
8. AT LOW POINTS USE OPPOSING LEFT AND RIGHT HAND DEFLECTORS SO AS TO INTERCEPT FLOW FROM BOTH DIRECTIONS.

DES CKD	SCALE: 1 : 40	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS UNIVERSAL SIDE ENTRY PIT SHEET ONE OF ONE				ORIGINAL SHEET SIZE
DATE		REC		FILE	JOB No	PLAN	CAD	ISSUE
DRN DRN		APPROVED		STD DR19	STANDARD	STD DR19		
		APP					A4	

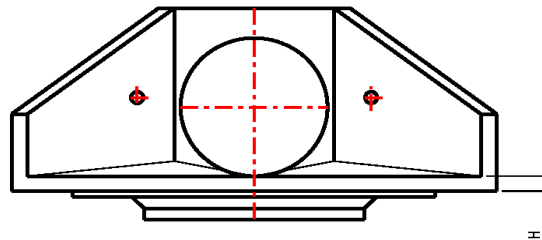
Section 3 - Construction Standards and Specifications ...



PLAN VIEW



C-C SECTION



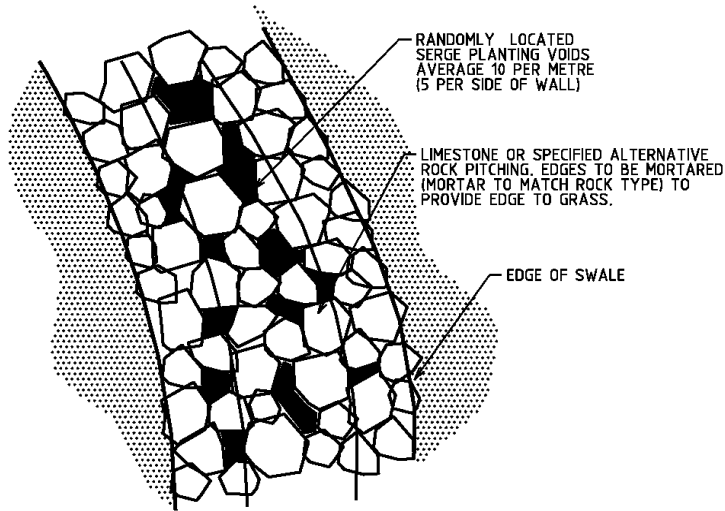
SIDE VIEW

NOM PIPE SIZE	MASS KG	A	B	C	D	E	F	G	H	ANGLE θ
300	415	367	650	1850	600	920	270	250	65	45°
375	400	450	650	1850	600	920	270	250	65	45°
450	395	538	650	1850	600	920	270	250	65	45°
252	690	620	800	2300	750	1070	320	250	75	45°
600	680	702	800	2300	750	1070	320	250	75	45°
675	1050	786	1000	3000	1000	1320	320	300	75	45°
750	1030	870	1000	3000	1000	1320	320	300	75	45°
900	940	1050	1060	2040	850	1340	570	115	100	30°
1050	1325	1215	1225	2370	1005	1500	640	125	100	30°

DIMENSIONS IN mm

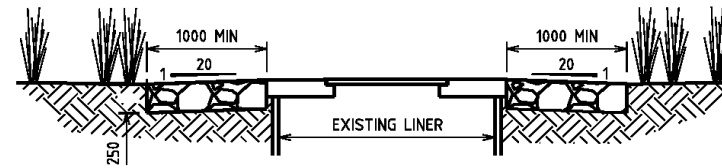
DES CKD	SCALE: N.T.S.	RECOMMENDED		CITY OF BUSSETON CITY STANDARD DRAWINGS HEADWALL SPECIFICATIONS SHEET ONE OF ONE			ORIGINAL SHEET SIZE	
DATE		REC		FILE STD CR09	JOB No STANDARD	PLAN STD-CR09	CAD	ISSUE
DRN DRN		APPROVED						MF
		APP						

Section 3 - Construction Standards and Specifications ...



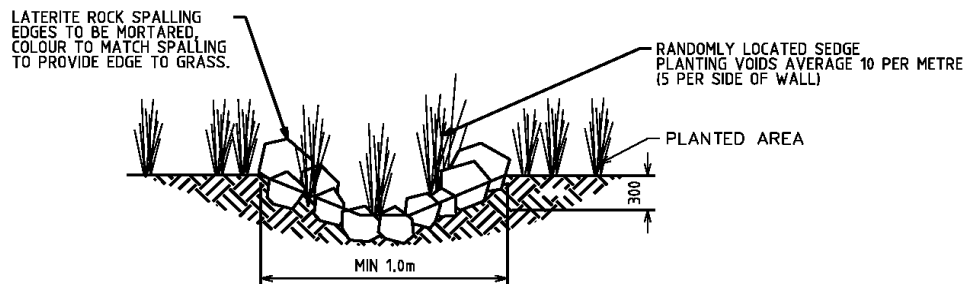
INDICATIVE SWALE PLAN

SCALE: 1:50



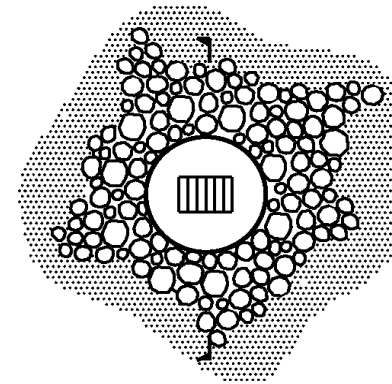
BUBBLE UP PIT SECTION

SCALE: 1:50



INDICATIVE SWALE SELECTION

SCALE: 1:50



BUBBLE UP DETAIL PLAN

SCALE: 1:100

DES CKD	SCALE: AS SHOWN	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS BUBBLE-UP PIT SWALE ROCK PITCHING SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE	JOB No	PLAN	CAD
DRN DRN		APPROVED		STD DR25	STANDARD	STD DR25	A
		APP					A4 MF

MIXING AND PLACING OF CONCRETE

The Contractor shall give the City's Representative sufficient notice for inspection of the formwork and reinforcement for approval. No concrete will be placed without this approval.

Concrete mixers may be either truck mounted or stationary. Truck mixed concrete shall comply with AS 1379. Mixers and chutes shall be washed between loads and all washing water shall be discharged before any material for the next batch is loaded. The concrete shall be mixed until all materials are uniformly dispersed throughout the mix and every particle of aggregate is coated with mortar. No concrete may be discharged from the mixer until mixing has been in progress for at least two (2) minutes after all materials including water have been placed in the mixer. All concrete shall be placed in the forms within 90 minutes of the time the cement is placed in the mixer. Concrete shall not be placed when the temperature in the mixer exceeds 35°C or the temperature in the forms exceeds 37°C.

Concrete shall be conveyed from the mixer to its final position in the form by conveyors, skips or chutes or by other means approved by the City's Representative and shall at all times be contained and moved in a manner which will cause the least segregation. Concrete may not be dropped into forms through a height exceeding 1.5m. The surface of slabs shall be finished with a steel float.

COMPACTION OF CONCRETE

All concrete shall be thoroughly compacted in place by mechanical immersion vibrators operated by experienced and competent personnel. The vibrators shall be inserted into the concrete at centres sufficiently close to ensure all concrete is completely consolidated and vibrators shall be withdrawn at such a speed that the void created by the vibrator closes up as it is withdrawn.

Vibrators shall not be placed in contact with reinforcement or formwork. The Contractor shall provide and use sufficient vibrators to compact thoroughly all concrete delivered to the forms and shall provide at least one (1) standby vibrator in working order at all times that concreting is in progress.

CONCRETE QUALITY CONTROL

The Contractor shall provide test certificates in accordance with AS 1012 from the suppliers of ready mixed concrete and shall the City's Representative to sample concrete as placed in the forms and shall provide everything necessary to make test cylinders or to carry out slump tests when required by the City's Representative.

FINISHING AND CURING OF CONCRETE

Forms shall not be removed until at least 24 hours after concrete has been placed or such longer period as the City's Representative may direct.

After removal of forms any rough or porous places or holes shall be submitted for inspection to the City's Representative who will direct any remedial action required. Minor honeycombing may be picked over and dressed up with a 2:1 cement mortar and the exposed surface shall then be rubbed until all marks are removed leaving the surface plane smooth and uniform in colour and appearance.

For at least seven (7) days after removal of forms concrete shall be kept unloaded and permanently damp by approved means or shall be covered with an approved curing membrane. Exposed surfaces shall be protected from rain, etc. until hard set has occurred. The concrete shall at all times be adequately protected from damage by traffic or other cause and shall not be fully loaded until the 28 day design strength has been attained.

SOAKWELLS

The location and size of soakwells is to be designed by the developer/applicant and approved by the Engineering and Works Services Division design staff.

The standard soakwell shall consist of:

- “Universal” side entry system with conversion slab (stock number S259) or suitable grated cover (trafficable);
- Soakwell (industrial) internal diameter 1200mm \varnothing by 1.2 metres deep;
- Circular trafficable concrete base with soak hole; and
- The soakwell is to be wrapped in filter-fabric.

CLAY OR SILT SOILS

Where there is no alternative to the installation of a soakwell the base shall be installed on aggregate to a depth of 150mm and clean uniformly graded sand will be used to backfill to 300mm around the soakwell to enhance soakage and retention.

SANDY SOILS

No aggregate is required.

HIGH WATER TABLE

Where the water table (normal) is shallower than the standard soakwell depth, the soakwell liner may be trimmed and grouted up to make a level surface for the side entry conversion slab or soakwell cover so that the top of the base is at or above the water table level.

In all situations:

- (a) Filter fabric is to be wrapped around the circumference of the soakwell to its full depth.
- (b) Compaction and consolidation of the sand around the soakwell is required to obtain a minimum of eight (8) blows per 300mm with the Perth Penetrometer test in sites other than the road edge. Where constructed on the kerbline the soil adjacent to the soakwell should be compacted to reach a minimum of 10 blows per 300mm using the Perth Penetrometer test.
- (c) Soakwells may be installed in-line in a piped drainage system. Soakwells can be used to aid an existing storm water line that is overloaded or installed where no piped drainage presently exists.

- (d) In some locations it may be necessary to construct a high level overflow into a slotted pipe with end capped and encased in fabric if the capacity of the soakwell needs to be increased. Engineering and Works Services Officers will provide construction details for individual sites.

9 Backfilling of Trenches

9.1 Backfill

Trenches shall be filled with sand or approved sandy loam at least to the level of the crown of pipes, filling being evenly placed on both sides of pipes, well watered and thoroughly rammed under haunches at the sides and on top, and compacted uniformly. Where the pipe line crosses any carriageway, or is laid in the line of kerb and gutter to be constructed under this contract, the whole of the trench shall be backfilled with sand or other approved material. The remainder of the trench shall be carefully filled with approved filling free from large stones or sods, well rammed and watered. Filling shall be carried up in layers not exceeding 225mm in thickness and shall be thoroughly consolidated, the filling on both sides of pipe being carried out at the same time. Filling shall be well packed around the barrel of the pipe and between pipe lines when two (2) or more lines of pipe are laid side by side. Separate conditions apply to back filling at pavement crossings.

The filling is to be compacted to a density which will offer a resistance of not less than eight (8) blows for the initial 300mm of a Standard Penetrometer, after a penetration of 150mm.

STANDARD PENETROMETER

The Standard Penetrometer is a flat ended 15.875mm (5/8") diameter round steel rod driven by a 9.0kg (20lb) mass falling through a height of 610mm (24") on to a circular anvil.

9.2 Surface Restoration

The surfaces of trenches after backfill shall be graded level with the surrounding ground and the Contractor shall during the period of maintenance make good any subsidence which may occur. The Contractor shall replace limestone and reshape the road surfaces to make them safe for all vehicular and pedestrian traffic.

All safety signs and barriers shall be put up and maintained by the Contractor for the duration of the work.

9.3 Pavement Crossings

The backfill used shall be clean and free from all deleterious material including roots, stumps, rocks and broken bitumen.

The sand refill shall be done using natural sand, free from rock or other hard or sharp objects that would be retained on a 12.3mm test sieve. The sand refill shall be placed in a layers of approximately 0.4m loose thickness, to above the top of the pipe sockets, and compacted with not less than four (4) passes of vibratory plate compactor having a minimum static mass of 50kg. If the refill material is dry, water shall be added to achieve a

Section 3 - Construction Standards and Specifications ...

near maximum density at optimum moisture content. The density will be checked using a standard sand penetrometer in sandy areas. Areas tested having less than eight (8) blows/300mm to a depth of 600mm will be re-compacted until this standard is achieved.

The trench fill shall proceed and be compacted in finished layers not exceeding 300mm. It is recommended that the soils be dampened to achieve maximum compaction.

The backfill shall be either excavated material or, where compacted backfill is specified in this sub-clause, granular material free from stones and roots that would be retained on a 53mm test sieve. Excavated material which, in the opinion of the City's Representative is unsuitable for use as backfill, shall be disposed of. Any shortage of approved backfill material resulting from rejection of material shall be made up with imported granular material as specified in this sub-clause. The backfill shall be compacted in the manner specified, that the refill level for contract purposes shall be 300mm below road surfaces. Where the pavement reinstatement is to be done by the Road Authority, 48 hours notice of backfill work is required in order that they can replace gravel or stone dust pavement.

Compacted Backfill - Backfill shall be compacted as specified above in all sealed and gravel paved areas, in shoulders of paved roads in unpaved driveways and crossovers, in right-of-way reserves and over concrete encased sewers.

Fresh gravel or crushed stone shall be used to "top up" the trench and the surface shall be left "humped" e.g. 10mm - 15mm rise over a 500mm wide trench, and maintained that way for a period of not less than three (3) working days and not more than six (6) working days.

The gravel patching shall be repaired and tidied up, water-bound and compacted to a 95% AASHTO standard.

The work will be checked 24 hours after water binding using an approved test.

All road pavement reinstatements shall be swept, primed or primer sealed and surfaced with a 30mm thick 10mm dense graded asphalt.

The reinstatement shall be finished flush with the existing pavement surfacing.

The whole site shall be cleaned and tidied, kerbs replaced, excess materials, traffic signs, lights and barriers removed.

For under road boring or jetting, pressure grouting around the pipe or ducts will be required.

GRASSED AREAS

Backfill to un-paved areas - Where grassed areas are encountered the Contractor shall ensure that the top 100mm topsoil and turf are cut into manageable portions and placed in a separate stockpile. Sand refill and backfill procedures will be carried out in a similar manner to that specified above, except that the required penetrometer reading will be six (6) blows/300mm. When the backfill is 100mm below the original level, the stockpiled topsoil shall be replaced, compacted, watered and levelled and reseeded or replanted. Trees and shrubs disturbed or damaged shall be replaced.

Where reinstatement of grassed areas is required the trench area shall be "topped" off with the original topsoil, which will have been separately stockpiled for this purpose. If topsoil is not available suitably prepared and mixed garden soil will be placed.

Section 3 - Construction Standards and Specifications ...

Trench compaction procedure is as for road repair specification.

Reseeding and fertilisation shall be done using hand raking and spreading of:

Kikuyu	5kg/ha
Couch	5kg/ha
Daliak Clover	5kg/ha
Cereal Rye	10kg/ha
Agras	360kg/ha
Su, Cu, Zn	200kg/ha

With the whole area to be thoroughly watered twice weekly for three (3) weeks.

Jetting or under road boring will be required to be pressure grouted.

TREES, SHRUBS AND FLOWERS

Please refer to *“Trees to be Maintained”* on page 12 for information regarding the retention and protection of trees and shrubs; and page 21 for *“Declared Rare Flora”* requirements.

10 Road Construction Standards

10.1 General

All road pavements shall be constructed in accordance with this specification and shall conform with approved drawings and plans, or as required by the City's Representative. This specification shall be read in conjunction with Standard and Sections 1 - *Guidelines and Administration Requirements for Subdivisions and Developments* and 2 - *Designs and Plans for Roads, Earthworks, Paths and Storm water Drainage*.

The normal minimum residential road pavement shall consist of a sub-base of approved limestone, crushed rock and/or laterite gravel, a base course of top quality laterite gravel or crushed rock and a surface course having a total consolidated thickness on completion as shown on the drawings and/or as required by the City's Representative, constructed on a prepared sub-grade. No single course of base or sub-base shall be laid in a thickness, when consolidated, of greater than 160mm or less than 80mm. If the pavement comprises of two (2) or more courses, the surface course shall not exceed the thickness of the base course.

Pavement designs will be required for all subdivisions.. Pavement designs are to be carried out in accordance with ARRB Manuals and provided when submitting the engineering drawings to the City for checking and approval.

Required equipment, plant or machinery are detailed in Appendix 1 of this Specification.

Maximum depth of stormwater allowed to pond on the road is 10mm. otherwise corrective work will be required.

JOINING EXISTING PAVEMENTS

Where the specified pavement is to be joined with an existing pavement, the existing pavement shall be broken out or thoroughly scarified so that any fresh pavement material may be bonded to the old pavement of the existing road. The pavement shall then be formed and compacted to the levels and the density of the existing pavement and as shown on the drawings and/or as required by the City's Representative. It is essential that smooth junctions be made with existing work.

OPENING TO TRAFFIC

The Contractor shall permit traffic to use the pavement as it is constructed, when required. Any provision necessary to ensure the safety of traffic on account of the incompleteness of other portions of the work shall be made, as directed by the City's Representative, without extra cost. The Contractor shall provide an adequate junction with the side track or road at either end of each length. The Contractor must maintain the necessary signs and lights at all times including any detour approved by the City's Representative. Failure to do so may result in a charge by the City to the Contractor.

10.2 Sub-Grade Preparation

Where required, filling shall be a clean sand or a gravelly sand with a maximum particle size of 50mm and a Plasticity Index not exceeding six (6). Filling material shall be free from clay lumps, debris, weeds, organic or other deleterious material.

Section 3 - Construction Standards and Specifications ...

The placement of filling sand shall be in layers not exceeding 300mm loose thickness, and shall be watered and rolled with vibrating drum rollers to a Dry Density Ratio of not less than 95% (modified compaction).

In areas of cut, the area to be paved shall be boxed out to the width between kerb face lines plus a minimum of an extra 600mm width along each line. Where there is no kerbing, the edge of boxing shall be at least 500mm more on each side than the width of required road shoulder. This 500mm (or 600mm for no kerb) will be used to taper down the depth of base/sub-base course and the balance back filled with topsoil and stabilised, into the table drain (if any). The level of the boxed out surface shall be as for finished design level less the total thickness of pavement (base course plus sub-base if provided).

Heavy clay or other unsuitable cohesive material shall be removed to at least 400mm below sub-grade level or as directed by the City's Representative, and the excavations shall be filled with clean sand or filling material as specified above, compacted as detailed for filling and drained if necessary.

The surface of the boxed out sub-grade shall be lightly watered before laying the base course and given not less than six (6) coverages of a vibrating steel drum roller having a static drum weight not less than four (4) tonne.

The tolerance for sub-grade width shall be - 0mm, + 100mm. The finished sub-grade shall be within +5mm to -30mm of the design levels.

Sub-base or base course construction shall not proceed prior to the City's Representative approving the sub-grade.

Testing for CBR, where required by the City's Representative, shall be carried out as directed at the cost of the Contractor.

10.3 Sub-Base Construction

Sub-base material shall be clean limestone or gravel with a maximum particle size of 38mm and shall be well graded from coarse to fine. The Plasticity Index shall not exceed 6 and the material shall be free from clay lumps, oversize, debris, organic or other deleterious material.

The sub-base material shall be placed in a single layer without disturbing the sub-grade and after compaction shall finish to a minimum full depth width 500mm behind design face of kerb or to the edge of the design shoulder, plus a tape thickness over a further 500mm in the case of the latter.

The sub-base material shall not be spread on a water-logged sub-grade or if free water is evident in the sub-base.

After preliminary compaction, the sub-base material shall be lightly scarified or bladed and the loose layer graded to the required cross section. The material shall be continuously watered to maintain the material at or near optimum work site contours during grading and rolling. Compaction shall be by means of rolling with approved self-propelled (SP) steel-wheel rollers weighing not less than eight (8) tonnes, suitable SP vibratory or multi-wheel rollers. The rolling shall be carried out parallel to the centreline of the road and shall progress gradually from the low to the high part of the road surface. The rolling shall proceed so as to obtain uniform lapping of the rear wheel tracts covering the entire surface until minimum compaction of 95% of the maximum dry density as determined by testing in accordance with AS 1289 E2.1.

Where in the opinion of the City's Representative damage to adjoining properties may result, the use of vibrating rollers will not be permitted. The Contractor may be required to arrange a survey of structures adjoining the works by an assessor practising in the insurance claims field.

All irregularities in the longitudinal grade and cross-section shall be made good by scarifying, grading and adding material during rolling. This process will continue until the road sub-base is brought to a uniformly compacted smooth and even surface.

If, during the construction period, the surface of the sub-base shows, in the opinion of the City's Representative, evidence of crazing, ravelling, laminating, potholing, corrugation, consolidation, subsidence or lack of cohesion, the sub-base shall be loosened uniformly by harrowing or other approved means, additional material added where necessary to fill depressions or to provide binding and the whole compacted as specified herein.

The Director, Engineering and Works Services may direct that the unsatisfactory material be removed from the site and replaced with superior materials. No additional payment will be allowed for the additional work or cost involved in rectification of the sub-base.

The sub-base construction shall be approved by the City's Representative prior to the commencement of the placing of the base material.

Prior to laying of the base material all utilities service crossings beneath roadways shall be installed. All road crossings shall be backfilled and compacted as per the requirements for sub-grade and sub-base construction.

10.4 Base Course - Laterite Gravel

Refer to Appendix 2 "MATERIALS SPECIFICATION - LATERITE GRAVEL" on page 112.

The base course shall be laid without disturbing the sub-base (if any) and after compaction, shall finish not less than 100mm thick, or if no sub-base is provided, not to be compacted in layers greater than 150mm depth and to a minimum full depth width 600mm behind the design face of the kerb and tapered to the full width of the sub-grade.

SPREADING

The material shall be spread to the required consolidated thickness by means of an approved mechanical spreader or to the required loose thickness in a uniform layer on the sub-grade or sub-base course by tipping directly from approved vehicles capable of depositing the material in a uniform layer. Only experienced grader operators shall carry out this phase of the work.

The material shall be damped either at the source of supply by water sprays on it as it comes from the chute into the storage bin or during loading or by drip irrigation methods, etc. The material shall be maintained at optimum moisture content (OMC), within a tolerance of plus or minus two (2)%, until spreading and consolidating is completed, additional water being added as necessary during rolling. Water quality limits are 6000ppm of total dissolved salts (TDS) and spray trucks should have constant pressure spray bars.

Water appliances must not be left standing on the work where leakage may cause over watering.

Materials shall be spread without segregation of large or fine particles. Segregated materials shall be remixed by disc harrows and/or blading. Construction shall commence with the point nearest the source of the materials and proceed continuously away from this point. All graders used shall have cutting edges better than 75% wear fitted for this phase of the works.

No material shall be spread upon a salty or saturated sub-grade. If at any time the sub-grade material should become churned up or mixed with the pavement, the Contractor shall, without additional compensation, remove the mixture, reshape with clean material, which shall be compacted satisfactorily and uniformly with the surrounding surface. After the first course has been spread and compacted satisfactorily the second course shall then be spread uniformly on the first course and similarly treated.

The Director, Engineering and Works Services must approve the use of any geo-textiles and written consent obtained prior to installation and must be designed to the manufacturer's specification.

COMPACTION

The material shall be compacted to design density by rolling and maintaining the material at or near optimum moisture. Each course shall be rolled until it is compacted to a firm, even surface, by a roller weighing at least eight (8) tonne static weight, and the Contractor shall ensure that the roller operators are using the machines correctly ballasted in accordance with the manufacturer's specifications.

Vibrating or pneumatic tyred rollers may be used as supplementary to solid wheeled rolling. The rolling shall begin at the sides and progress to the centre, parallel with the centre line of the roadway, uniformly lapping each preceding track, covering the entire surface thoroughly, and continuing until the material does not creep or wave ahead of the roller, and the surface presents a smooth, uniform appearance. On curves, rolling shall begin at the low edge of the pavement and progress towards the higher edge. When completed, the pavement shall be firm and unyielding to the satisfaction of the City's Representative. The gravel shall have a minimum compaction of 98% of the maximum dry density for bitumen areas and 90% for other areas, when tested in accordance with AS 1289 - E2.1.

The surface course shall be tested by template to ensure accuracy, and any irregularities greater than 10mm when tested with a straight edge 3 metres in length shall be made good by addition or removal of material and further rolling until the specified cross-section is obtained. A tolerance of levels of 6mm will be permitted.

If, during the construction period, the surface of the base shows, in the opinion of the City's Representative, evidence of crazing, ravelling, lamination, potholing, corrugation, consolidation, subsidence or lack of cohesion, the base shall be loosened uniformly by harrowing or other approved means, additional material added where necessary to fill depressions or to provide binding and the whole compacted as specified herein.

THE FINISHED SURFACE

The finished basecourse shall be within +10mm to -0mm of the design levels.

The finished surface of the base course shall be finished to between 30mm and 40mm below the finished design level in the case of the final seal being asphalt. In the case of chip primer seal and seal, 15mm below the finished design level.

The finished surface of the base course shall conform to the design crossfall within the tolerance of plus or minus 0.2%.

The finished surface of the base course shall not deviate from a three (3) metres straight edge by more than 10mm at any point.

Shall be tight, dense and hard worked to finish free of high spots or hollows or boney areas lacking sufficient fines.

No vehicles, including those engaged in the work, especially lug tyre materials, shall pass over the previously spread material until consolidation has been completed in accordance with this specification, unless the pavement is kept free of wheel tracks by the continuous use of a blade-grader or approved type of road drag, and vehicles are effectively prevented from tracking. Any damage to the sub-grade caused by traffic shall be made good by the Contractor at his own expense. Tractor prime movers shall have diamond pattern tyres only.

The Contractor shall supply and apply to the pavement all necessary water to complete consolidation by rolling and watering as specified herein.

The maximum salt levels shall be 6000 ppm TDS and pH shall be between 6.0 and 8.0 unless the City's Representative gives specific approval.

Priming and/or surfacing shall not proceed prior to the City's Representative approving the finished base course and signed off on the density test results. The City's Representative may require any repairs to be undertaken on the base course prior to priming or primer sealing.

10.5 Bitumen Works

INTRODUCTION

The essential feature of a sprayed binder construction is the application of a thin layer of binder to the pavement of a pre-determined and uniform thickness. The binder layer may be required to be absorbed into the surface of the pavement base, and the process is called "priming". It may also be required to function partly as a "primer" and partly to retain a cover aggregate layer, and the process is then called "primer sealing". Lastly, if its function is solely to retain a cover aggregate layer, the process is called "sealing" and the construction is called a "spray seal" which may be one (1) or two (2) coats.

For two (2) coat seals the primerseal and final seal are to be 10mm aggregate size. When the final wearing surface is to be asphalt the primerseal may be a 5m or 7 mm aggregate size.

Although binder may be sprayed at temperatures up to 200°C, it cools rapidly after forming a film on the pavement. Investigation has indicated that the decrease in binder temperature is very substantial in the first minute after spraying and after two (2) minutes, it is only slightly above the original pavement surface temperature.

The sprayer covers the treatment area much more quickly than any equipment applying cover aggregate and consequently, the wetting of a cover aggregate by the binder film mainly takes place with the binder near the pavement surface temperature. This is important for an understanding of the factors which affect the adhesion between the binder and a cover aggregate.

Full records must be kept of the whole spray application process. This includes records of temperature, areas sprayed, quantities and rates. Standard record forms approved by the Director, Engineering and Works Services shall be used and completed by the Spray Operator and verified by the site Supervisor.

The City almost exclusively uses binders in "hot" form. Emulsions are not precluded but are subject to specification submission and City approval before use.

THE PROCESS

This is the process of applying a low viscosity binder to prepare (compacted) and (usually) unbound mineral aggregate base. The binder used is called a "primer". The primer is intended to be absorbed by the top of the base and provides a surface which is easily wetted by any bituminous construction placed on it. It also provides some cohesion to the fine aggregate particles near the surface and prevents the formation of dust. Penetration is usually about 5mm and absorption should preferably be complete within 24 hours of application.

A primed base should be capable of resisting the disruptive action of traffic for the short period (days to a few weeks) before the main bituminous construction is applied.

If the application rate is too high or adverse conditions such as cool, wet weather are obtained after application, some of the primer can remain on the pavement surface and it may have to be blotted with sand. This is not only a potential traffic hazard but also can upset the performance of any bituminous construction placed on it later by increasing the amount of binder in that construction.

Problems have been encountered where primers (and even the seal binder) are absorbed too much into compacted unbound granular bases made from limestones and sandstones. These natural materials are used as pavement base materials in remote areas of Australia and some of these, although having suitable mechanical properties, can be highly absorptive. When high absorption takes place, the primer is dispersed as a thin film on the aggregate and hardens quickly and the pavement surface remains absorbent. When the seal binder is subsequently applied, it also is absorbed and there is insufficient binder remaining on the surface to give a durable seal. With such base materials, absorption is minimised by compacting thoroughly near the moisture content for maximum (dry) density.

Primer or primer seals may therefore not be applied to limestone or sandstone sub-bases or base surfaces.

Usually very low viscosity cutback bitumens are used for priming but “proprietary” materials are marketed for the purpose and these can contain adhesion agents. Bitumen emulsions can be used but a critical adjustment of the moisture content of the surface of the base is required if the operation is to be successful.

RATES OF APPLICATION OF PRIMER

The primer application rate to be used on a particular base construction is most often decided from local experience of the base material being used. The rate primarily depends on the porosity of the surface and very porous surfaces may have to be sprayed twice. More viscous primers are used as the porosity increases. A general guide to binder class and application rates for the different degrees of surface porosity is as follows (rates relate to hot bitumen).

- (a) Low Porosity Surfaces
Pavements which are hard and dense when compacted and include dense-graded crushed rock, gravels or sands with fine soil binders (e.g. sand clays). Cutback bitumens in the viscosity range of 0.008 to 0.05 Pa.s at 60°C (AMCOO and AMCO) should be used at rates of application of between 0.5 and 1.1 L/m² depending on the degree of compaction and moisture content of the surface.
- (b) Medium Porosity Surfaces
Includes pavements which are less dense when compacted than group (a), usually due to a silty soil binder in the base aggregate. Cutback bitumen in the viscosity range 0.025 to 0.05 Pa.s at 60°C (AMCO) should be used at rates of application of between 0.6 to 1.3 L/m².
- (c) High Porosity Surfaces
Includes all base materials deficient in fine aggregate and is often difficult to compact. Cutback bitumen in the viscosity range of 0.06 to 0.44 Pa.s at 60°C (AMC1 or AMC2) should be used at rates of application of between 0.8 and 1.4 L/m².

PRIMING

Priming shall not proceed until the base course surface has dried back to a moisture content not exceeding 3%.

All clay patches, debris and other contaminants on the base course surface should be removed. The prepared base course shall be swept of all loose dust and dirt to expose a matrix of stone particles without changing the texture, grade or levels.

A mechanically operated rotary broom may be used for sweeping provided it does not disturb the stones in the surface and any additional sweeping necessary to obtain a satisfactory clean surface shall be done by hand using stiff bass or similar approved brooms. The sweeping shall be completed as far as practicably possible immediately before the application of the primer. All sweepings and dust shall be completely removed off the road. the City's Representative may reject the prepared surface if the surface is defective after sweeping.

Dry surfaces, may be lightly dampened prior to priming on a dense surface.

The Contractor shall protect adjacent structures such as kerbing, from splatter by paper sheeting or a single coat seal.

Priming is usually used when asphalt or a single coat seal is to be applied within six (6) months of the date of priming.

PRIMER SEALING

Refer to Appendix 2 "MATERIALS SPECIFICATION - TYPICAL SAND (FINE AGGREGATE) GRADING SPECIFICATION FOR PRIMER SEALING on page 114.

A primer seal expected to take the traffic load without deterioration for at least 12 months and generally up to two (2) years before the final spray seal is applied. As the name indicates, it is a combination of a priming and sealing operation which consists of an application of a primer binder midway in viscosity between that of a primer and a seal bitumen followed by an application of cover aggregate. This can be a "single size" aggregate of nominal size 5, 7 or 10mm or a graded crushed rock aggregate or natural sand which mostly passes the 4.75mm sieve.

The application rate is to be suitable for the volume of traffic, the surface being sprayed and the temperature of the road surface.

SPRAY SEALS

This type of surfacing, placed on a primed or primer sealed unbound base, provides the lowest cost "all weather" pavement. It effectively seals off the surface of the base, prevents the (direct) ingress of surface water into the pavement structure and is capable of withstanding all but the most severe traffic stressing. In its simplest and most common form, it is a single application of binder and one-sized aggregate (single seal). For special purposes and, particularly when using a bitumen emulsion binder, the application processes are repeated once to give a "double seal". The life of a sprayed seal is generally less than that of the underlying structure so a pavement will receive one or more spray seals (reseals) after the "initial" seal before it has to be strengthened with an overlay or reconstructed.

Section 3 - Construction Standards and Specifications ...

For a seal surfacing to be a success, it not only has to be designed correctly and applied with good control but also the weather has to be relatively warm and dry at the time of application and during at least the first 24 hours after application. When a seal is placed on the more heavily trafficked routes, the speed of the vehicles must be controlled for the first hour or so after application to allow the cover aggregate to form an interlocking mosaic. If fast traffic is allowed to pass over the seal before this process has taken place, gross displacement of the aggregate can occur.

Residual (usually Class 170) bitumens and cutback bitumens give the most durable spray seals. Bitumen emulsions are used in the City for relatively small isolated jobs (e.g. maintenance reseals) where it is not economic to arrange bulk supplies of hot bitumen.

PRINCIPLE OF DESIGN

The rate of application of binder required for a single sealing operation is calculated from the average least dimension (ALD) of the single-sized cover aggregate which is to be used based on the concept that the binder film should partially fill the voids in a one particle thick close packed layer of the aggregate such that it rises about two-thirds of the way up the sides of the particles.

The method calculates the binder requirement at the temperature of the pavement after any cutter present in the binder has evaporated. For operational purposes, this has to be translated to its equivalent for (a possibly) cutback material sprayed at high temperature. By convention, design binder application rates for both residual and fluxed and/or cutback bitumens are given as the residual bitumen (plus any flux oil used) application rate at 15°C.

CALCULATION - BITUMEN APPLICATION RATE - SINGLE SEAL

It is assumed that the aggregate particles, after rolling and compaction and use by traffic, will lie close packed as a single layer with the least dimensions vertical, and that the average thickness of this layer will be the ALD and its void content will be 20%.

$$\text{Application Rate (L/m}^2\text{)} = \frac{\text{Voids filled (\%)}}{500} \times \text{ALD (mm)}$$

Having determined the application rate according to this method, adjustments are made according to the nature of the surface being treated.

BINDER

Bitumen Emulsion - Bitumen emulsion shall be uniformly and evenly sprayed onto the existing surface at a rate shown below:

<i>Nominal Aggregate Size</i>	<i>Application Rate for Bitumen Emulsion (L/m²)</i>	<i>Approximate Application Rate Residual Binder (L/m²)</i>
3 mm (or sand)	0.80	0.50
7 mm	0.40 - 1.00	0.55 - 0.60
10 mm	1.10 - 1.60	0.65 - 1.00

Hot Cut-Back Bitumen - The use of a cut-back bitumen prime for primer seal. In such cases, the surface shall be primed with a medium curing cut-back bitumen applied at a design/determined rate measured at 15°C and at a temperature between 70 - 120°C. The

proportion of medium curing cutter oil and application rate shall be dependant on the condition of the base surface and traffic density.

The primer or primer seal shall be applied by an approved mechanical sprayer which has been tested in accordance with the standards laid down by NAASRA for the "Testing of Mechanical Sprayers of Bituminous Material".

Areas where, in the opinion of the City's Representative, the direct use of a mechanical spray is impracticable, may be sprayed using a hand lance fed from the mechanical sprayer.

AGGREGATE

The primer shall immediately after spraying be covered with approved 5mm diorite or granite aggregate so that all sprayed areas shall be completely covered within a period of 15 minutes.

The cover material shall be spread by means of an approved aggregate spreader attached to the body of a motor vehicle transporting the metal. Such equipment shall be capable of spreading a uniform layer of aggregate.

AGGREGATE APPLICATION RATES - SINGLE SEALS

The volume of aggregate required per unit area may be calculated from the ALD according to the empirical relationship:

$$Application\ Rate\ (m^3/m^2) = ALD\ (mm) / 0.66$$

Alternatively, it may be calculated by measuring the quantity which can be spread by hand one stone thick, tightly paced and with least dimension vertical on a tray of known area.

These calculated rates of application must be increased by a small amount to allow for imperfect spreading and losses by traffic "whip off". The increase will vary with aggregate size and will generally be between 2% for 20mm aggregate and 10% for 7mm aggregate.

Typical application rates for "Single Size" aggregates:

<i>Nominal Size (mm)</i>	<i>Average Least Dimension Range (mm)</i>	<i>Application Rate Range (m²/m³)</i>
20	8.6 - 13.7	77 - 50
14	6.4 - 9.7	100 - 67
10	4.1 - 7.1	167 - 91
7	3.8 - 4.6	200 - 143

Within 15 minutes of the application of the aggregate and before use by any traffic, rolling shall commence with a 5 - 8 tonne self propelled steel wheel roller. This initial rolling shall preferably consist of at least three (3) complete rolls over the area concerned, but should any general crushing occur under the roller, such rolling shall be stopped regardless of the number of rolls completed.

The surface shall then be back rolled with a pneumatic tyred roller until proper interlocking of the chipping and adhesion of the binder to the stone takes place. During this operation,

the material is to be constantly broomed to ensure that an even layer of material is equally spread and rolled hard.

The primer shall be applied to at least 400mm behind the proposed kerb line or edge of bituminous surfacing, where there is no kerb.

Surfacing shall not proceed until the prime coat has been approved by the City's Representative and concrete kerbing has been installed, finished and cured to approval.

Following two (2) to three (3) days of the application of the primer/primer seal and aggregate, excess aggregate should be swept across the surface for further bedding to occur. Excess shall be swept off the level surface within seven (7) days after completion of the sealing.

10.6 Single and Two Coat Seals

The sealing of rural roads shall be carried out in accordance with the specifications outlined below. The preferred material for non urban situations is hot Class 170 bitumen, but cationic emulsion may be used for winter applications where agreed (All urban road works shall have 30mm minimum thickness asphalt to AAPA Perth No. 1 Specification).

BITUMEN/AGGREGATE APPLICATION RATES - DOUBLE SEALS

When using two applications of bitumen and aggregate, it is usual for the aggregate of the second application to be about half the size of that of the first application. The first binder application should be slightly less than that required for a single seal with the larger aggregate (for the calculated rate, the "voids filled" is reduced by 10%) and the second binder application should be based on the ALD of the smaller aggregate as if it were being applied to a smooth surface.

The first aggregate application rate should be that calculated for the single application method without adding all allowance for "whip off" by traffic and the second depends on the amount of the smaller aggregate required to lodge in the voids of the first application. This has to be determined by trial and may range between 110 and 250 m²/m³.

An example of a double seal is a first application of bitumen at 0.95 L/m² with a 14mm cover aggregate applied at 82 m²/m³. This is followed by a second application of bitumen at 0.55 L/m² with a 7mm cover aggregate applied at 166 m²/m³.

For two (2) applications of emulsion and aggregate (double seal), it is possible to use a larger aggregate size for the first application although the first application of bitumen (as emulsion) must necessarily be low. The texture produced by the first aggregate application then allows higher rates to be used for the second emulsion application.

An example of a double seal with bitumen emulsion is a first application of 1.1 L/m² covered with a 20mm aggregate followed by a second application of 1.8 L/m² covered with a 10mm aggregate.

Where two (2) applications of binder are applied concurrently, the City will require a 24 month maintenance retention bond to be paid as a final seal bond. This will be to the value of the final coat to address any failure such as stripping, bleeding, etc.

BITUMEN QUALITY

Bitumen shall be straight run Class 170 bitumen to which a cutter and/or an adhesion agent may be added. It shall not be fluxed for final seal. The emulsion used shall conform to physical qualities sampling and testing to AS 1160 and the hot bitumen shall conform to AS 2008. Fluxing oil may “permanently” soften bitumen. It may be used in cold conditions.

Amounts of cutter required to produce primer and primer-binder from Class 170 Residual Bitumen (Parts of cutter per 100 parts of Bitumen by volume at 15°C).

<i>Purpose</i>	<i>Priming</i>			<i>Primer Sealing</i>			<i>Spray Sealing</i>		
Class (AS.2157)	AMC0 0	AMC0	AMC1	AMC2	AMC3	AMC4	AMC5	AMC6	AMC7
Amount of Cutter	127	78	51	37	27	19	12	7	3

The City’s Representative may direct the Contractor to sample for testing the bituminous material on-site. Such a request shall be complied with by the Contractor.

AGGREGATE QUALITY

The crushed aggregate shall consist of either clean quarried chips of sound rock, free from bedding planes or lines of weakness. Sealing aggregate shall be clean crushed blue metal, free from dirt, dust and other deleterious materials. It shall not be weathered, disintegrated stone, or pyrite and shall be uniform in quality. Materials with a high proportion of quartz may be rejected.

Where the City’s Representative deems necessary, the sealing aggregate shall be pre-coated with a 50/50 mix of diesel/kerosene at 5 L/m³ thoroughly mixed and stockpiled for at least 72 hours prior to sealing to allow absorption of the pre-coat material.

All aggregates used shall be tested in accordance with AS 1141 and AS 1289 and shall conform to the current Main Roads WA (MRWA) Specification.

TESTING AGGREGATE PRIOR TO PURCHASE

The cover aggregate material must be tested with samples direct from the supplier’s stockpile, prior to purchase.

Should it be found on testing that material delivered to the job stockpile does not conform to these specifications, such material shall be removed from the site and replaced with approved aggregate at the Contractors cost.

All testing shall be carried out to AS 1141 and standard MRWA practices. Bitumen and aggregate samples and spray truck testing may be required at the MRWA facilities in either Perth or Bunbury.

AUTHORITY TO COMMENCE SPRAYING

Spraying shall not be undertaken until the pavement has been prepared to the satisfaction of the City’s Representative. There are several acceptable options to achieve satisfactory sealing works due to variation in gravel base and weather variation. On occasions a 50/50 hot bitumen tack coat is used and variations of the primer seal design to use stone dust.

Section 3 - Construction Standards and Specifications ...

After the surface to be sprayed has been broomed to remove loose material and particularly any adhering lumps of clay or soil, the beginning and end of the spray run should be masked by paper to give a clean edge.

METHOD OF SEALING - BITUMEN

The Contractor shall give the City's Representative at least 48 hours notice of the intention to apply the binder and the approval of the City's Representative shall be obtained before any spraying shall proceed.

Remove sand, dirt, etc, with hard brooms prior to sealing so that the surface shall be clean and free from clay, oil, grease. Protect adjacent structures from splatter by paper sheeting. No binder shall be applied whilst the pavement temperature is less than 25°C, during wet or rainy conditions, or when adverse weather conditions may prevail at any time during such work. In dry conditions, if considered necessary by the City's Representative, the surface shall first be damped with water as directed.

The first seal coat shall be applied and sprayed by an approved power sprayer at the nominal rate approved by the City's Representative.

The bitumen application rates for seal coats shall be as follows, but may be varied by the City's Representative:

- 1.2 - 2.0 litres residual bitumen/m² pavement surface area measured at 15°C for 14mm granite or diorite aggregate and 1.0 - 1.7 L/m² for 10mm aggregate on the through carriageways.
- 1.0 - 1.8 litres residual bitumen / m² pavement surface area measured at 15°C for 0 - 14mm granite aggregate on the shoulder pavement.

The bitumen spraying temperature shall be as specified below, or as otherwise directed by the City's Representative:

% of Medium Curing Cutting Oil Added to Bitumen	0	2	4
Binder Spraying Temperature Range (Degrees Celsius)	165 - 175	160 - 170	155 - 165

The spraying of the bitumen for each run of the sprayer shall start and finish on bitumen laminated paper. The sprayer shall start each run at least 10 metres before the bitumen laminated paper and shall cross the paper at its correct spraying spread. The sprayer shall maintain its correct spraying speed over the full length of each run and shall cross the finish paper at this speed. The paper so used and any spilt bitumen shall be removed and disposed of in an approved manner. All tapers and fillets shall be sprayed after masking with bitumen laminated paper.

Where in the opinion of the City's Representative the direct use of the mechanical sprayer is impracticable, the bitumen may be applied by using a hand lance fed from the mechanical sprayer.

The bitumen edge shall not deviate from the desired edge lines by more than 50mm. The rate of deviation of the bitumen edge from the desired edge lines shall not exceed 1 in 400.

Sections of the seal where the edges of bitumen do not conform to the requirements of this clause will be rejected.

All necessary precautions shall be taken to prevent bitumen from adhering to any existing structure. Any damage or defacement shall be made good immediately sealing in that section has been completed and no payment will be made for the cleaning work.

OTHER SPRAYED BINDER PROCESSES

SURFACE ENRICHMENT - is the application of a thin layer of bitumen to any bituminous surfacing which has an acceptably deep macrosurface texture or is porous enough to receive it without forming a fatty or smooth (slick) surface. It may be applied to "rejuvenate" an old surface where the original bitumen has become very hard or to a surface which appears to be deficient in bitumen. Bitumen deficiency in a sprayed seal construction is usually due to excessive absorption of seal binder into the base.

The "overspray" material is usually applied as an emulsion (preferably of the cationic type) in order to facilitate its rapid drainage into the macrotexture of pores of the surface. Cutback bitumens have been used.

The disadvantage of such treatments is that some bitumen or oil remains on the aggregate surface. This is a potential skidding hazard until it is removed by weathering or traffic. The treatments should be confined to the more lightly trafficked pavements.

Slow setting anionic emulsions (ASS Class) slightly diluted with water (four (4) parts by volume of emulsion to one (1) of water) are sprayed at about 0.9 L/m². This gives a residual bitumen application rate of about 0.4 L/m². Dilution water has to be checked for hardness and if necessary treated with a softening agent.

Badly deteriorated sprayed seal surfaces on lightly trafficked roads have been treated with cutback bitumen containing 10 to 30 parts by volume of cutter and sprayed at about 0.8 L/m² (about 0.6 L/m² residual bitumen). Slow interdiffusion of the old and overspray bitumen will take place and a significant extension can be expected.

TACK COATS

TACK COATING is the process of spraying a very thin layer of binder on to a pavement surface before application of a plant mix layer. The binder wets parts of the surface and adhesion of the plant mix layer is facilitated. If the pavement surface has been recently primed or is a (clean) layer of new plant mix, a tack coat is necessary. Rapid setting bitumen emulsions (preferably of the cationic type - CRS) or priming grade cutback bitumens are used for this process and applied to give a bitumen application rate of between 0.1 - 0.2 L/m² depending on the condition of the pavement surface.

After application, time must be allowed for evaporation of emulsion water or cutter before the plant mix is placed.

Tack coats are typically used prior to asphalt application onto old seals or directly onto prepared base course materials.

SEALING METHOD - AGGREGATE

Sufficient loaded trucks shall be at the site to provide the full cover of aggregate for the area sprayed.

The aggregate shall be dry at the time of application and shall be uniformly spread over the sprayed area by means of an approved type of steel wheeled roller, followed by a suitable multi rubber tyred roller. The number of passes required shall be as determined by the City's Representative. Where necessary, the surface shall be lightly broomed during rolling to obtain an even spread of aggregate material. Rolling and brooming shall be continued until no further aggregate can be incorporated into the bitumen.

Rolling shall proceed continuously during the operation and in such a manner that all areas of the pavement are equally and thoroughly rolled without crushing of the aggregate cover or damage to the surface of the pavement.

Sufficient spare aggregate shall be kept available for hand spreading of any bare or insufficiently covered areas as necessary to provide a uniform and complete cover which does not leave any bitumen exposed.

Any excess aggregate not incorporated in the seal after the completion of rolling shall be swept off the seal surface such that a wind row does not exist at the seal edge or on the shoulder. Where the roadway to be sealed is kerbed the excess aggregate may be swept hard against the kerb during interim sweeping operations but shall be picked up and removed to an approved location during the final sweeping. The time lapse between the completion of rolling and the final sweeping shall be advised by the City's Representative and will be between two (2) and seven (7) days.

MEASUREMENT - APPLICATION RATES

The Director, Engineering and Works Services requires the Contractor to record and demonstrate that the bitumen or emulsion spraying rates and the aggregate cover rates, as specified above are complied with.

The Contractor shall produce such evidence in a form satisfactory to the City's Representative upon request.

The following records shall be kept of all spray runs by a competent person and supplied to the City's Representative:

- Location driver.
- Supervisor.
- Spray Width.
- Start Chainage - Finish Chainage/Section.
- Side of Road (Left or Right).
- Air and Road Temperature.
- Bituminous Material Temperature.
- Volume of Bituminous Material used.
- Average Bituminous Material Application Rate.

- Bitumen class, mix, details of contents.

Application rates must be calculated after each spray in order that any necessary adjustment can be made to the following run.

Aggregate volume shall be measured in the truck at the point of spreading. A payload line shall be painted inside the truck bodies and parallel to the floors. Each load shall be levelled to facilitate comparison of payload line with the volume of the aggregate to be recorded.

The actual application rate of cover aggregate shall be calculated from the measured volumes spread and the actual area measured on the ground.

Records are to be in duplicate and signed by driver and supervisor.

MAINTENANCE PERIODS AND BONDING

In rural and semi-rural areas where 2 coat seals are used the second coat seal is to be bonded for a 24 month period after Practical Completion. The second coat seal is to be applied approximately 12 months after the primerseal, and preferably in the summer months, and held for another 12 months against failures such as stripping or bleeding. The value of the bond is to be cost of the works plus 50%.

10.7 Asphalt

GENERAL

It shall be the responsibility of the Consulting Engineer to design the mix detailing all properties for approval by the City. Asphalt mix design should be in accordance with *Appendix 2 "CHARACTERISTICS OF ASPHALT PAVING MIXTURE" on page 122* and meet the requirements by weight when determined by AS sieves. This Specification is to be read in conjunction with AS 2150, AS 2008, AS 2734.

The Contractor with the Consultant Engineer shall provide the tentative mix designs for the approval of the City's Representative and detail all properties including with gradings and bitumen content.

For public roads or roads which will be declared public roads, it is stressed that mix design shall provide for not less than 60% of the mineral filler to be in the form of added mineral filler (that is hydrated lime).

For the purposes of this Clause mineral filler shall be taken to mean all that mineral matter in the mix passing the 0.075mm AS sieve.

Bitumen content will be higher for local and low traffic roads and lower for higher traffic roads and intersections.

The mixes proposed by the Contractor/Consultant as provided for above shall be subject to the approval of the City's Representative and once approved, mixes shall not be varied without express authority.

Section 3 - Construction Standards and Specifications ...

AGGREGATE - All aggregates used shall meet the requirements of AS 2150. The aggregate shall be diorite or granite with approval – Appendix 2 “AGGREGATES” on page 120.

BINDER - The binder shall be Class 170 or Class 320 residual asphaltic bitumen complying with AS 2008. The residual binder, that is the residual asphaltic bitumen, shall be determined as a percentage by weight of the total mixture.

The MARSHALL CHARACTERISTICS (stability, flow and quotient) of a test lot when tested in accordance with the current Australian and/or MRWA standard, shall form part of the determination for the quality level of the asphalt.

The Marshall quotient is the calculated ratio of stability to flow which represents an approximation of the ratio of load to deformation and may be used as a measure of the asphalt’s resistance to permanent deformation under load.

The Marshall characteristics of a test lot shall be judged on one of the three quality levels:

- Conformance;
- Conditional Conformance; and
- Non-Conformance.

If the stability and quotient are both within or equal to the specification parameters, the asphalt is deemed conforming to specification.

If the stability or quotient are +0.1 or -0.1 (kn/mm) it shall be deemed as conditionally conforming.

<i>Quality Level</i>	<i>Acceptance Factor</i>
Conformance	1.000
Conditional Conformance	0.7000
Non-Conformance	0.000

If either the stability or quotient is outside the specification by +0.1 or -0.1, the asphalt is deemed non-conforming. At the direction of the Superintendent or the City’s Representative, the Contractor shall arrange, at the Contractor’s expense, for the test lot to be removed and replaced with fresh asphalt and retested. Removal shall be carried out so as not to damage the underlying layers or any road furniture such as gully gratings. Any such damage shall be repaired at the Contractor’s expense.

DENSITY

Density (compaction) shall be judged at one of three quality levels:

- Conformance;
- Conditional Conformance; and
- Non-Conformance.

When tested in accordance with Section 9.4 of AS 2734, the Characteristic Percent Marshall Density (Compaction) for any test lot of a minimum six (6) Marshall Density tests shall be deemed to be conforming if it attains the minimum value required for the mix type as shown in the following table.

Section 3 - Construction Standards and Specifications ...

Where a characteristic Percent Marshall Density is less than the specified density the Quality Level shall be deemed to be either non-conformance or conditional conformance depending on the difference between the Characteristic Percent Marshall Density and the specified density. The tolerances applicable to conditional conformance are given in the following table.

An Acceptance Factor shall be applied for work at the appropriate conformance level. The acceptance factor shall reflect the lower level of serviceability of conditionally conforming asphalt.

Where any test lot of asphalt works is deemed non-conforming, the Contractor shall arrange, at the Contractor's expense, for the test lot to be removed and replaced with fresh asphalt and retested. Removal shall be carried out so as not to damage the underlying layers or any road furniture such as gully gratings. Any such damage shall be repaired at the Contractor's expense.

<i>Marshall Blows</i>	<i>Characteristic Marshall Density (R_C%)</i>
35	96
50	95
75	94

The Characteristic Percent Marshall Density R_{CT} of a test lot shall be calculated as follows:

$$R_{CT} = R - 0.91s$$

Where:

R is the mean of the results of the percentage of Marshall Density tests on the lot being assessed, reported to the nearest 0.1 percent.

s is the standard deviation of the results of the percentage of Marshall Density tests on the lot being assessed and reported to the nearest 0.1 percent.

<i>Characteristic Percent Marshall Density</i>	<i>Quality Level</i>	<i>Acceptance Factor</i>
R_{CT} equal to or greater than R_C	Conformance	1.0
R_{CT} less than R_C and greater than $R_C - 3\%$	Conditional Conformance	$1 - 0.1 (R_C - R_{CT})$
R_{CT} less than $R_C - 3\%$	Non-Conformance	0.0

Rounding of all calculations should be accordance with AS 2706. Where specified a standard deviation (s) formulae for the distribution of the values shall be used to determine acceptance of the work.

ASPHALTIC MAT VOIDS

The asphaltic mat voids is the relationship between the maximum density and the mean core density of a sample test lot. It is calculated as follows:

$$AMV = \frac{MD - CD}{MD} \times 100$$

Where:

AMV = Asphaltic mat voids
MD = The maximum density of a test lot
CD = The mean core density of a test lot

It shall be judged on one of three quality levels:

- Conformance;
- Conditional Conformance; and
- Non-Conformance.

(a) 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. Where the asphaltic mat voids is greater than 10.0 but less than or equal to 12.0, it shall be deemed as conditional conformance. Where asphaltic mat voids is less than 2.5 or greater than 12.0, it shall be deemed as non-conforming.

(b) 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. Where the asphaltic mat voids is greater than 10.0 but less than or equal to 12.0, it shall be deemed as conditional conformance. Where the asphaltic mat voids is less than 3.5 or greater than 12.0, it shall be deemed as non-conforming.

(c) 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 the asphaltic mat voids is greater than 11.0 but less than or equal to 12.0, it shall be deemed as conditional conformance. Where the asphaltic mat voids is less than 3.5 or greater than 12.0, it shall be deemed as non-conforming.

Where any test lot of asphalt work is deemed non-conforming, the Contractor shall arrange, at the Contractor's expense, for the test lot to be removed and replaced with fresh asphalt and retested.

Removal shall be carried out so as not to damage the underlying layers or any road furniture such as gully gratings. Any such damage shall be repaired at the Contractor's expense.

Where for any individual core the asphaltic mat voids is less than 3.0 for 75 blow mix or 2.5 for 50 blow mix or 2.0 for 35 blow mix, additional testing shall be carried out to determine

Section 3 - Construction Standards and Specifications ...

the extent of unstable asphalt. This asphalt shall be removed and replaced at the Contractor's expense.

The MINIMUM THICKNESS of asphalt to be laid shall be specified by the Superintendent or the City's Representative. Asphalt is to be laid to the following depth:

- Local roads - 30mm depth
- Industrial roads – 40mm
- Roundabouts - 40mm

Class 320 bitumen is to be used on roundabouts where heavy truck traffic can be predicted.

The thickness of the asphalt shall be judged on one of three quality levels:

- Conformance;
- Conditional Conformance; and
- Non-Conformance.

When tested for thickness any test lot of a minimum of six (6) core samples shall be deemed to be conforming if the average thickness does not exceed the minimum thickness by less than 15% or more than 20% nett of corrective courses.

Should the average thickness be less than the minimum thickness specified by greater than 15%, conditional conformance shall apply.

Should any one (1) of the six (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 non-conformance acceptance factor for that area may apply, alternatively the Contractor may arrange, at the Contractor's expense, to have the area of thin pavement overlaid or removed and replaced with fresh asphalt and retested. Removal shall be carried out so as not to damage the underlying layers or any road furniture such as gully gratings. Any such damage shall be repaired at the Contractor's expense.

The average thickness of asphalt laid shall not exceed the minimum by greater than 20% nett of corrective course. the City shall only pay (if applicable) for the proportion of mix necessary to achieve minimum thickness less 20%.

Where it is necessary to overlay or remove and replace asphalt, the minimum overlay or layer thickness shall not be less than 20mm. the City will only accept the proportion of asphalt necessary to achieve the specified minimum thickness.

QUALITY CONTROL

The mix Supplier shall operate a fully equipped quality control laboratory at his/her point of supply and all testing shall be under the direct supervision of personnel fully experienced in all test methods required to establish that mix produced satisfies the requirements of this specification.

Section 3 - Construction Standards and Specifications ...

The City’s Representative shall have full access to the Contractor’s appointed mix supplier and lay plant, laboratory, stockpiles and staff in order that he may take samples, observe procedure, testing and the like and the Contractor shall afford him all reasonable access and assistance (including the supply of labour).

The Contractor shall ensure samples for testing of the mix (including compaction testing) are taken at not less than the following frequency (for each mix):

- Marshall properties - 4 tests per day or 1 per 75 tonnes;
- Extraction grading and bitumen content - 1 per day or 300 tonnes;
- In-situ density - 1 test per 150 tonnes laid, and all testing shall be at no cost to the City of Busselton.

The City’s Representative may vary the testing frequency as seen fit up or down on the above at no cost to the City in order to be satisfied that all material meets the requirements of this specification.

TEMPERATURE

Strict control of temperatures shall be maintained in order to avoid the burning of the binder and at the same time provide the maximum laying qualities in the mix.

Bitumen Maximum	160°C
Aggregate Maximum	190°C

The temperature of the mixture at the mixing plant shall be not more than 175°C. When delivered to the spreader, the temperature of the mixture shall be generally not less than 135°C.

Any material which is found to be at a temperature exceeding 175°C at the mixing plant or 165°C at the spread plant shall be rejected and shall not be placed on the road pavement.

The Director, Engineering and Works Services will have the right to fix the minimum temperature at which the material will be delivered to the road, lower maximum or higher minimum temperatures, and if necessary a range. No range shall be narrowed more than 10°C.

It shall be the Contractor’s sole responsibility to provide a suitable long stem thermometer to check the temperature of the mix at any time should the City’s Representative so request.

No mix to be laid on wet surfaces or during wet weather.

SUPERVISION

The Contractor shall not undertake spreading or compaction except under the supervision of an experienced laying supervisor. Spreading and finishing shall to proceed without the approval of the City’s Representative and all works carried out shall be to the full satisfaction of the City’s Representative.

PREPARATION OF THE SURFACE

Surface preparation, which shall include sweeping and chipping and the burning off of all rich fat areas shall be done immediately before applying the tack coat. Any area which contains an

excess of binder in such quantity that there is any possibility of the excess binder coming to the surface of the new work; no asphalt shall be placed upon such area until all such excess binder has been removed to the satisfaction of the City's Representative.

TACK COAT

It is of the utmost importance that the tack coat shall be applied (in accordance with AS 2734, Section 5) uniformly and thinly over the whole area to be treated. It shall be applied only to a clean, dry surface. The tack coat is required to be applied to all base course surfaces, old seals and asphalt surfaces.

Splash guards shall be supplied and used to protect property (i.e. Kerbs, etc.), traffic and adjoining work from damage. the City's Representative shall direct the length of tack coat which may be put out beyond the point at which the spreading of asphalt is to be undertaken and the period of time which must elapse before spreading commences on the tack coat. The length of tack coat permitted ahead of the work shall be determined, having regard to all the conditions at the site of the work and possibilities of damage to the tack coat. Traffic control must be undertaken to prevent damage to vehicles and to maintain the tack coat.

In dusty conditions, every precaution shall be taken to avoid freshly tack coated surfaces from being contaminated by dust or other wind blown foreign material.

No asphalt shall be laid on the tack coat until, in the opinion of the City's Representative, the emulsion has broken and the water has been substantially evaporated.

The Contractor shall arrange the work in order to provide a period of time between the application of a tack coat and the laying of asphalt, which will meet these requirements. The laying of asphalt on to the newly laid tack coat will not be permitted under any circumstances.

When directed by the City's Representative, preparatory to re-surfacing those areas in which there are departures of more than 20mm from a three (3) metre straight edge, a separate regulating course shall be placed for the correction of both longitudinal and transverse pavement shape.

The application rate shall fully surface the surface with a residual binder content of 0.1 L/m² (general criteria).

TRANSPORTATION OF THE MIXTURE

The mixture shall be transported from the mixing plant to the work in tight vehicles with metal bottoms previous cleaned of all foreign materials. When directed by the City's Representative, the vehicles shall be suitably insulated. Each load shall be covered with canvas or other suitable material of sufficient size to protect it from the affects of the weather. The inside surface of all vehicles used for hauling the mixture, may be lightly lubricated with a thick oil or soap solution just before loading, but excess of lubricant will not be permitted. No loads shall be sent out so late in the day as to interfere with spreading and compacting the mixture during daylight.

The temperature of the asphalt as delivered to the point of spreading, shall not vary more than 15°C and shall not be less than 120°C or more than 165°C. Any loads outside the allowable range of temperature, or shows signs of drainage of the binder, will be rejected and shall not be placed on the road.

PLACING OR SPREADING OF THE MIXTURE

Prior to delivery of the mixture, the prepared base shall be cleaned of all loose or foreign material.

The mixture shall be laid upon a base which is clean and dry and only when weather conditions are suitable and atmospheric temperature above 10°C, except under special circumstances as approved by the City's Representative. Mixing and placing of asphaltic concrete 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 asphalt shall be spread as to produce a layer of specified compacted thickness, and tamped by means of a power driven spreading machine in the highest elevation of the cross section of the pavement. It shall spread without tearing, gouging or shoving to produce a surface free from waves, depressions or other defects.

A corrector course may be required where there are departures from the design thickness by more than 20mm from a three (3) metre straight edge. The corrector thickness shall not be greater than five (5) times (x) the largest aggregate dimension.

The mixture shall be spread to such lines, level and camber as detailed in the approved drawings or as directed by the City's Representative.

Adjoining the edge of a lane which has been spread, tamped and rolled the asphalt shall be spread to a thickness, making due allowance for compaction as required, such that after compaction the finished surface shall comply with this Specification.

Adjoining a lane which has been spread and tamped but the outer edge of which has not been completed, the asphalt shall be spread to the height of the unrolled material at that edge (see longitudinal joints).

The spreader shall be so operated that material does not accumulate along the sides of the receiving hopper. Any mix in or under the machine which has become cold due to delay in the transport of the mix, or for any other reasons, shall be removed. Where the end of the spread material has cooled due to delay in the delivery of the mix, or when resuming work on the next day, a transverse joint shall be formed by cutting the spread material to a vertical face before any fresh mix is spread. More than one longitudinal joint will not be permitted if the total width of paving is less than 7.4 metres.

In the event of faulty operation of the mechanical spreader causing irregularities in the spread material, work shall be suspended until the fault is rectified. If the irregularities are of a minor nature and the source has not cooled appreciably, it will be permissible to spread a thin layer of fresh mix by hand, level it with board rakes and roll quickly. Should this treatment fail to produce a surface of acceptable texture and regularity, or if the faults left by the spreader are of appreciable depth, then the defective surface shall be removed, and fresh material shall be laid as previously described.

The temperature of the mix when it is tipped into the spreader shall not be less than 135°C. Spreading shall proceed without undue delay and initial rolling of the mix shall commence at a temperature of not less than 120°C.

Section 3 - Construction Standards and Specifications ...

Immediately after any mat is spread, and before roller compaction is commenced, the surface shall be checked, and inequalities adjusted, all fat, sandy, segregated, hungry or dusty accumulation from the paver removed by rake or hoe, and replaced with satisfactory mix. Irregularities in alignment and grade along the outside edge shall be corrected by the addition or removal of mix before the edge is rolled. A competent worker who is capable of performing the work incidental to the correction of all pavement irregularities, shall be employed. Special attention shall be given to the straight-edging of each course immediately following the initial rolling.

In narrow base widening, deep or irregular sections, inter-sections, turn-outs, or driveways, where it is impracticable to spread and finish, level, or surface mixtures by machine methods, acceptable hand methods may be used as directed or approved by the City's Representative.

Where any mix is to be spread by hand, it shall be dumped on a steel dump board outside the area on which it is to be spread. The mix shall immediately be distributed into place in a loose layer of uniform density and to the correct levels. It shall be distributed into place by means of hot shovels and spread with hot rakes in a loose layer of uniform density and correct depth. Tines of the rake shall be not less than 12mm longer than the loose depth of mixture and spaces between tines shall not be less than the maximum diameter of aggregate particles except that in no case, should spaces be less than 25mm. "Slinging" of mix from shovels shall be avoided. It shall be spread without tearing, gouging or showing to produce a surface free of waves, true to line, level and camber. All coarse aggregate remaining on the surface shall be removed and the surface adjusted as directed by the City's Representative after spreading and prior to compaction. A heated steel hand tamper shall be kept on the job for use in places inaccessible to the roller.

Loads shall not be dumped any faster than they can be properly handled.

Workers shall not be permitted to stand on the hot mixture and the raking shall be carried out in a careful and skilful manner such that after the first passage of the roller over the raked mixture, a minimum amount of back patching will be required.

Placing of the mixture shall be as continuous as possible and to the full satisfaction of the City's Representative. The roller shall pass over the unprotected edge of the fresh laid mixture only when laying of this course is to be discontinued for such length of time as to permit the mixture to become chilled.

The Contractor is required to remove all debris, waste and surplus material from the site and to leave all structures, kerbs and other surfaces clean and intact/undamaged.

COMPACTION

Uniform compaction to the required density shall be achieved before the temperature of the mix falls to 80°C. The Contractor shall ensure that the complete operation from mixing to final compaction is maintained within the specified temperature ranges.

If the Contractor is unable to complete compaction of the mixture at a temperature above 80°C, work shall cease unless the Contractor can prove to the satisfaction of the City's Representative that the specified compaction is being attained at the lower temperature.

INITIAL COMPACTION

After spreading, the mixture shall be thoroughly and uniformly compressed as soon after being spread as it will bear the roller without undue lateral displacement. For compaction the mix shall be rolled uniformly with not less than two coverages of a self-propelled, reversible, smooth steel wheel tandem roller. Tandem drum vibrating rollers operating at 30 - 50 Hz may be used.

The Contractor shall provide a minimum of one steel roller and one (1) pneumatic tyred roller (as described in Appendix 1) for each asphalt paver in use on the job, but the City's Representative may require the provision of additional rolling equipment if, in his/her opinion, the rollers on the job are not obtaining the required compaction of the mixture.

For compacting confined areas, the Contractor shall provide a small roller and/or a mechanical impact type or vibrating type hand-operated compactor of size and mass acceptable to the City's Representative.

Undue delays in rolling freshly spread mixture will not be tolerated. Initial compaction of the asphalt shall be achieved using the self propelled steel wheel roller. Rolling shall start longitudinally at the sides and proceed toward the centre of the pavement overlapping on successive passes by at least 150mm. Successive passes of the roller shall be of slightly different lengths. A minimum of three (3) passes shall be completed as soon as practicable but before the asphalt temperature falls below 110°C. Subsequent to at least three (3) passes of the static wheel roller, rolling shall be carried out using the pneumatic tyred roller.

PNEUMATIC TYRED ROLLING

Where the width of the pavement permits, it shall be subjected to diagonal rolling in two (2) directions with a tandem roller weighing not less than 10 tonnes, the second diagonal rolling crossing the lines of the first.

Immediately following the completion of the breakdown rolling and while the asphalt mixture is still hot, the mixture shall be rolled with not less than 12 coverages of a self-propelled pneumatic tyred roller weighing not less than 10 tonnes ballasted and having tyre pressure of not less than 600kPa.

The roller shall be equipped with heavy duty smooth tread square section tyres and shall be capable of speeds up to 10km/hr. The speed of the steel wheeled roller shall not exceed 5km/hr or 10km/hr in the case of a pneumatic tyred roller and shall be at all times slow enough to avoid displacement of the hot mixture. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall at once be corrected by the use of rakes and of fresh mixture where required. Rolling shall proceed continuously until all roller marks are eliminated and no further compression is possible.

All coverages of pneumatic tyred rolling shall be completed prior to the temperature of that particular area of the mat falling below 90°C. An accurate shielded pavement temperature thermometer shall be provided by the Contractor for the use of the City's Representative.

FINAL ROLLING

A self-propelled smooth steel roller, weighing not less than 10 tonnes, as specified shall be used for rolling the asphalt as soon as the temperature will permit after pneumatic tyred rolling to produce a smooth, dense and tight surface.

Final rolling shall consist of not less than four (4) coverages of the steel roller, but in any case, shall be sufficient to remove all pneumatic tyred roller marks. Final rolling shall be completed prior to the mat temperature falling below 85°C.

ROLLING GENERAL

All rolling shall be carried out in an orderly and systematic pattern immediately behind the spreader commencing at the outer side of the land and overlapping on successive trips by at least one half of the rear wheel of the roller.

Under no circumstances shall rolling with steel wheel rollers be continued if the asphaltic concrete begins to shove and crack. The spread of the rollers shall, at all times, be slow enough to avoid displacement of the mix and shall not be greater than 5km/hr.

The wheels of the roller shall be kept wet and clean during rolling. All rollers shall be used with their driving wheels nearest to the spreader. Rollers shall not be left standing on the new work surface where there is any risk of the surface being damaged thereby. The practices detailed in AS 2734.8 shall be taken as a guide to rolling practices.

To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened without an excess of either oil or water. The rollers shall be in good condition, capable of reversing without backlash. They shall be operated by competent and experienced roller drivers and shall be kept in continuous operation as nearly as practicable in such a manner that all parts of the pavement shall received substantial equal compression. Parking of rollers on recently rolled work will not be permitted.

TAMPING

Along kerbs, channels, headers, manholes and similar structures, and at all places not accessible to the roller, thorough compactions shall be secured by means of hot tampers and at all contacts of this character the joints between these structures and the mixture must be effectively sealed.

In all areas inaccessible to normal rolling equipment special techniques such as the use of heated hand tampers, light hand held rolling equipment and the like shall be used to achieve the surface finish and degree of compaction specified for other areas. Particular care shall be used in such areas and only experienced staff shall be employed.

Any course after final compaction shall be smooth and true to the established levels crown and grade. The course shall have the thickness as detailed on the drawings and shall at no point vary more than + 5 mm -2mm.

Any low or defective areas shall be immediately remedied by cutting out the defective area and replacing it with fresh, hot mixture which shall be immediately compacted to conform with the surrounding area and shall be thoroughly bonded to it. The surface of the finished course shall be free from depressions exceeding 5mm as measure with a three (3) metre straight edge. Notwithstanding, the above, the surface shall be free draining at all times.

After final compaction, the finished work shall at no point have a density of less than 97% of the Marshall maximum density. On pavements using 7mm or 5mm mixes, the insitu void ratio of the finished work shall be within the range specified.

All test holes shall be cleaned out and filled with fresh, hot mixture which shall be immediately compacted to conform with the surrounding area.

COMPACTION STANDARDS

The asphalt shall be compacted to a density of not less than 98% of the Marshall density as determined by AS 2150.

Core samples of the compacted asphaltic concrete will be taken and the field density determined. The samples will be taken for the full depth of the asphaltic concrete and may be either approximately 150mm² or 100mm \varnothing cores. All density holes shall be repaired as specified for small defective areas, by and at the cost of the Contractor.

Particular care shall be taken at all joints to ensure the compaction standard specified is met at joints. Core samples may be directed to be taken at any joint at the discretion of the City's Representative.

JOINTS

Joints shall be constructed in such a manner that they are waterproof. The finished surface at all joints shall have the same texture, density and smoothness as elsewhere.

Except for joints with a previous days work, all joints shall be formed while the asphalt is hot and in a readily compactable condition, and when the temperature of the mix is greater than 90°C.

Asphalt shall be spread in such a manner as to minimise the number of the joints in the carriageway, and unless otherwise specified or the City's Representative consents otherwise, the layout of joints shall conform to the following requirements:

- (a) Longitudinal and transverse joints shall be made in a careful manner, well bonded and sealed. Joins between old and new pavements or between successive days work, 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 as to expose a fresh surface, after which the hot mixture shall be placed in contact with it and raked to a proper depth and grade. Hot smoothers or tampers shall be employed to heat up the old pavement sufficiently without burning, to ensure a proper bond.
- (b) Before placing the mixture against surfaces of longitudinal joints, kerbs, gutters, headers, manholes or other surfaces, the contact surfaces shall be painted with the thin uniform coating of hot bitumen or cutback, as directed by the City's Representative.
- (c) In making the joint along an adjoining edge of kerb, gutter or pavement, just enough of the hot material shall be carried back to fill any space left open. This joint shall be set-up with the back of a steel rake to the height and level necessary to receive the maximum compression under rolling. The work of

setting up this joint shall be performed always by competent workmen, who are capable of making a correct, clean and neat joint.

- (d) Any longitudinal joint on the first strip laid which is knocked down by traffic or rolling shall be cut back to its full depth so as to expose a fresh surface before additional materials are laid alongside it.
- (e) All longitudinal joints shall be parallel to the centre line of the carriageway. 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 mis-direct traffic from the design travel paths. Jointing in critical traffic path areas shall be approved by the City's Representative prior to the placing of the wearing course. 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.
- (f) Where asphalt is required to match 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. Where required, the Contractor shall remove sufficient of the existing pavement to enable a smooth riding surface across the junction.

LONGITUDINAL JOINTS

Hot Joints - When constructing hot longitudinal joints, a 150mm wide strip of asphalt along the outer edge of each lane shall not be rolled until after the adjoining lane has been spread. The longitudinal joint shall then be constructed by rolling the 150mm wide strip of asphalt simultaneously with the material in the adjoining lane.

Cold Joints - Where a hot longitudinal joint is not possible, the 150mm wide strip shall be rolled before the temperature of the asphalt has fallen below 85°C. When rolling along a free edge, the rollers should not overhang the edge by more than 50mm. Before placing the adjoining lane, the edge shall be cut back with a power saw or other approved means to expose a clean straight vertical face the full depth of the layer of course. The sawn edge shall be spray painted with a uniform thin coat of bituminous emulsion before placing the adjoining asphalt.

All longitudinal joints shall be offset from layer to layer by not less than 150mm. Where proposed lane line positions are provided longitudinal joints in the wearing course shall be made to coincide with these by the use of spreading widths corresponding with the lane widths.

TRANSVERSE JOINTS

Transverse Joints shall be at right angles to the direction of spreading, and shall be formed or sawn to a straight vertical face for the full depth of the layer or course. At a formed joint the layer or course shall be checked longitudinally with a straight edge, and if there is any loss of shape, the end of the lane shall be cut back with a power saw to remove the area with defective shape.

Before placing the adjoining asphalt in the lane, the face of the joint shall be spray painted with a uniform thin coat of asphalt.

Section 3 - Construction Standards and Specifications ...

Transverse joints shall be staggered at least six (6) metres in the various lanes across the pavement.

In any individual layer transverse joints in adjoining paver runs shall be displaced longitudinally by not less than two (2) metres.

Transverse joints in any layer shall be longitudinally displaced from any transverse joints in the layer immediately beneath. The minimum displacement shall be two (2) metres except that the City's Representative may direct a minimum displacement of up to seven (7) metres.

METHOD OF MEASUREMENT

The average rate of spreading by compacted weight over any section or sections of the job is determined by the City's Representative, shall be 24kg/m²/10mm thickness.

When ordered by the City's Representative, the asphalt supplier shall forward a signed certificate giving the following information:

- Date material supplied;
- Description of material supplied;
- Nett weight of material actually supplied;
- Ambient Temperature;
- Temperature of mix in the hopper;
- Area covered; and
- Coverage per tonne.

If the total nett weight supplied for each course over any section, as determined by the City's Representative, does not meet with the requirements of this specification, the City's Representative shall have the right to with-hold approval and/or payment for that section until he is satisfied that the requirements have been met.

11 Extruded Kerbing

11.1 Cross Sections

The following sections shall be used unless otherwise shown on the approved drawings or as directed by the City's Representative but shall approximate to:

Mountable.....	300mm base x 115mm back
Semi-Mountable.....	250mm base x 150mm back
Barrier Kerb	200mm base x 150mm back
Flush Kerb.....	300mm base x 150mm high

Heights referred to are above finished final seal levels.

See drawings STD-RD01 on page 84, STD-RD02 on page 85, STD-RD04 on page 86 and STD-RD08 on page 87 for standard kerb details.

11.2 Materials & Construction

QUALITY OF CONCRETE

All concrete used shall be supplied in a ready mixed state and shall comply with the requirements of 'AS 1379: Specification and Supply of Concrete'. All concrete used in the works shall develop a minimum compressive strength of 32 MPa at 28 days with a maximum slump of 90mm.

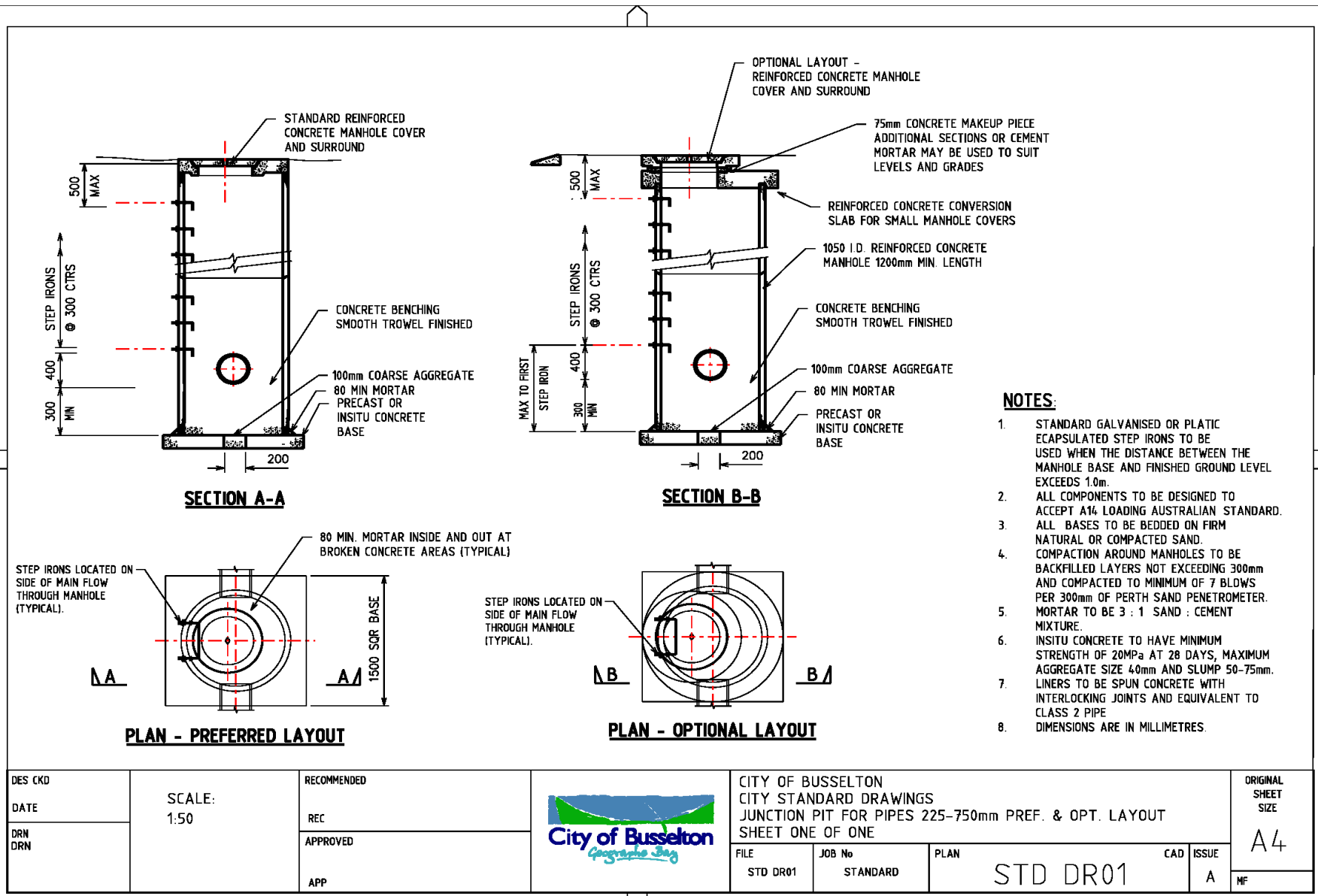
Where flush kerbing is to be used which could carry loadings, on a regular basis, the strength should be to 32 MPa at 28 days with steel reinforcing. Three (3) 10mm steel rods are to be placed centrally for added strength.


TOLERANCES

The finished product shall be true to the dimensions specified and shall be a smooth finish. The tolerances for kerbing shall be in accordance with the following requirements:

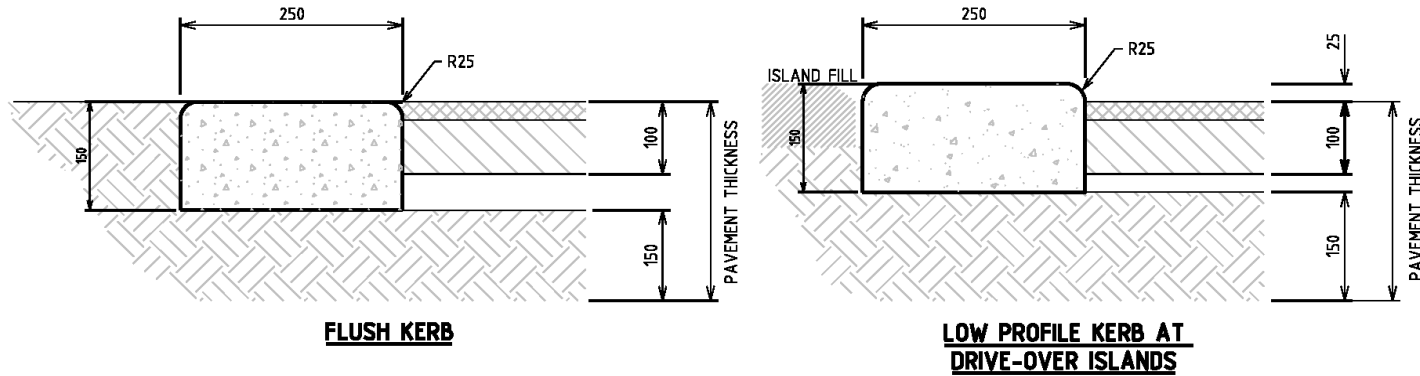
- the top surface of the kerb shall be parallel to the ruling grade of the pavement and shall be free from depressions exceeding 5mm when measured with a 3m straight edge;
- level $\pm 5\text{mm}$;
- line $\pm 10\text{mm}$ to face of kerb or gutter line; and
- cross section dimensions $\pm 5\text{mm}$.

Section 3 - Construction Standards and Specifications ...



DES CKD	SCALE: 1:50	RECOMMENDED		CITY OF BUSSELTON JUNCTION PIT FOR PIPES 225-750mm PREF. & OPT. LAYOUT SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE	JOB No	PLAN	A4
DRN DRN		APPROVED		STD DR01	STANDARD	STD DR01	
		APP				MF	

Section 3 - Construction Standards and Specifications ...



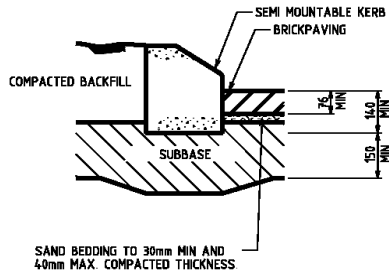
NOTES:

1. CONCRETE FOR KERBING SHALL CONFORM TO AS 1379
2. MINIMUM COMPRESSIVE STRENGTH 25 MPa AT 28 DAYS.
3. MAXIMUM AGGREGATE SIZE 10mm
4. MAXIMUM SLUMP 80mm
5. KEYED KERBING SHALL BE PROVIDED WHERE RADIUS OF CURVATURE IS LESS THAN 40m. KEYS SHALL BE PROVIDED AT MAXIMUM 1m CTRS ON KERB CENTRELINE.
6. EXPANSION JOINTS SHALL BE PROVIDED AT 5m CENTRES AND SHALL CONSIST OF A FOAM FILLED, MASTIC SEALED GAP 12mm WIDE CUT TO THE FULL DEPTH OF THE KERB.
7. CONTRACTION JOINTS SHALL BE PROVIDED AT 2.0m CENTRES, CONSISTING OF A GROOVE TROWELLED INTO THE CONCRETE SURFACE.
8. KERB TYPES ARE AS INDICATED ON THE DRAWINGS.
9. ALL DIMENSIONS ARE IN MILLIMETRES
10. RIGHT HAND SIDE INDICATES FACE OF KERB.

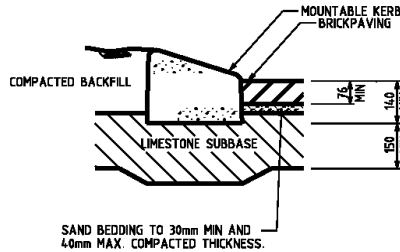
B: SHIRE CHANGED TO CITY, MPa CHANGED TO 25

DES CKD DEC 14	SCALE: NTS	RECOMMENDED REC		CITY OF BUSSELTON CITY STANDARD DRAWING FLUSH AND LOW PROFILE KERBING SHEET ONE OF ONE			ORIGINAL SHEET SIZE A4
DRN LM		APPROVED APP		FILE STD RD02	JOB No STANDARD	PLAN STD RD02	CAD ISSUE B

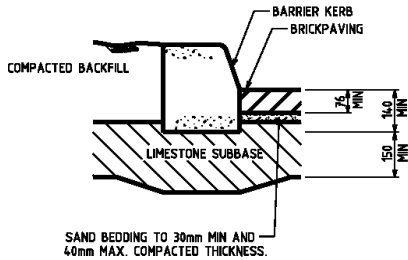
Section 3 - Construction Standards and Specifications ...



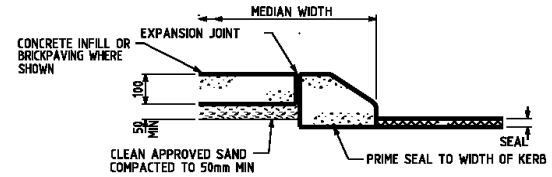
SEMI MOUNTABLE KERB AT BRICKPAVING
SCALE: 1:20



MOUNTABLE KERB AT BRICKPAVING
SCALE: 1:20



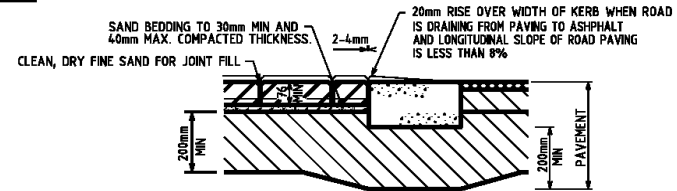
BARRIER KERB AT BRICKPAVING
SCALE: 1:20



SEMI MOUNTABLE KERB AT MEDIAN
SCALE: 1:20

NOTES:

1. DEPTH OF PAVEMENT AND SEALS TO BE IN ACCORDANCE WITH CITY OF BUSSELTON TECHNICAL SPECIFICATIONS FOR SUBDIVISIONAL DEVELOPMENT.
2. REFER TO DRAWING STD RD01 & RD02 FOR FURTHER DETAILS RELATING TO KERB CONSTRUCTION
3. ALL DIMENSIONS ARE IN MILLIMETRES..

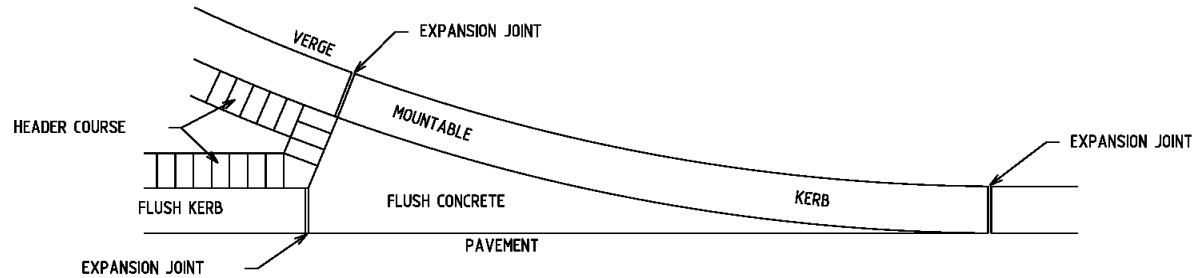


FLUSH KERB (EDGE BEAM) AT BRICKPAVING
SCALE: 1:20

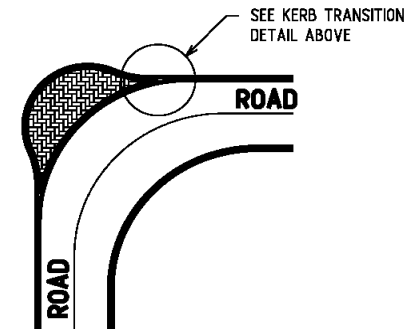
B. SHIRE CHANGED TO CITY, MPa CHANGED TO 25

DES CKD DEC 14	SCALE: AS SHOWN	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS SPECIAL KERB (EDGE BEAM) AT BRICKPAVING SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DRN LM		REC		FILE STD RD04	JOB No STANDARD	PLAN STD RD04	CAD ISSUE B
	APPROVED	APP					MF

Section 3 - Construction Standards and Specifications ...



**ENTRY STATEMENT / EYEBROW
KERB TRANSITION DETAIL**



**TYPICAL BRICKPAVED
EYEBROW**

NOTES:

1. FLUSH KERB / MOUNTABLE KERB SHALL BE CAST MONOLITHICALLY (TYP).

DES CKD	SCALE: N.T.S.	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS ENTRY STATEMENT/EYEBROW KERB TRANSITION SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE STD RD08	JOB No STANDARD	PLAN STD RD08	CAD ISSUE
DRN DRN		APPROVED					
		APP					MF

LAYING METHOD

The surface of the road and/or trench if applicable shall be thoroughly swept clean of all loose material prior to the kerb being cast, to ensure the maximum bond between the kerb and the pavement material. It is essential that adequate notice be given to the Director, Engineering and Works Services or the delegated officer for all inspections or approvals for any stage of the works. No inspections will be undertaken without at least 24 hours prior notice being given by the Superintendent or the contractor with the knowledge of the Superintendent. No kerbing is to be laid without being inspected by the City.

A string line or similar shall be pegged on an offset alignment to the kerb at sufficiently frequent intervals to ensure that the accuracy of the finished alignment conforms with the requirements given.

The Contractor shall lay the kerb so that the top of the kerb is straight and removes any longitudinal imperfections or undulations, caused through an uneven road surface. Where there is a change, road longitudinal alignment the top of the kerb shall gradually change alignment to follow the road level.

The first 150mm of any new pour shall be cut away and removed. The gap between the old and new work shall be filled by hand placing, rodding and shaping of the concrete until a satisfactory shape and finish has been obtained.

The finished product shall be generally true to the dimensions specified and shall have a smooth finish, free from porous or lean patches. The top surface of the kerb shall be parallel to the ruling grade of the pavement and shall be free from depressions greater than 5 mm when measured with a three (3) metre long straight edge.

CONTRACTION JOINTS

Contraction joints shall be constructed every 2.5 metres run of kerbing. The contraction joints shall be five (5) mm wide and deep and shall be cut through the kerb to the road surface level with an approved tool, immediately after extrusion. Care must be taken to avoid any disturbance to the edges of the joint and any such disturbance must be made good immediately.

Immediately after the contraction joints have been formed, the extruded kerb shall be finished by the application of a two (2) part to one (1) part cement slurry by means of a kerb shaped screed. The quality of sand used in the slurry mixture shall be in accordance with AS 2758.1 and AS 1141. The finishing shall bridge over the contraction joints to form a continuous cover.

EXPANSION JOINTS

Not less than 24 hours after placement of the kerb, expansion joints shall be formed by cutting completely through the kerb with a suitable cutting wheel at 5 metre intervals and at sides of drainage gullies. The expansion joints shall be 10 mm - 12 mm wide.

After inspection by the City's Representative, an approved butyl mastic compound filler and foam or polyurethane backing shall be placed in each expansion joint. Alternatively filling materials may be used if specifically approved in writing by the City's Representative.

Care must be taken to avoid any disturbance of the edges of the joint and any such disturbance must be made good immediately.

TRANSITIONAL PIECES

Transitions from one profile to another shall be made uniformly and neatly over a length of 600 mm.

CURING

The Contractor is responsible for the kerb until it has hardened. No payment shall be made for kerbing damaged by rain, vandalism or accident, before curing for 24 hours takes place.

TRENCHING

The City will require the Contractor to trench beneath extruded kerbing so that a concrete key is made into the pavement base course for all curbs with a radius less than 40m. The trench shall not be less than 150mm wide x 80mm deep and cleaned free of debris and rubble prior to laying of the kerb. The trenching and additional concrete used shall be considered an additional cost to the works and the Contractor shall provide a rate for this. Flush kerbing requires full depth trench i.e. 250mm wide by 150mm deep, so that the top of the kerb is flush with the finished final seal surface.

The road base depth underneath flush kerbing and keyed kerbing is to be maintained to ensure structural strength.

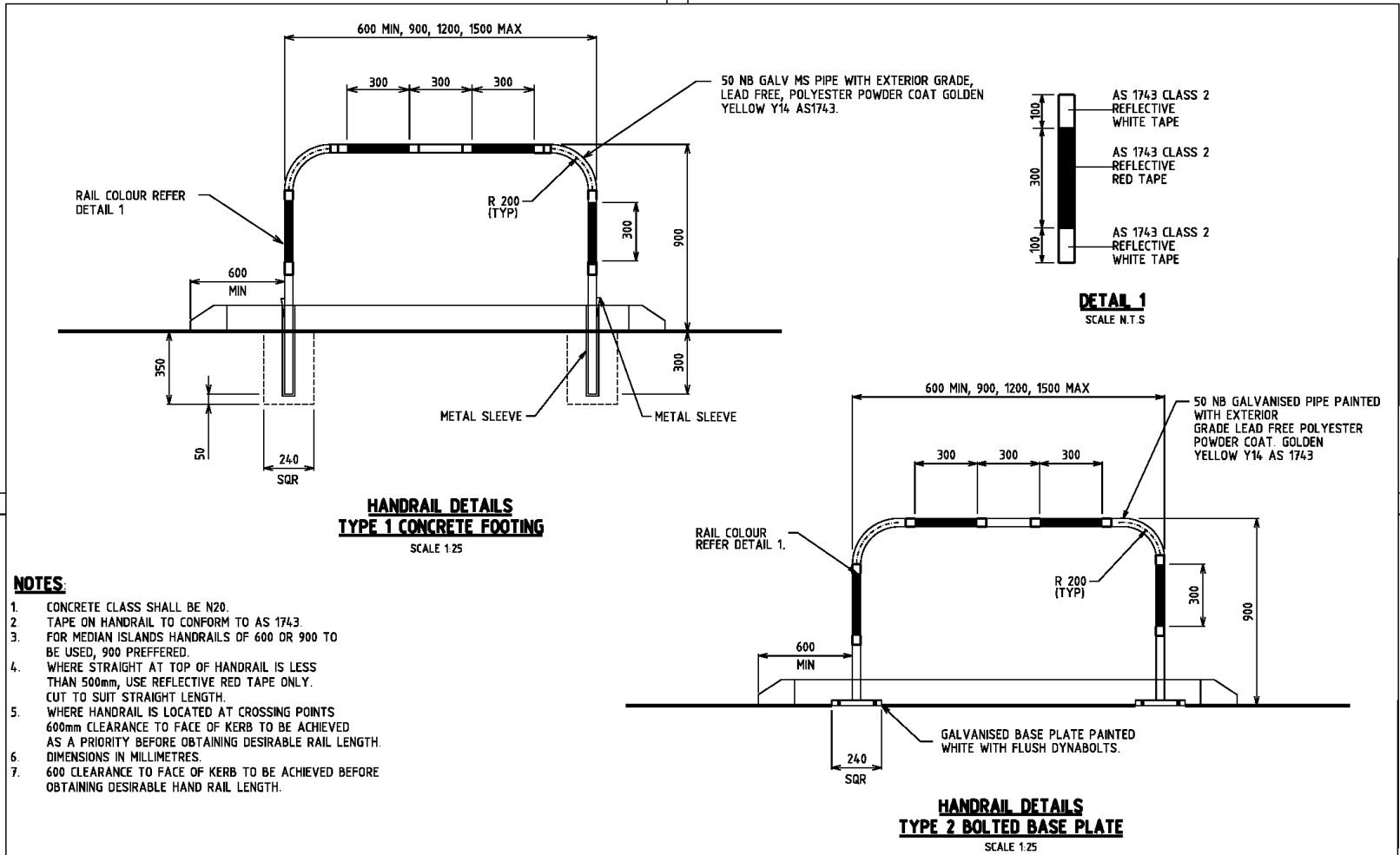
11.3 Traffic Islands/Pedestrian Ramps

Traffic or other island noses with a radius of less than 600mm are constructed to join kerbs at an angle of less than 45° the area behind the circular kerb section shall be filled with concrete to finish flush with the top of the kerb. Concrete infill shall be 150mm minimum thickness.

Pedestrian ramps are to finish flush with the road seal such that no lip is created.

Refer to drawing STD-FP07 on page 90 construction details for kerb ramps.

Section 3 – Construction Standards and Specifications ...



- NOTES:**
1. CONCRETE CLASS SHALL BE N20.
 2. TAPE ON HANDRAIL TO CONFORM TO AS 1743.
 3. FOR MEDIAN ISLANDS HANDRAILS OF 600 OR 900 TO BE USED, 900 PREFERRED.
 4. WHERE STRAIGHT AT TOP OF HANDRAIL IS LESS THAN 500mm, USE REFLECTIVE RED TAPE ONLY. CUT TO SUIT STRAIGHT LENGTH.
 5. WHERE HANDRAIL IS LOCATED AT CROSSING POINTS 600mm CLEARANCE TO FACE OF KERB TO BE ACHIEVED AS A PRIORITY BEFORE OBTAINING DESIRABLE RAIL LENGTH. DIMENSIONS IN MILLIMETRES.
 6. 600 CLEARANCE TO FACE OF KERB TO BE ACHIEVED BEFORE OBTAINING DESIRABLE HAND RAIL LENGTH.

DES CKD	SCALE: AS SHOWN	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS HANDRAIL DETAILS SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE	JOB No	PLAN	A4
DRN DRN		APPROVED		STD FP07	STANDARD	STD FP07	
		APP				MF	

11.4 Cleaning Up

The Contractor shall remove from the site any waste concrete, debris, rubbish, excavated material and the like which are the result of his/her operations, and dispose of properly as directed by the City's Representative.

All excess mortar, concrete spillage fins and trimmings shall be removed from the kerbing and the road surface.

Clean up from each discrete work site shall be effected within three (3) working days of completion of the curing compound application.

11.5 Non-Compliance

Any work not complying with the above specification shall be removed from site at the Contractor's expense and no payment for such will be made.

12Line Marking

All line marking and signage is to be approved by Main Roads WA with endorsed plans forwarded to the City. All signage and line marking is to be installed at the expense of the developer.

Sweep all surplus aggregate from the area of the lines to be marked, and clean off all dirt, clay and grease from areas to be painted.

Paint shall be a full strength proprietary brand road marking paint, formulated specifically for that purpose and include reflective particles.

Line marking for parking bays, traffic separation, etc. shall be not less than 75mm wide.

The minimum dimensions for parking bays shall be as detailed in the Town Planning Scheme unless otherwise directed by the City's Representative or the Director, Lifestyle Development.

13 Footpaths, Dual-Use Paths and Cycleways

13.1 General

Cycleways, shared paths and footpaths shall be provided in accordance with Liveable Neighbourhoods. They shall be designed in accordance with Austroads Part 6A: Pedestrian and Cyclist Paths.

The construction of cycleways, shared paths and footpaths shall be executed under the supervision of and to the direction of the City's Representative.

MATERIALS

All materials used in the construction of the works shall be in accordance with the standard specification of the City and any materials used which are inferior to those specified or as directed by the City's Representative shall be liable to rejection and replacement without payment or compensation being made to the Contractor for the supply, deliver, laying, placing, finishing, removal or disposal of anything so rejected as directed by the City's Representative.

Asphalt shall be road pavement quality and strength and includes provision for "gravel-pave".

Unsealed paths may be used in 'trail' situations where approved by the City. Such paths shall be constructed in fine (passing 10mm sieve) crushed limestone.

PREPARATION

Excavation by the Contractor shall be to the line and levels indicated on the plan or as stated in the specifications. The sub-grade shall be watered and rolled with a vibratory pedestrian roller to achieve a 95% maximum dry density and be free of depressions, sticks, stones, wet spots, rock or other deleterious materials.

All surplus materials to be removed from site at Contractors expense, and taken to the nearest City waste disposal site.

Arrangements to notify and seek alterations, adjustments or relocation of any service authority manholes, plugs, tap boxes or the like must be made by the Contractor direct with the appropriate local supervision by that Authority.

DIMENSIONS

Cycleways shall be constructed 2.5m wide, dual use paths 2.0m wide and footpaths 1.5m wide. The crossfall of the path to be constructed shall be 1% + 1% and – 0.5% unless directed otherwise by the City's Representative.

The minimum thickness of the concrete pavement is to be as shown on standard drawing STD-FP04 on page 99. Where vehicle access to properties is to be constructed, the depth is to be 100mm and where paths cross existing crossovers, the depth shall be to 110mm, and in accordance with the separate Standard and Specification 4 - *Crossovers*. At intersecting streets, the path is to extend around the sweep to the tangent point on the intersecting

road. Pedestrian ramps to be constructed 2.0m wide and shall be constructed at all crossing points with a slope of not greater than 1:10.

Concrete is the standard construction in residential areas with crossovers, developed verges, utility service manholes and regular vehicle access.

SAND BED

The path is to be placed on a prepared compacted sand bed. The Contractor will shape the sand bed and screed to profile and crossfall and consolidate to provide the finished pavement thickness. Compaction to be tested to six (6) blows/300mm with Perth penetrometer. Required compaction will be easier at optimum moisture content. Compaction test results are to be provided to the City, prior to laying of the concrete, at the rate of 1 test per 50 lineal metres from a NATA registered laboratory. Concrete is not to be laid on those sections of sub-grade not achieving the minimum compaction standard.

The longitudinal profile shall be established in relation to the extruded concrete kerb where laid or crossover levels where no kerb has been laid, or generally following the natural surface where the site is unimproved.

13.2 Concrete Path Construction

GENERAL

The concrete used in this construction shall be provided by a pre-mixed concrete company working to Australian Standards, delivered at the site of the works in company concrete trucks. Each batch provided shall be supported with evidence of strength, slump, aggregate size, etc.

The quality of concrete used shall be minimum produced to AS 1379 as amended for Ready Mixed Concrete. An approved early hardening accelerator admixture may be used. The minimum cement content shall be 200kg/m³. The water cement ratio shall not exceed 0.5.

Concrete shall satisfy the following specifications:-

- StrengthMinimum 25 MPa at 28 days.
- Aggregate sizeMaximum 20mm
- SlumpMinimum 75mm at delivery

The concrete to be placed and well tamped to remove all voids and to work fines to the surface for trowelling.

Concrete shall be evenly placed to the depth specified and shovelled into position continuously and spaded especially at all edges to give maximum density. No break in operations shall be permitted from time of placing to finishing except as authorised by the City's Representative.

Placement and working of concrete shall follow the Standards Australia specification and compaction of the placed concrete by the use of a vibrating screed board operating from the steel or timber edge forms will be used.

When the sand bed is dry, it is to be damped down prior to the concrete pour to minimise effect of hydration.

EXPANSION JOINTS

Transverse expansion joints shall be placed at 5m intervals for both footpaths and dual use paths along the full length of the pavement. The joints shall be 10mm wide and extend the full depth and width of the pavement and shall be filled with an approved expansion joint filler. The joint filler shall not exude bituminous material when compressed in hot weather. The following materials are approved:

- Non-Porite – Bitumen impregnated by cold solvent process
- Expandite – Flexicell
- Meljoint – Melcann

Other expansion joint fillers may be approved such as Lock joints.

Expansion joints shall be installed where the pathway abuts utility service structures, drainage pits and/or existing crossovers.

See drawing STD-FP03 on page 95 For further details.

CONTROL JOINTS

Transverse control joints shall be placed at 2.5m intervals, equally spaced between expansion joints. The control joint shall be aligned at 90° to the pavement alignment and shall be a minimum of 5mm deep and shall provide a vertical plane of weakness through the pavement. The joint shall be made by depressing an approved grooving tool into the surface of the pavement.

CONFLICT WITH EXISTING CROSSOVERS

Where a crossover is in place and is precast concrete slabs, the slabs are to be removed and carefully placed to one side of the crossover, where they shall be collected by the City. The Contractor will construct the footpath through the crossover.

If the crossover is insitu concrete and is less than 100mm thick, the Contractor shall cut out the crossover, remove it and replace the area removed with 110mm thick concrete pavement.

For all other types of crossover, the existing crossover is to be removed and the path is to be constructed through the crossover.

CROSSOVER LEVELS AND JUNCTIONS

The crossover levels will be as specified by the City's Representative but in no case shall the crossover junction at the property line be stepped unless specifically authorised by the City's Representative.

The crossover junction with the kerb face line shall be finished with an approved bull-nose section, or shall be matched to mountable kerb section as the existing situation requires. Where a dual use path is being constructed neither the kerb or the bull nose is required and a prop rail will be installed.

FINISH

A hair broom finish shall be provided to the surfaces of the slab with joints and edges polished smooth with jointing and edging tool.

The alignment of the edge of the path is to be straight and true to the planned alignment and the specified width.

Set out all string lines, form work and levels necessary to produce the specified results and finish.

A steel trowel finish is not permitted on a crossover or path.

COMPLETION

In general, the works are to be left clean and tidy. The roadway to be swept, clean of cement droppings, slurry, etc. Backfill with soil, suitable for regrowth of lawn. Reticulation is to be reinstated including adjustment of sprinkler spray outlets to avoid over spraying the path, as a matter of courtesy and to encourage a stable and maintained verge.

Surplus construction material to be removed from site. Backfill with topsoil behind path to top of pavement and screed off. Spread any surplus soil. Remove surplus concrete and construction materials. Cut back to a reasonable slope on the verge. Topsoil and turf runners or seeds shall be used as backfill and reinstatement where applicable.

PROTECTION

Protection of works and the public shall be provided by the Contractor who shall supply and keep supplied as directed all necessary signs, barricades, road warning signs, temporary bridges or any other thing necessary or as may be directed by the City Engineer and failure to provide or keep provided shall render the Contractor liable.

If wet weather threatens, the slab is to be completely covered with polythene film to prevent damage to the surface and edges.

Similarly, in hot dry weather when it is considered by the City's Representative that rapid dehydration will affect the strength and surface finish, the slab to be treated with "Calcure" D applied to manufacturer's instructions.

Under no circumstances is the road surface to be used as a mortar board for mixing cement, concrete, slurry, etc.

SUBSTANDARD WORKMANSHIP

Variation from alignment-horizontal or vertical, porous surface finish, closed expansion joints, construction joints in mid slab, concrete strength less than the specified strength, constitute substandard workmanship.

Sections of work that are unsatisfactory to be removed and replaced.

Any damage which may occur to any the City facilities or private property during the course of the works or which may subsequently become evident from the operations thereof shall be the sole responsibility of the Contractor who shall be held responsible for the repair,

replacement legal claim liability or any other thing which may arise from the carrying out of any such works.

13.3 Bitumen Path Construction

GENERAL

Dual use paths using an asphalt wearing course shall be constructed to the lines, levels and pavement design as detailed on the approved drawings.

SUB-GRADE

The sub-grade shall be boxed out and compacted so as to provide even compaction to a depth of 450mm. The compaction shall not be less than 95% of maximum dry density when measured in accordance with 'AS 1289: Methods of Testing Soils for Engineering Purposes'

WEARING COURSE

A 30mm thick wearing course of 7mm nominal aggregate asphalt shall be laid. Where "Gravelpave" is used the thickness is to be 30mm. Limestone may be used as a base material providing the surface seal thickness is increased to 30mm.

KERBING/EDGE RESTRAINT

Where kerbing is required to retain asphalt paths, it shall consist of 100mm x 25mm merchantable quality Jarrah set flush with the seal. The kerbing is to be installed on both sides including sweeps. Where a path exists the kerbing is to be continuous and the path made good up to the kerbing.

The edge of the timber kerb is to be supported by 100mm x 50mm x 300mm Jarrah pegs @ maximum 1.5m spacing. Alternatively an additional gravel shoulder 0.3m wide and 150mm consolidated thickness shall be provided to each side.

BASE

The gravel base is to be good quality, laterite gravel, free from excessive amounts of clay, vegetation silt, etc.

Gravel to have total compacted thickness of not less than 150mm in the case of a domestic car crossover, and not less than 200mm in the case of heavy vehicles using the path.

Gravel is to be spread, rolled, water-bound and corrected as necessary to shape, grade, etc. to a minimum worked depth of 100 and 150mm respectively.

Typical drawings showing construction details of footpaths are shown on drawings STD-FP05 on page 101; STD-FP on page 102; STD-FP08 on page 103; STD-FP09 on page 104; STD-FP10 on page 105 and STD-FP11 on page 106.

13.4 Pedestrian Access Way Construction

The path is to be centrally placed, not less than 2.0m wide and extend the full length of the pedestrian access-way to the adjacent road. Any deviation from this alignment requires the written approval of the City's Representative. All conditions for footpath construction apply to pedestrian access-ways where appropriate. Pedestrian access ways may also be required to be paved to accommodate a flood route.

A 150mm \varnothing white painted steel bollard, 1200mm high capped with red reflective tape, shall be placed at each entrance to the pedestrian access way on the road reserve boundary. The path shall be widened by 600mm at the bollard and tapered to normal width with a one (1) in five (5) gradient.

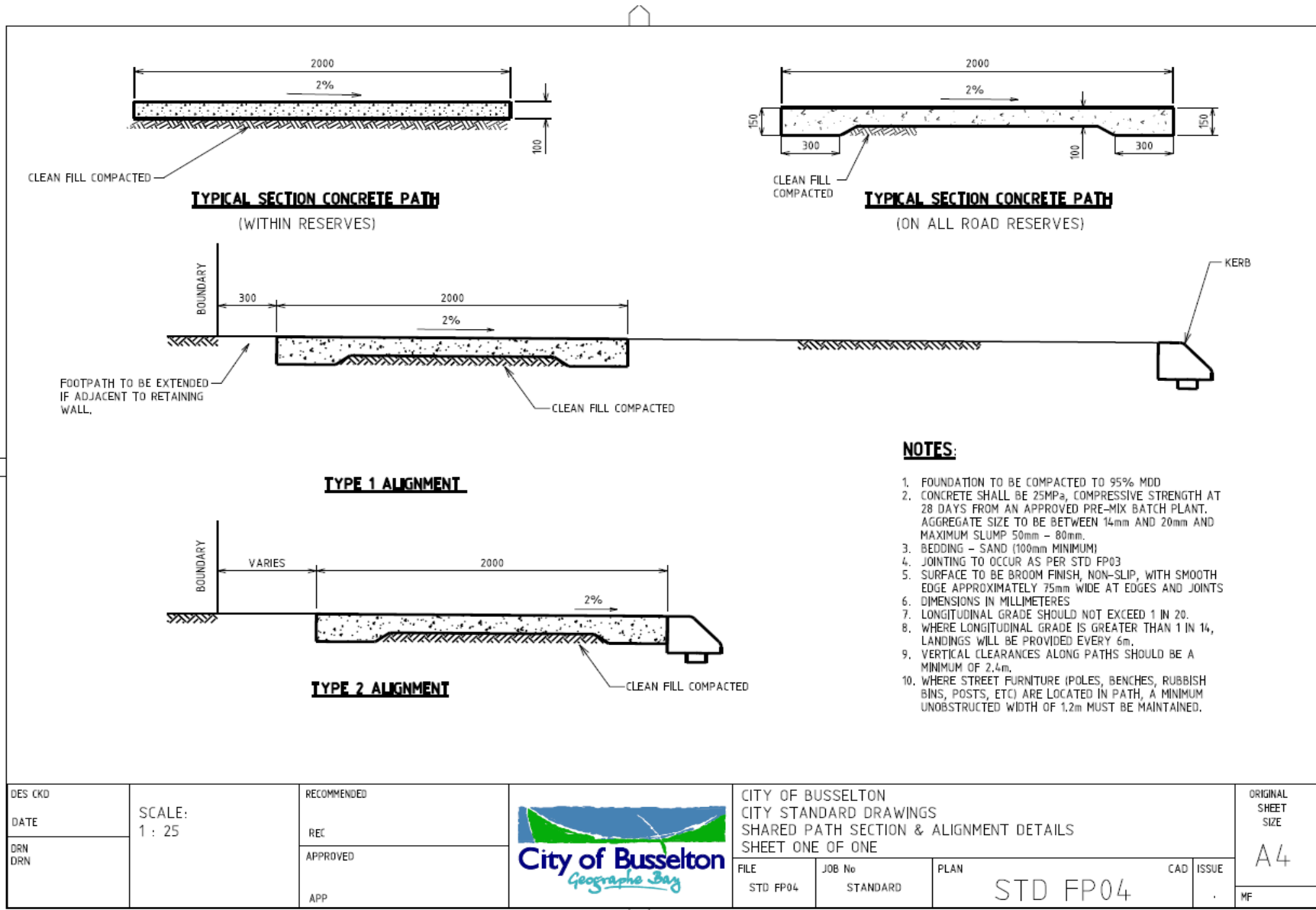
13.5 Path Tolerances

Works shall be undertaken to the following tolerances:

- (a) Vertical location of footpath in relation to 2% grade line from top of kerb + or - 10mm;
- (b) Grade across footpath shall be 1% + 1% and -0.5%;
- (c) Path surface shall be true to line and not deviate more than 10mm under a three (3) metre straight edge;
- (d) Surface irregularities, including abutting to service authority manholes, etc. shall not exceed 3mm;
- (e) Thickness: + or - 5mm;
- (f) A random testing programme will be used to check thickness and if any point is outside the tolerance, further testing shall be undertaken within that 5m section and the adjoining 2 sections on each side. Three or more additional thickness tests will be taken on each of the sections. If any of these show a reading that is outside the required tolerance, that section of footpath shall be removed and replaced with new work to this specification;
- (g) Width of footpath to be + or - 20mm.

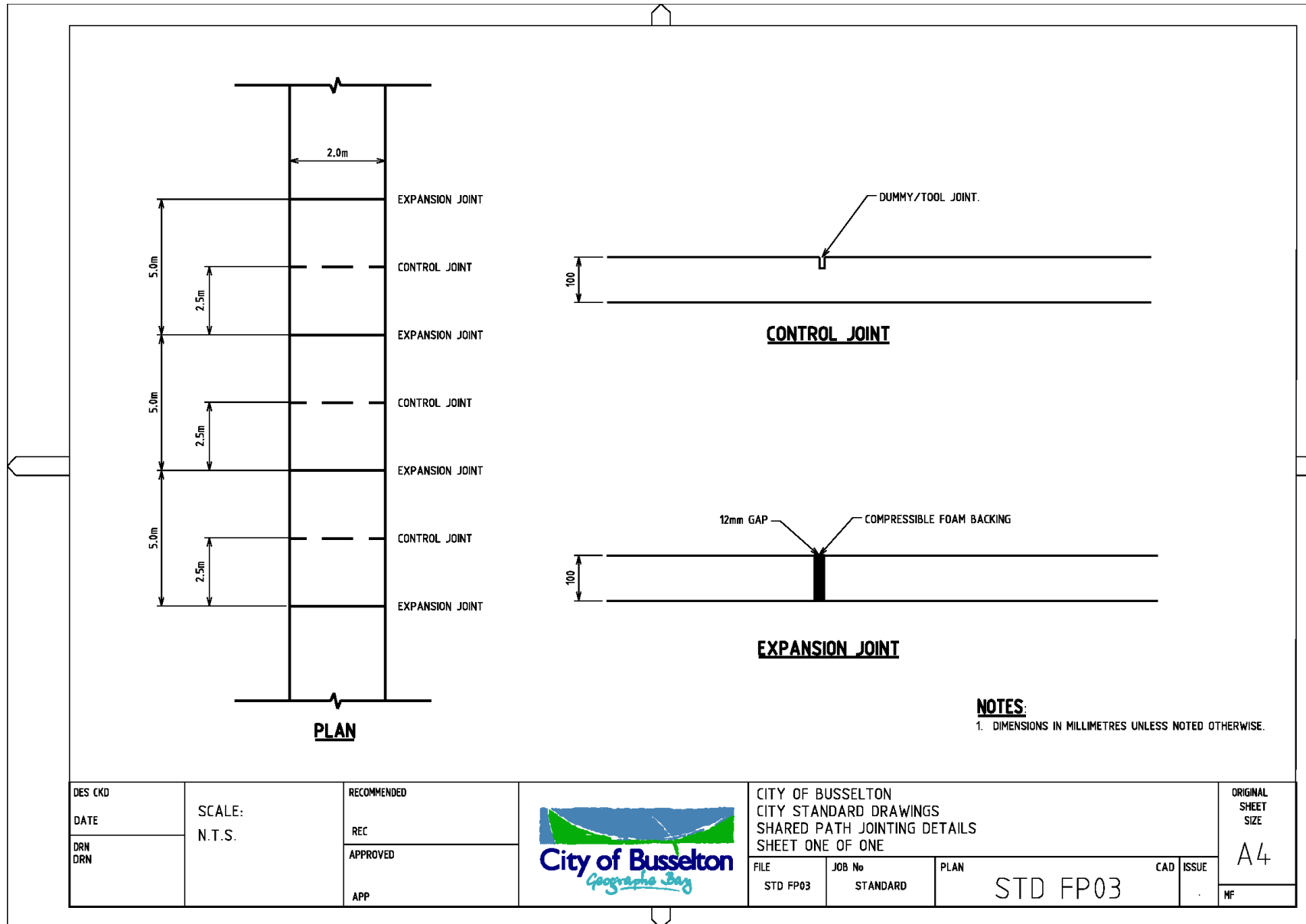
Any sections of footpath not meeting the requirements of this specification or that in the opinion of the City's Representative is of inferior quality, shall be removed from the site and replaced to the satisfaction of the City's Representative, at the Contractor's expense.

Section 3 – Construction Standards and Specifications ...

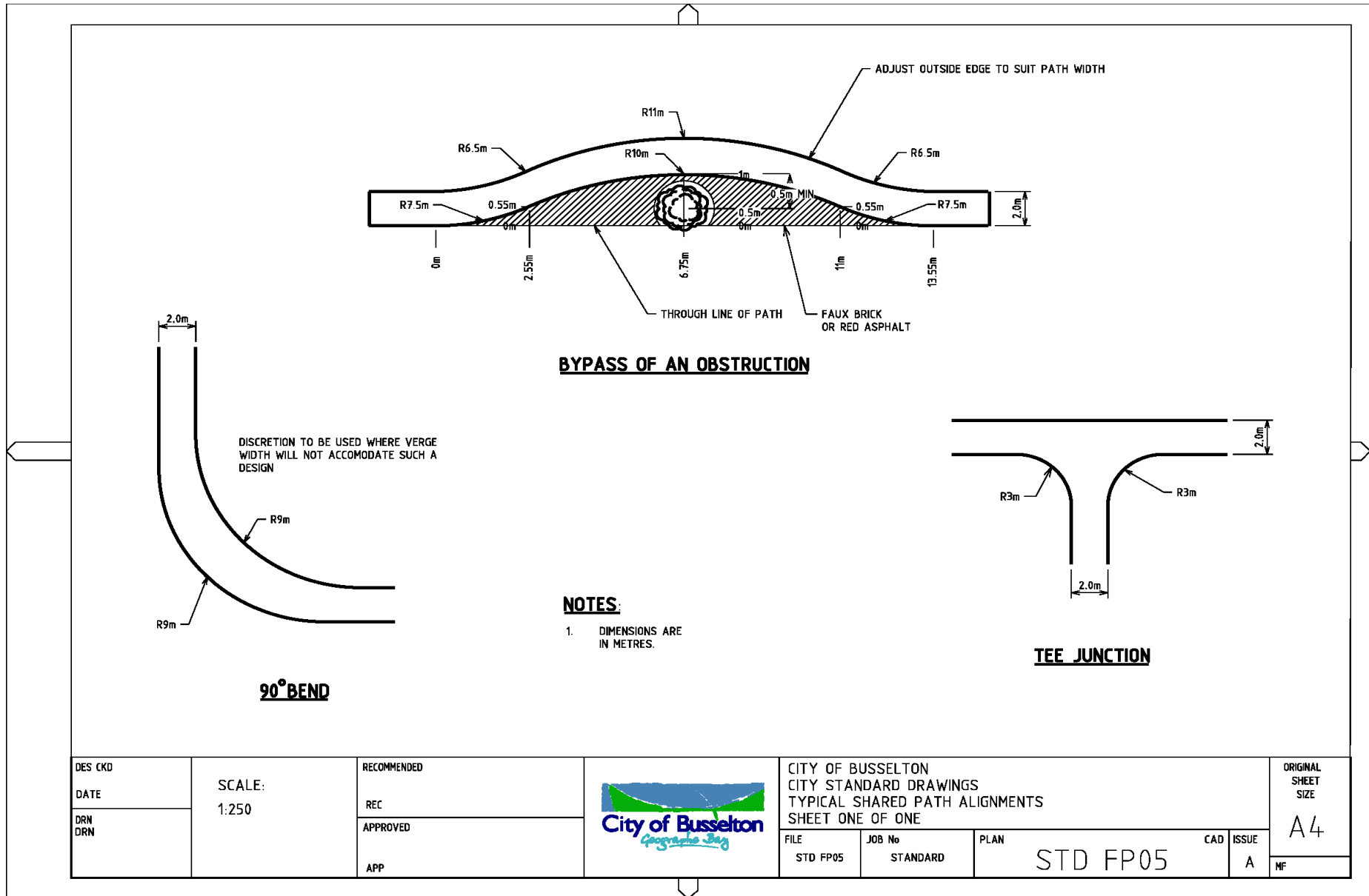


DES CKD	SCALE: 1 : 25	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS SHARED PATH SECTION & ALIGNMENT DETAILS SHEET ONE OF ONE				ORIGINAL SHEET SIZE
DATE		REC		FILE	JOB No	PLAN	CAD	ISSUE
DRN DRN	APPROVED	STD FP04		STANDARD	STD FP04	.	MF	A4
	APP							

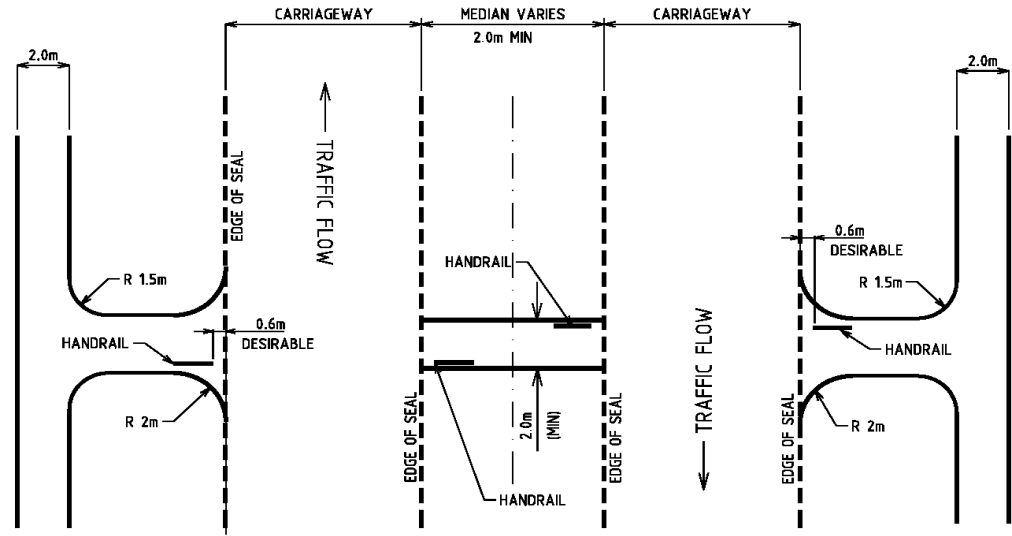
Section 3 – Construction Standards and Specifications ...



Section 3 – Construction Standards and Specifications ...



Section 3 – Construction Standards and Specifications ...



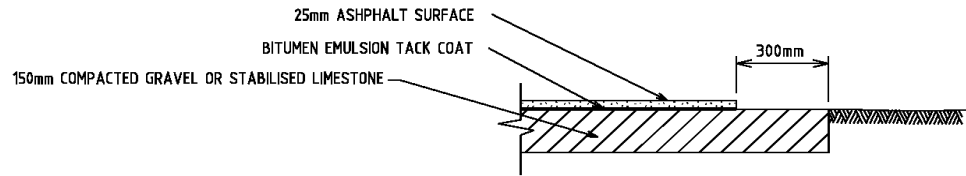
TYPICAL CROSSING AT ROAD WITH MEDIAN

NOTES:

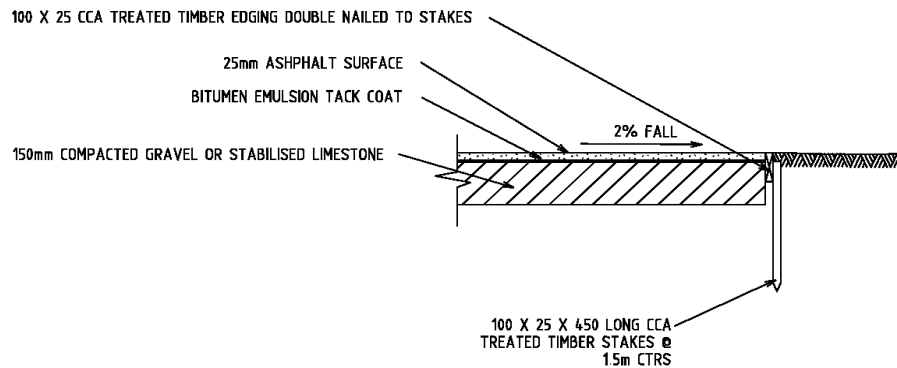
1. DISCRETION TO BE USED WHERE VERGE WIDTH WILL NOT ACCOMMODATE SUCH A DESIGN.
2. WHERE PATHS CROSS KERB FACE, PROVIDE PEDESTRIAN RAMPS TO DWG No. STD FP02.
3. HANDRAILS TO BE LOCATED ON TRAFFIC APPROACH SIDE OF CROSSING AS PER FP01.
4. FOR HANDRAIL DETAILS REFER TO DWG No. STD FP07.
5. DIMENSIONS ARE IN METRES.

DES CKD	SCALE: 1 : 250	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS SHARED PATH CROSSING TREATMENT AT ROADS WITH MEDIANS SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE STD FP06	JOB No STANDARD	PLAN STD FP06	CAD A
DRN DRN		APPROVED				ISSUE A	MF
		APP					

Section 3 – Construction Standards and Specifications ...



**TYPICAL SECTION
BITUMINOUS CONCRETE
TYPE 1**

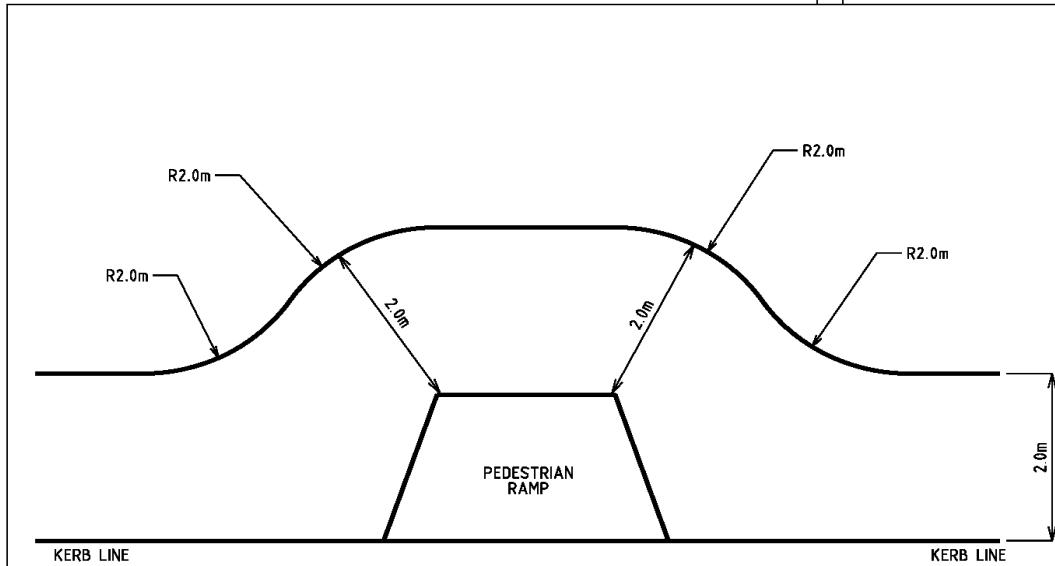


**TYPICAL SECTION
BITUMINOUS CONCRETE
TYPE 2**

NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES

DES CKD	SCALE: 1 : 200	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS TYPICAL SECTIONS BITUMINOUS SHARED PATHS SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE STD FP08	JOB No STANDARD	PLAN STD FP08	CAD ISSUE
DRN DRN		APPROVED					MF
		APP					

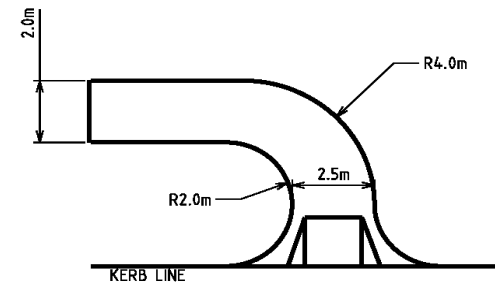
Section 3 – Construction Standards and Specifications ...



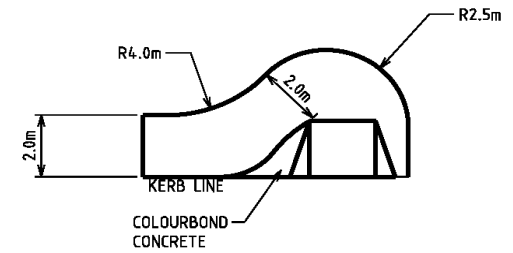
MID-BLOCK CROSSINGS
SCALE N.T.S

NOTES:

1. FOR HAND RAIL DETAILS REFER TO STD FP07.
2. DIMENSIONS ARE IN METRES.
3. FOR HANDRAIL LOCATION DETAILS REFER TO FP01



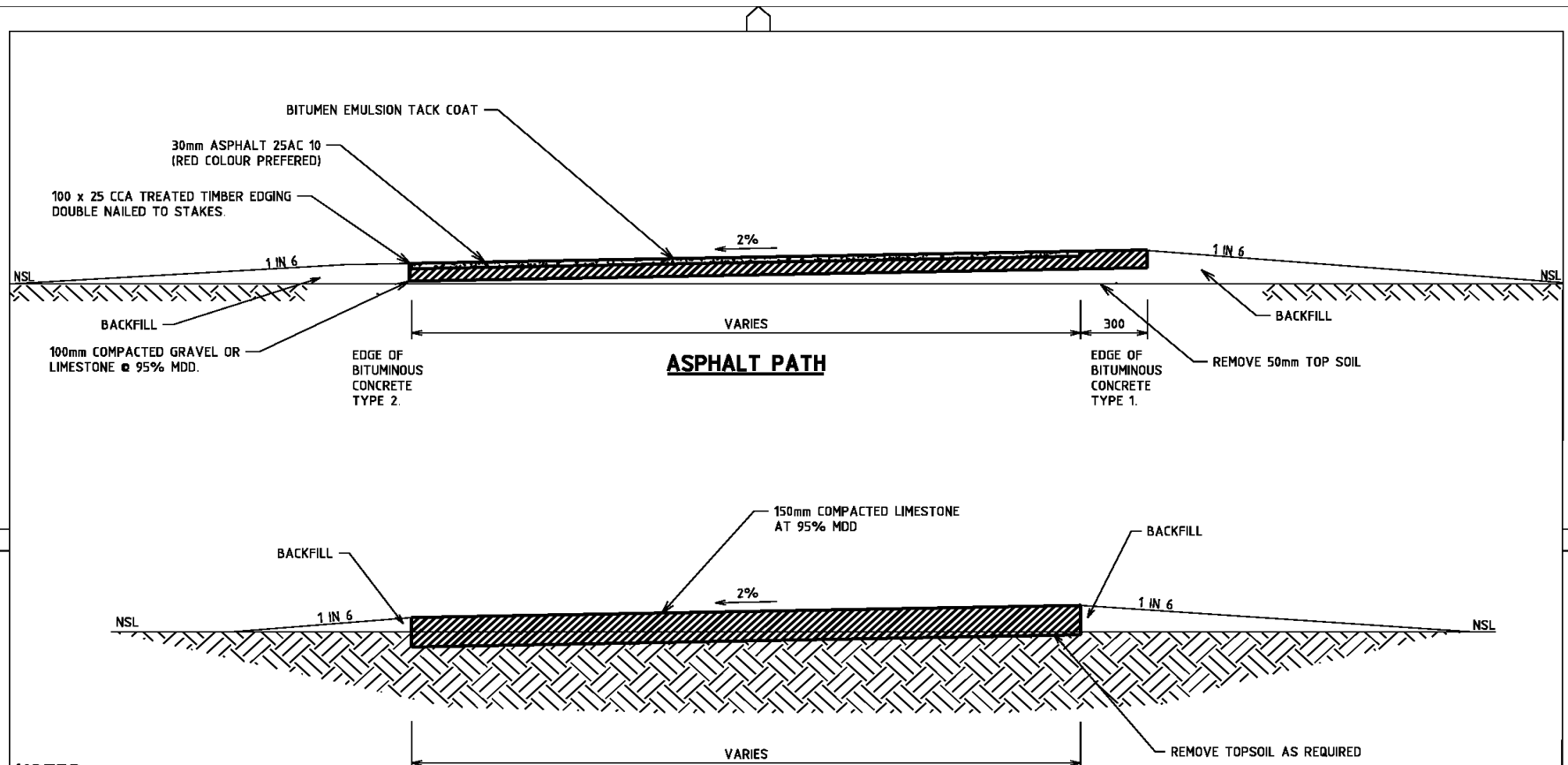
**90° TERMINATION WITH PATH
OFFSET FROM KERB**
SCALE 1:200



**90° TERMINATION WITH
PATH AT KERB**
SCALE 1:200

DES CKD	SCALE: AS SHOWN	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS WIDENING DETAILS AT CROSSING POINTS SHEET ONE OF ONE				ORIGINAL SHEET SIZE
DATE		REC		FILE STD FP09	JOB No STANDARD	PLAN STD FP09	CAD A	ISSUE A
DRN DRN		APPROVED						MF
		APP						

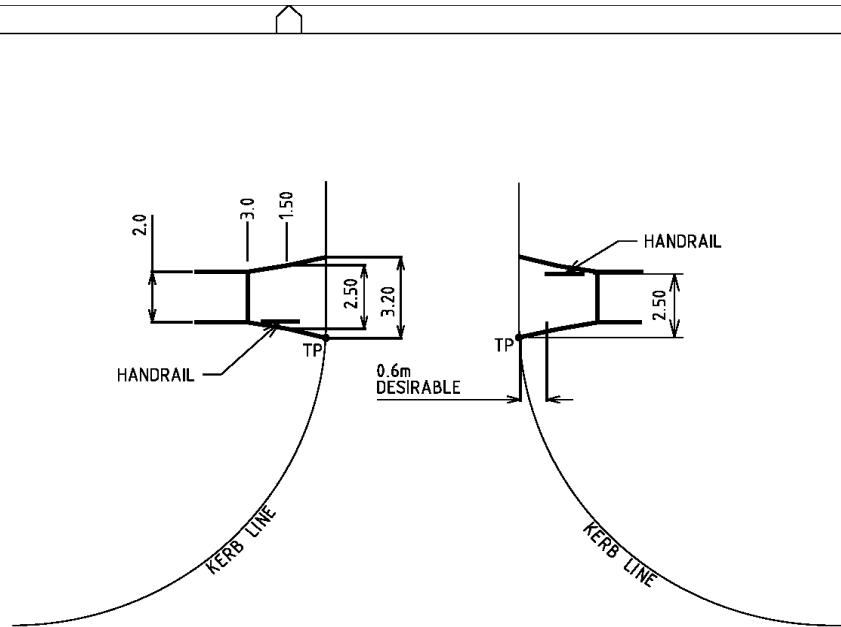
Section 3 – Construction Standards and Specifications ...



NOTES:
1. ALL DIMENSIONS ARE IN MILLIMETRES

DES CKD	SCALE: 1 : 25	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS BITUMEN AND LIMESTONE PATH TYPICAL SECTION SHEET ONE OF ONE			ORIGINAL SHEET SIZE	
DATE		REC		FILE	JOB No	PLAN	CAD	ISSUE
DRN DRN		APPROVED		STD FP10	STANDARD	STD FP10	A	A4
		APP					MF	

Section 3 – Construction Standards and Specifications ...



TYPICAL LOCAL ROAD CROSSING

NOTES:

1. FOR HANDRAIL LOCATION REFER TO STD FP01
2. FOR HANDRAIL DETAILS REFER TO STD FP07
3. ALL DIMENSIONS IN METRES

DES CKD	SCALE: 1 : 250	RECOMMENDED		CITY OF BUSSELTON CITY STANDARD DRAWINGS TYPICAL LOCAL ROAD CROSSING SHEET ONE OF ONE			ORIGINAL SHEET SIZE
DATE		REC		FILE STD FP11	JOB No STANDARD	PLAN STD FP11	CAD ISSUE REV
DRN DRN		APPROVED					MF
		APP					

14 Brick or Block Pavement

14.1 General

Brick (clay) or block (concrete) pavements are permitted in selected locations as approved by the Director, Engineering and Works Services. Products used shall be from manufacturers of certified, tested and proven products. The use of bricks or blocks may be either feature of function based and for footpath or road use and designed accordingly.

Brick or block pavements shall be constructed to the manufacturer's specifications and to the lines and levels shown on the approved drawings or as required by the City's Representative. The levels shall be such that the pavement will be free draining onto the adjacent road even after re-sheeting of that adjoining road with 30mm of asphalt.

SUB-BASE

The sub-base where required shall be constructed in accordance with this specification and manufactures specifications, but shall generally be not less than 200mm thickness of compacted limestone for roadways and 100mm for footpaths subject to occasional vehicle loads.

EDGE CONSTRAINT

Extruded concrete kerbing or restraining beam shall be constructed along all road edges of the interlocking pavement in accordance with this specification. The edge beam separating the adjacent flexible pavement shall be flush of dimensions not less than 300mm wide x 200mm deep.

BEDDING SAND

The bedding material shall be a clean well graded concreting sand passing a 7.75mm AS sieve and have a maximum of 5% passing a 0.075mm AS sieve. Bricklayers sand and single sized dune sands are not suitable. The sand shall be non-plastic and free from deleterious materials such as stones, tree roots, clay lumps and excessive organic material.

Stockpiled sand shall be protected from excessive changes in moisture content. At the time of placing, the sand shall have a uniform moisture content.

Sand shall be spread loosely to a uniform depth and screeded to the nominated design profile with sufficient surcharge to allow for compaction to a thickness of 25mm, + or - 5mm.

Bedding sand shall be screeded slightly ahead of laying of interlocking blocks and maintained in a loose condition and protected from pre-compaction including pedestrian traffic or heavy rain. Any pre-compacted sand or screeded sand left overnight shall be removed and replaced with fresh loose sand.

LAYING

Paving units shall be placed with 2-4 mm gaps between adjacent units in herringbone, maintaining correct joint alignment but without pre-compaction of the sand bedding layer. It is important that the joint width between paving units be maintained.

All full units shall be laid first. Any gaps at the pavement edge adjacent to the kerbing shall be neatly filled by cutting units to size. Small gaps less than 30% of the unit size shall be infilled with blocks cut to not less than 70% of the block size by cutting the next full block to make a fit.

COMPACTION OF PAVEMENT & JOINT FILLING

After laying, the units shall be immediately compacted and brought to level by not less than three (3) passes of a vibrating plate compactor. The plate shall have sufficient area to simultaneously cover 12 units and a suitable medium such as rubber or wood shall be placed between the vibrating plate and the pavement.

As soon as possible after compaction, sand for joint filling shall be broomed over the pavement and into the joints. Excess sand shall be removed as soon as joints are filled.

The sand used for joint filling should pass a 1.18mm sieve and have approximately 10% of silty material but be free of all soluble salts or contaminants likely to cause efflorescence or staining. For 300mm from the edge of the pavement, the joint filling shall consist of a 4:1 mix of 1.18mm sieve sand and cement.

INITIAL ACCEPTANCE OF PAVING

The finished pavement shall conform to the construction tolerances and be free draining at all times. The applicable finished surface tolerance is a maximum deviation from the bottom of a three (3) m straight edge, shall be 10mm.

The blocks shall be true to shape and not cracked. A maximum of 1% of chipped or spalled units will be accepted.

The colour of the pavement will be uniform, however, any slight differences due to different batches shall be transverse to the road centreline.

The surface texture is to be uniform throughout.

The completed running surface is to be satisfactory for the anticipated traffic with special emphasis on vehicle vibration and drumming and emitted noise.

PERFORMANCE IN MAINTENANCE PERIOD

The stability of the pavement to be such that creep movements by the blocks do not create joints greater than 5mm in width nor affect the location or stability of the kerbing or adjacent bituminised pavements. The sand filler should be stable and such as not to be eroded under normal conditions. Rotation of units to be minimal with no other detrimental effects permitted.

Edge cracking of the units is not to exceed 1% provided they do not have an adverse effect on the stability of the pavement.

Individual units should not show any sign of deterioration nor should there be signs of wear.

Skid resistance/surface polishing - The surface polishing should be minimal, however, it is imperative that the skid resistance of the surface be compatible with the adjoining bitumen roads. The minimum acceptable pendulum value is 60.

14.2 Road Paving Bricks

All testing is carried out in accordance with Australian Standards AS1226 test methods where applicable. Testing is to be carried out by a NATA registered laboratory.

Length (mm)	230
Width (mm)	110
Depth (mm)	75
Approximate weight (kg)	4.2
Average compressive strength (Mpa)	40.0
Characteristic Compressive strength (Mpa).....	327.0
Average Transverse Strength (Mpa).....	5.0
Characteristic Transverse Strength (Mpa).....	3.5
Average Cold Water Absorption (%)	9.9
Average Boiling Water Absorption (%).....	12.5
Average Bulk Density (kg / m ³).....	1950
Average Porosity (%)	25.0
Liability to Efflorescence	Nil - Slight
Average Slip/Skid Resistance (BPN ₂₀)	80

Part 15

Street signs shall be erected in accordance with the requirements and standards of the City of Busselton, **Australian Standard AS1742.5** and the “**Manual of Uniform Traffic Control Devices - Part 5: Street Name and Community Facility Name Signs**”.

Sign Specifications:

Sign Depths, Letter Heights and Types

Where the speed limit is less than 70 kph street name signs are to be as follows:

- 150mm depth blade - 100mm DN legend

Where the speed limit is 70 kph or higher street name signs are to be as follows:

- 200mm depth blade - 120mm DN legend

Busselton Central Business District (CBD):

- 150mm depth blade - 100mm 85% Century Bold

Colours

Background Colour: White (Minimum Class 1 retro-reflective)

Legend Colour: Black

Materials & Erection

- Street Name plates shall be extruded (non-corrosive) aluminium sections, not less than 3mm in thickness (similar to Jason’s JNSX 150 (150mm height) or JNSX 200 (200mm height))
- Blades are to be “diamond grade” reflective material
- Sign fittings as per drawing STD RD 09 are to be used
- Mounting brackets shall be adjustable clamps, which may be fixed to both top and bottom of the plates extruded section
- Brackets shall be suitable for attachment to Western Power timber power and light poles, galvanised steel power and light poles, or nominal 57mm (O.D) galvanised steel poles. Twin poles shall be used when blade length exceeds 900mm
- Plates shall not be drilled for mounting in any way
- When the Street Name plate is attached to a nominal 57 (O.D) galvanised steel pole then the poles shall be set vertically and located on the 2.75m street alignment. The street name plate shall be mounted a minimum height of 2.5m from the ground to the bottom of the sign
- The post shall be securely set in 450mm x 450mm x 450mm mass concrete foundation of 20 Mpa concrete strength. The top of this foundation shall be 50mm below the finished ground level

The posts shall be left for six months and then shall be painted with a single coat of metal primer and a single coat of gloss yellow exterior paint.

Street Name Signs shall be placed at 90° degree angles to roads and shall be erected at all road junctions and intersections.

Section 3 – Construction Standards and Specifications ...

Non-Standard Street Name Signs

Non-standard materials, colours, posts, etc. may be considered for new subdivisions. The City may accept design variations to standard street signage for a particular estate, subject to approval by the Director, Engineering and Works Services.

Any future replacement of non-standard Street Name Signs by Council will be carried out using standard materials.

See ben dredge re this



PLANT & EQUIPMENT SPECIFICATION

ROAD BROOM

The road broom shall be a mechanically or power driven roller broom capable of removing excess cover material and/or other loose material from the pavement surface without damage to the existing surface. The rotary drawn broom must be capable of being used as a drag broom or a drag broom must be provided. The drag broom shall be capable of distributing loose cover material laterally or longitudinally, and shall not dislodge particles bedded in the binder material or damage the pavement in any way.

POWER SPRAYER

The power sprayer shall be tested in accordance with the standards laid down by the NAASRA for the "Testing of Mechanical Sprayers of Bituminous Material". The sprayer shall have been tested for uniformity of transverse distribution and calibrated for overall rates of application.

RUBBER TYRED ROLLERS - BASE AND SEAL

Rubber tyred rollers shall be self propelled with a minimum mass of 11 tonnes and have multi wheels, each exerting a minimum load of 10 kN. The wheels shall have smooth pneumatic tyres inflated to pressures of at least 700 kPa and be fitted with scrapers and wheel washing sprays.

STEEL WHEEL ROLLERS - BASE AND SEAL

Steel wheel rollers shall be 5 - 8 tonne self propelled 3 wheeled rollers with a load / metre width of roller not exceeding 50 kN, fitted with scrapers.

PAVER

The spreading machine shall be of an approved self-propelled paver for roadworks, having an effective spreading capacity of not less than 250 tonnes of mix per eight (8) hour day. The spreading machine shall be in good condition and equipped with hoppers, distributing screws, adjustable screed and equalising devices, capable of distributing hot asphalt over the full width of the strip being spread and adjustable to transverse slope and depth as required. The machine shall also be provided with heated tamping bar for compaction of the material after spreading and screeding. The spreading machine shall be operated at a uniform rate which shall be the lowest consistent with the continuous operation of the mixing plant. The spreading of material by hand behind the spreading is not permitted except by approval of the City's Representative. It shall also containing the following features:

- Means of pushing each truck during spreading with a rapid-acting device to engage and release trucks.
- A receiving hopper into which motor trucks can discharge the mixed material.
- Distributing screws to place the material evenly in front of the screed plate, without segregation.
- Automatic tamping devices.
- An adjustable screed capable of providing a smooth even surface free from tears or other blemishes, to widths between 1.8 - 4.3 m.
- An approved heating device to control the temperature of the screed.
- Effective steering, such that the mixture can be laid to a true line.
- Forward and reverse travelling speeds of 30 m / minute.
- Means of adjusting the depth of spread between 15 - 150 mm (compacted).

COMPACTION EQUIPMENT (ASPHALT)

Self-propelled, reversible, smooth steel drum tandem roller weighing between 6-10 tonnes with a wheel loading of between 25 - 50 kN / m of roll.

- Steel static three-wheeled rollers, the wheel pressures of the rear wheels shall not be less than 60 kg/cm width.
- Steel static tandem wheeled rollers weighing not less than 10 tonnes no more than 12 tonnes. The wheel pressures of the rollers shall not be less than 45 kg/cm width.

Section 3 – Construction Standards and Specifications ...

- Pneumatic tyred multi-wheeled rollers equipped with pneumatic tyres of equal size and diameter having treads satisfactory to the City's Representative. The tyres shall be so spaced that the entire gap between adjacent tyres will be covered by the tread of the following tyre. The tyres shall be capable of being inflated to 700 kPa or such lower pressure as designated by the City's Representative and the rollers shall be so constructed that the total weight of the roller can be varied to produce an operating weight per tyre of up to 200kg. The total operating weight and tyre pressures shall be varied as directed by the City's Representative.
- Vibrating rollers each of minimum static mass of six tonnes capable of varying the amplitude and/or frequency of vibration may be used subject to approval by Director, Engineering and Works Services. Vibratory compaction shall be discontinued in areas where it is considered such vibration could cause damage to adjacent buildings or structures.
- An approved brush or similar device shall be fitted so that each tyre or roll is kept clean of foreign material and kept uniformly wet. Tyres shall be free of pit marks.

STANDARD PENETROMETER

The Standard "Perth" Penetrometer is a flat ended 16mm (5/8") diameter round steel rod drive by a 9.1kg (20lb) mass falling through a height of 600mm (24") on to an annular anvil.



MATERIALS SPECIFICATION

CRUSHED LIMESTONE SUB/BASE MATERIAL

Crushed limestone shall be obtained and crushed to comply with the grading in this specification.

The limestone shall be free from sand, loam, capstone, roots and other foreign material, and shall not contain either oversize spalls or an excessive proportion of fine grained material.

Testing

Methods of sampling and testing of crushed limestone shall be in accordance with the following Australian Standards:

- AS 1141: Methods of Sampling and Testing Aggregates
- AS 1289: Methods of Testing Soils for Engineering Purposes

Properties

When tested the crushed limestone shall conform to the following requirements:

- A resistance to abrasion when determined in accordance with the Los Angeles Abrasion Test to show a weight loss not exceeding 60% nor less than 20%.
- Calcium carbonate content shall not be less than 60% by weight.
- California bearing ratio (CBR) soaked 4 days at 94% of MDD and 100% of OMG.

Grading

The crushed limestone for sub-base shall comply with the following grading requirements:

Sieve Size (Square Opening AS Sieve)	Percent Passing By Weight
75mm	100%
19mm	55-85%
2.36mm	35-65%

DEFECTIVE MATERIALS

Notwithstanding this specification, any sample, which in the opinion of City's Representative, is composed of unsuitable material or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of the specification, shall be rejected. Any material thus rejected, shall immediately be removed and no liability for payment in any manner what-so-ever will be accepted by the City for such rejected consignment.



MATERIALS SPECIFICATION

PRE-MIXED BITUMEN EMULSION STABILISED LIMESTONE

Bitumen Emulsion - Specification

The bitumen emulsion shall be of an approved slow breaking anionic type and shall contain only water, emulsifying agents and class 170 bitumen. No other materials shall be present. The bitumen content shall be a minimum of 60%.

Bitumen Stabilised Limestone

General

The specification for the limestone shall be as per the section for crushed limestone.

Bitumen Stabilised Limestone Specification

The bitumen stabilised limestone shall be supplied from an approved source (which can provide material to the specifications under the contract) and shall be a thoroughly mixed and homogenous mixture when delivered to the site. The mixture shall contain a minimum of 2% residual bitumen by weight of the limestone.

The product shall conform to the following requirements:

- maximum Dry Density (Modified ASSHO) - 1750 kg/cubic metre minimum; and
- maximum Dry Compressive Strength (unconfined, cured 1 day and oven dried for 16 hours) - 10.5 kPa minimum.

The stabilised material shall be mixed for such a length of time to ensure even dispersion of the bitumen emulsion.

DEFECTIVE MATERIALS

Notwithstanding this specification, any sample, which in the opinion of the City's Representative, is composed of unsuitable material, or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of the specification, shall be rejected. Any material thus rejected, shall immediately be removed and no liability for payment in any manner what-so-ever will be accepted by the City for such rejected consignment.



MATERIALS SPECIFICATION LATERITE GRAVEL

A gravel base course shall consist of a combination of soil binder, sand and gravel and shall conform to this specification. The gravel shall be well graded sandy loam gravel free from roots, humus, vegetable matter, clay lumps, oversize and other deleterious material, and shall have the following properties:

- Maximum Size - All gravel shall pass the 37mm B.S. Sieve.
- Coarse aggregate retained on a 2.36mm sieve shall consist of hard, durable particles or fragments of gravel. Materials that break up when alternatively wetted and dried shall not be used.
- Coarse aggregate shall have a percentage wear by the Los Angeles Abrasion Test of not more than 45.
- Fine aggregate passing a 2.36mm sieve shall consist of natural or crushed sand and fine mineral particles passing the 0.065mm sieve.
- The ratio of the portion passing the 0.075mm sieve to the portion passing the 0.425mm sieve shall fall within the range of 0.3 to 0.7.

SOIL CONSTANTS

The portion of the sample which passes the 0.425mm sieve (soil mortar) shall conform to the following requirements when tested in accordance with AS 1289.

Plastic limit shall not exceed.....	20
Liquid limit shall not exceed	25
Plasticity Index shall not exceed	6
Linear Shrinkage shall not exceed	3%
Maximum dry compressive strength shall not be less than	2.3 Mpa
Dust ratio	0.3 - 0.7

GRADING

Grading - The grading shall be close to the maximum density curve and fall within the design grading envelope.

When tested in accordance with AS 1289 C6.1, the grading of the gravel shall conform to the following requirements:

AS Sieve SIZE (mm)	% Passing By Mass Minimum and Maximum Limits
37.5	100
19	71 - 100
9.5	50 - 81
4.75	36 - 66
2.36	25 - 53
1.18	18 - 43
0.425	11 - 32
0.075	4 - 19
0.0135	2 - 9

DEFECTIVE MATERIALS

Notwithstanding this specification, any sample, which in the opinion of City's Representative, is composed of unsuitable material, or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of the specification, shall be rejected. Any material thus rejected, shall immediately be removed and no liability for payment in any manner what-so-ever will be accepted by the City for such rejected consignment.



MATERIALS SPECIFICATION

TYPICAL SAND (FINE AGGREGATE) GRADING SPECIFICATION FOR PRIMER SEALING

These rates of application are only a guide and field trials to determine the best rates should be carried out.

Sieve Size (mm)	Percentage (by mass) passing for:		
	<i>Class 1 Ideal</i>	<i>Class 2 Average</i>	<i>Class 3 Very Fine</i>
9.50	100	100	-
4.75	85 - 100	85 - 100	100
2.36	-	-	85 - 100
1.18	25 - 50	50 - 85	-
600 µm	0 - 20	20 - 50	50 - 80
300 µm	0 - 5	0 - 10	-
75 µm	0 - 2	0 - 2	0 - 2

Class 1 - The most suitable grading.

Class 2 - Sands which are finer than Class 1 but have given good results in sprayed work.

Class 3 - Sands which are very much finer than Classes 1 and 2 but which have been used with moderate success when the advantage of obtaining a better material at a higher cost was very doubtful. Not recommended for general use.



MATERIAL SPECIFICATION AGGREGATE (FINE CRUSHED ROCK)

QUALITY

Crushed stone material shall be quarried from an approved source and consist of durable rock free from sand, vegetable matter and any other deleterious material. It shall be freshly blended prior to delivery and conform to the following requirements:

- (i) Wear - The aggregate shall have a Los Angeles Abrasion value not exceeding 20% for granite or diorite and 35% for other types of stone.
- (ii) Grading - The grading of the portion passing a 19mm AS sieve shall conform to the following requirements:

SIEVE SIZE	Percentage by weight passing
19mm	100%
9.5mm	70 - 80%
4.75mm	40 - 65%
2.36mm	30 - 50%
0.425mm	12 - 30%
0.075mm	3 - 12%

The ratio of the portion passing 0.075mm sieve to the portion passing 0.425mm sieve shall fall within the range of 40 - 60%. The portion of the total sample retained on the 19mm sieve, shall not exceed 5% of the total sample.

- (iii) Flakiness Index - The mass of stones in the sample which have a least dimension less than 60% of the ALD of all stones shall not exceed 35%.
- (iv) Elongation Factor - The ratio of the Average long dimension to the average least dimension shall not exceed 2.75 for the sample.

SOIL CONSTANTS

The portion of the sample which passes the 0.425mm sieve (soil mortar) shall conform to the following requirements when tested in accordance with AS 1289 - Part C.

Liquid limit shall not exceed	25
Plasticity Index shall not exceed	5
Linear Shrinkage shall not exceed.....	1%
Dry compressive strength shall not be less than	1.75 Mpa

FLUXING OIL

Flux oil shall be the recognised petroleum products furnace fuel oil conforming to the following requirements:

Distillation (initial boiling point)	190°C minimum
Distillation (temperature at 50% recovery.....	320°C minimum
Viscosity at 50°C	50 - 100 mm ² / s
Flash Point.....	65°C minimum
Miscibility with equal parts of Class 160 bitumen.....	Complete/No precipitation
Water Content	0.5% maximum
Sulphur Content	3.5% maximum
Sediment Content.....	0.15% maximum
Pour point.....	65°C maximum

DEFECTIVE MATERIALS

Notwithstanding this specification, any sample, which in the opinion of the City's Representative, is composed of unsuitable material, or is composed of material which would break down with ageing or weathering to such an extent that it would then fall outside the limits of the specification, shall be rejected. Any material thus rejected, shall immediately be removed and no liability for payment in any manner what-so-ever will be accepted by the City for such rejected consignment.



MATERIALS SPECIFICATION

BITUMEN

The bitumen shall be a straight run slightly blown bitumen distilled from an asphaltic base petroleum. The grade is to be Class 160 (120 - 200 Pascal second viscosity at 60°C) and it shall comply with AS 2008 and the current NAASRA specification.

Bitumen emulsion shall conform as regards physical qualities, sample and testing with AS 1160 for Class 50 bitumen. It shall not contain less than 60% bitumen.

MEDIUM CURING CUTTING OIL

Medium curing cutting oiling shall be a petroleum product conforming to the following requirements:

Distillation (initial boiling point).....	132 - 160°C
Distillation (final boiling point).....	265°C maximum
Distillation (temperature at 50% recovery).....	220°C maximum
Flash Point Open	35°C minimum
Relative Density at 25°C kg/l.....	0.78 - 0.92
Miscibility with equal parts of Class 160 bitumen.....	Complete/No precipitation
% Aromatics (% Vol.)	15% minimum
Water Content	0.05% maximum
Viscosity at 40°C	1.0 - 1.4 mm ² /s



MATERIALS SPECIFICATION SEALING AGGREGATE

The proportion of flat or elongated particles in any grading of course aggregate shall not exceed 20%. A flat particle is one having a ratio of width to thickness of greater than 3 and an elongated particle is one having a ratio of length to width greater than 3. There shall not be more than 2.5% of particles of greater length in any direction than twice the gauge, and there shall not be more than 20% in excess of the gauge.

The crushed stone shall consist of clean, tough, durable fragments free from an excess of thin or elongated pieces, free from soft or disintegrated pieces, stone coated with dirt or other deleterious matter.

Wear - the aggregate shall have a Los Angeles abrasion value not exceeding 20% of wear for diorite and not exceeding 40% for granite.

The bulk specific gravity of the particles of diorite shall not be less than 2.90 (2.60 for granite).

The elongation factor which shall be defined as the ratio of the average long dimension to the average least dimension shall not exceed 2.75 for the sample.

METHOD OF SAMPLING AND TESTING

The method of testing the road metal shall be in accordance with AS 1141 and as amended from time to time.

The Flakiness Index of Granite shall not exceed 30.

GRADING REQUIREMENTS - (PERCENTAGE BY WEIGHT)

AS mm sieve	14mm	10mm	7mm	5mm
37.5				
26.5				
19				
16	100			
13.2	80 - 100	100		
9.5	0 - 20	80 - 100	100	
6.7	0 - 2	0 - 25	80 - 100	100
4.75		0 - 2	0 - 30	80 - 100
2.36				0 - 30
1.18				0 - 0.5
600 micron				

AVERAGE LEAST DIMENSION REQUIREMENTS

SIZE NUMBER	1	2	3
Nominal Size (mm)	8 - 13	5 - 19	7
Average Least Dimension	9 - 13	6 - 8	4 - 6



MATERIALS SPECIFICATION AGGREGATES

All aggregate, with the exception of naturally occurring sands shall be the product of crushing sound stone quarried from approved deposits.

Sound stone of diorite shall be considered as that material having less than 25% secondary materials as determined by the methods of microscopic examination and quarry sampling employed by the Main Roads Department of Western Australia.

Sound stone of granite shall only be used when specifically approved by the City's Representative.

COARSE AGGREGATE shall consist of hard, durable, fine grained crushed stone of uniform quality, free from soft or weathered particles, clay, salt, or other deleterious material. The aggregates shall comply with the requirements of AS 2150 relating to the following properties:

- (a) Los Angeles Value not to exceed 25 or a mixture of crushed material and natural sand provided that, if natural sand is included in the mixture, the amount used shall be so limited that it will not contain less than 50% by weight of crushed particles. The Flakiness Index of the aggregate shall not exceed 35%.
- (b) The grading for nominal 10mm, 7mm and 5mm aggregates shall be as specified in Table 1 AS 2758.1 (Single Sized Aggregates) and the limits of deviation for supplied aggregate shall to differ from the submitted grading by more than the maximum listed in Table 2.
- (c) Particle density shall be not less than 2,100 kg/m³ when determined in accordance with AS 2150.

FINE AGGREGATE shall consist of clean, hard, tough, durable, uncoated grains, uniform in quality and shall conform to the requirements of AS 2150 relating to the following properties:

- (a) Fine aggregate shall comply with the grading and deviation limits detailed in AS 2150.
- (b) The material finer than 75 micron shall not exceed the limits detailed in AS 2150.

Section 3 – Construction Standards and Specifications ...

MINERAL FILLER shall be thoroughly dry and shall be free from lumps, organic matter or clay particles. Added mineral filler shall conform with the requirements of AS2357-1980 and shall be hydrated lime (1.5% by weight).

If filler is required to be added to the mixture in order to make it comply with the specified limits of the paving mixture, it shall consist of Portland Cement, ground limestone, stone dust or other approved material. The aggregate for the wearing course shall be subjected to the Sand Equivalent Test by the method specified in AASHTO T176 - 56.

If in order to comply with the grading limits of the paving mixture, filler other than stone dust has been added, the sand equivalent test shall be carried out on that portion of the aggregate passing a 4.75mm AS sieve, excluding such added filler. If the combined aggregate mixture contains the specified amount of material passing a 0.075mm sieve without the addition of Portland Cement, ground limestone or other similar material, or if stone dust has been added to the mixture in order to comply with the specified requirements, the sand equivalent test shall be carried out on the whole of the portion of the combined aggregate passing a 4.75mm sieve. The requirement for the sand equivalent test shall be not less than 50.

It should be noted that anti-stripping agents in lieu of hydrated lime will not be accepted.



MATERIALS SPECIFICATION CHARACTERISTICS OF THE ASPHALT MIXTURE

This specification is to be read in conjunction with the following documents.

- AS 2150: Hot Mix Asphalt.
- AS 2008: Residual Bitumen for Pavements.
- AS 2734: Asphalt (Hot Mixed) Paving - Guide to Good Practice.
- Main Roads Western Australia, Methods for Sampling and Testing of Asphalt.
- Technical Specification, Tender Form and Schedule for Supply and Laying of Hot Asphalt Road Surfacing (AAPA/IPWEA)

Specification

All asphalt pavements and wearing courses shall be laid in accordance with the AAPA/IPWEA specification.

The paving mixture for the surface course shall meet the following requirements by weight when determined by AS sieves. The residual binder, that is the residual asphaltic bitumen, shall be determined as a percentage by weight of the total mixture.

ASPHALT MIXES – HIGHWAYS, ARTERIAL, INDUSTRIAL & DISTRIBUTOR ROADS

Property	Mix Designation		
<i>Grading limits % passing AS sieve</i>	<i>AC10</i>	<i>AC14</i>	<i>AC20</i>
26.5mm	-	-	100
19.0mm	-	100	90 - 100
13.2mm	100	85 - 100	75 - 90

Section 3 – Construction Standards and Specifications ...

9.5mm	90 - 100	70 - 85	60 - 80
6.7mm	70 - 90	62 - 75	50 - 70
4.75mm	58 - 76	53 - 70	40 - 60
2.36mm	40 - 58	35 - 52	25 - 43
1.18mm	27 - 44	24 - 40	18 - 35
600µm (microns)	17 - 35	15 - 30	14 - 27
300µm	11 - 24	10 - 24	9 - 21
150µm	7 - 16	7 - 16	6 - 15
75µm	4 - 7	4 - 7	3 - 7
Bitumen Content	5.0 - 7.0	4.5 - 6.5	4.0 - 6.0
Marshall Voids (%) 50 blow	3.0 - 5.0	3.0 - 5.0	3.0 - 5.0
Marshall Voids (%) 75 blow	4.0 - 6.0	4.0 - 6.0	4.0 - 6.0
Minimum Marshall Stability 50 blow	6.5kN	6.5kN	6.5kN
Minimum Marshall Stability 75 blow	8.0kN	8.0kN	8.0kN
Marshall Flow (mm)	2.0 - 4.0	2.0 - 4.0	2.0 - 4.0
Marshall Quotient (kN/mm) 50 blow	1.7	1.7	1.7
Marshall Quotient (kN/mm) 75 blow	2.0	2.0	2.0

Note: Bitumen shall be Class 320 unless otherwise requested by the City's Representative.

Traffic Recommendations over 20 years design traffic:

<i>Range/Type</i>	<i>Mix</i>	<i>Bitumen Type</i>
Heavy truck traffic	75 blow	Class 320
Greater than 2,000,000 ESA	75 Blow	Class 320
Less than 2,000,000 ESA	50 Blow	Class 170
Maintenance	50 Blow	Class 170
Intersections	75 Blow	Class 320

Section 3 – Construction Standards and Specifications ...

ASPHALT MIXES - RESIDENTIAL STREETS/CULS-DE-SAC

Property	Mix Designation		
<i>Grading limits % passing AS sieve</i>	<i>AC7</i>	<i>AC10</i>	<i>AC14</i>
19.0mm	-	-	100
13.2mm	-	100	90 - 100
9.5mm	100	95 - 100	70 - 90
6.7mm	80 - 100	80 - 95	62 - 75
4.75mm	70 - 90	65 - 80	47 - 67
2.36mm	45 - 60	45 - 60	34 - 52
1.18mm	35 - 50	35 - 50	25 - 41
600µm (microns)	22 - 35	25 - 40	16 - 32
300µm	14 - 25	15 - 25	9 - 21
150µm	8 - 16	7 - 15	5 - 13
75µm	5 - 8	3 - 10	2 - 8
Bitumen Content	5.0 - 7.0	4.5 - 6.5	4.5 - 6.5
Marshall Voids (%) 35 blow	3.0 - 5.0	3.0 - 5.0	3.0 - 5.0
Marshall Voids (%) 50 blow	3.0 - 5.0	3.0 - 5.0	3.0 - 5.0
Minimum Marshall Stability 35 blow	4.0kN	4.0kN	5.5kN
Minimum Marshall Stability 50 blow	5.5kN	6.5kN	6.5kN
Marshall Flow (mm)	2.0 - 5.0	2.0 - 4.0	2.0 - 4.0
Marshall Quotient (kN/mm) 35 blow	2.0 - 5.0	2.0 - 5.0	2.0 - 5.0
Marshall Quotient (kN/mm) 50 blow	2.0 - 4.0	2.0 - 4.0	2.0 - 4.0

Note: Bitumen shall be Class 170 unless otherwise requested by the City's Representative.

Traffic Recommendations over 20 years design traffic:

<i>Range/Type</i>	<i>Mix</i>	<i>Bitumen Type</i>
Greater than 500,000 ESA	Use distributor road mix	
Greater than 50,000 ESA	50 Blow	Class 170
Less than 50,000 ESA	35 Blow	Class 170
Maintenance	50 Blow	Class 170

Section 3 – Construction Standards and Specifications ...

ASPHALT MIXES - RECREATIONAL AREAS

Property	Mix Designation	
	AC5	AC7
<i>Grading limits % passing AS sieve</i>		
9.5mm	-	100
6.7mm	100	80 - 100
4.75mm	85 - 100	70 - 90
2.36mm	55 - 75	45 - 60
1.18mm	38 - 57	35 - 50
600µm (microns)	26 - 43	22 - 35
300µm	15 - 28	14 - 25
150µm	8 - 18	8 - 16
75µm	4 - 11	5 - 8
Bitumen Content	5.0 - 7.0	5.0 - 7.0
Marshall Voids (%)	3.0 - 5.0	3.0 - 5.0
Minimum Marshall Stability 35 blow	4.0kN	4.0kN
Minimum Marshall Stability 50 blow	5.0kN	5.5kN
Marshall Flow (mm)	2.0 - 5.0	2.0 - 5.0
Marshall Quotient (kN/mm) 35 blow	1.0	1.0
Marshall Quotient (kN/mm) 50 blow	1.7	1.7

Note: Bitumen shall be Class 170 unless otherwise requested by the City's Representative.

Traffic Recommendations:

<i>Range/Type</i>	<i>Mix</i>
Cycle Paths, Basketball Courts, etc.	35 Blow
Maintenance	50 Blow