1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of sawcutting concrete, reinforced concrete, concrete base, soil cement, and asphaltic concrete or concrete pavements.

2.0 PRODUCTS

3.0 EXECUTION

3.1 Construction

3.1.1 Proper barricades and traffic diversion shall be erected by the Contractor for protection as set out in the City of Regina Temporary Traffic Control Manual.

3.1.2 Sawcutting shall be carried out for all removal or trenching operation in order to leave a clean, straight edge for repair. The cut shall be of sufficient depth to permit removal without damage to the remaining structure.

3.1.3 During sawcut operations the Contractor shall take necessary steps to protect adjacent properties and structures from sawcut residue.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the removal and satisfactory disposition of Asphalt or Plain Concrete Pavements.

2.0 PRODUCTS

3.0 EXECUTION

3.1 Construction

3.1.1 The removal and satisfactory disposition of asphalt pavement and plain concrete shall be done in a safe manner, satisfactory to the Engineer.

3.1.2 Proper barricades and traffic diversion shall be erected by the Contractor for protection as set out in the City of Regina Temporary Traffic Control Manual.

3.1.3 Removal of asphalt pavement and plain concrete pavement when required for the removal and replacement of sidewalks curb and gutters shall be considered a subsidiary obligation under removal of curb or curb and gutter and shall be done in a manner satisfactory to the Engineer. Any excess removal of pavement, unless directed by the Engineer shall be replaced at the Contractors own expense.

3.1.4 Asphalt or concrete pavements that has been removed shall be stockpiled of at a site or sites designated by the Engineer. Disposal shall be at the City Landfill unless otherwise approved by the Engineer.

3.1.5 Landfill charges are the responsibility of the Contractor.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the removal of asphaltic concrete pavement by cold planing to the lines, grades and cross-sections shown on the plans or as designated by the Engineer. Included shall be all planing, sweeping, loading, handwork along gutter lines, additional work around manholes, catchbasins, valves and other appurtenances as well as the supply and replacement of all milling teeth required to complete the job.

2.0 PRODUCTS

2.1 Equipment

2.1.1 The equipment for removing the asphaltic concrete pavement shall be a machine capable of performing the work in a manner satisfactory to the Engineer.

2.1.2 The machine shall be power-operated and self-propelled, and shall have sufficient power, traction and stability to remove a thickness of bituminous surface to a specified depth, and provide a uniform profile and cross slope. The machine shall be capable of accurately and automatically establishing profile grades (within ± 10 mm) along each edge of the machine by referencing from the existing pavement by means of a ski or matching shoe, or from an independent grade line. The machine shall have an automatic system for controlling grade elevation and cross slope. The machine shall be equipped with a means to effectively control dust generated by the cutting operation.

3.0 EXECUTION

3.1 Construction

3.1.1 The surface resulting from the cold planing operation shall be in accordance with the plans and specified grades, and shall be characterized by uniform, discontinuous longitudinal striations or other uniform pattern and shall not be gouged or torn.

3.1.2 All loose material shall be removed from the milled surface and surface swept clean with a power broom. Employ dust control measures specified in Section 01001 General Requirements, Article 1.7 Dust Control.

3.1.3 If the road is to remain open to traffic, longitudinal, vertical drop-offs in excess of two inches at a lane line or at centerline shall not be left overnight.

3.1.4 Transverse faces existing at the end of a work period should be tapered in a manner approved by the Engineer to avoid a hazard for traffic.

3.1.5 Asphaltic concrete that cannot be removed by cold planing equipment because of physical or geometrical restraints should be removed by other methods acceptable to the Engineer.

3.1.6 If independent grade reference is required, it shall be designated in the plans and contract documents, and elevations shall be provided by the Engineer. Milled material shall be disposed of as specified or as directed by the Engineer.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the excavation of all materials other than rock excavation and shall include soil, frozen earth, roots and plain or bituminous bound base courses. Excavation shall be to the finished grade and cross-section shown on the drawings or designated by the Engineer.

1.1.2 Rock Excavation is defined as all individual boulders or concrete masses over 0.25 cubic metres in volume.

1.1.3 Waste excavation shall consist of removing unsuitable materials and stockpiling or disposing of material not incorporated into an embankment at a site designated by the Engineer.

2.0 PRODUCTS

3.0 EXECUTION

3.1 Construction

3.1.1 The Contractor shall shape the cut section to the depth and grades established by the Engineer. Suitable excavated material shall be used as far as practicable in the formation of fills or for other backfill. Excavated material not used in the subgrade construction shall be disposed of at the City landfill unless otherwise approved by the Engineer.

3.1.2 If the material below the subgrade surface is unacceptable as a foundation, it shall be removed and disposed of as designated by the Engineer. This work will be referred to as "sub-cut." Suitable excavated material from another portion of the project shall be used to fill the "sub-cut" area. If sufficient suitable excavated material is not available from the excavation, upon authorization of the Engineer, material shall be obtained from a borrow pit or other approved source.

3.1.3 Construction of embankments and reconstruction of sub-cut areas are to be in accordance with Section 2120 for Embankments.

3.1.4 The Contractor will be required to repair any damage caused to existing pavements, sidewalks or underground facilities during excavation, at his own expense to the satisfaction of the Engineer.

3.1.5 The Contractor will be responsible for constructing and maintaining any or all haul roads required in the execution of the work. The Contractor will be responsible for removing, trimming, scarifying and cleaning of the haul road sites to restore them to their original condition to the satisfaction of the Engineer.

3.1.6 Protect trees including root systems and canopy from damage in accordance with the *Regina Urban Forest Management Strategy* (Appendix G) and the *Forestry Bylaw #9607*.

1.0 GENERAL

1.1 Scope

The work shall consist of constructing embankments or miscellaneous backfills with excavated materials to the grades and cross-sections shown on the Plans or as designated by the Engineer.

2.0 PRODUCTS

2.1 In-situ material may be used for compacted fill where approved by the Engineer. Large roots, stumps, boulders larger than 100 mm in maximum dimension, clumps of frozen ice, snow or earth, and other debris that would prevent compaction shall not be permitted.

2.2 Coarse gravel is clean angular material required for stabilization for subgrade areas due to over excavation of unsuitable trench bottom conditions.

2.3 Topsoil is humus, peat or other material containing organics, which make up the top layer of the soil.

3.0 EXECUTION

3.1 Construction

3.1.1 Embankments shall be constructed with side slopes of five (5) metres horizontally to one (1) metre vertically, unless otherwise specified.

3.1.2 When directed, scarify to 150 mm depth or bench existing slopes in side hill or sloping sections to ensure a proper bond between new materials and existing surfaces. Obtain prior approval of method to be used.

3.1.3 The material shall be placed in compacted layers of uniform 150 mm thickness. The layers shall be carried up full width from the bottom of the fill to avoid the widening of the edges after final grade has been reached. Each layer shall be spread and bladed evenly by means of a blade grader or other approved equipment so that rollers used for compaction will bear evenly at all times.

3.1.4 The compaction equipment may be of any type, provided it is capable of compacting each lift of the material to the specified density. The Engineer has the right to order that any particular unit be removed from the work if it is not capable of compacting the material to the required density in a reasonable time. Hauling equipment will not be accepted in lieu of compaction equipment.

3.1.5 Subgrade areas, encountered in the construction of the embankment which are not sufficiently stable to properly support the embankment and any additional

loading or traffic requirements, shall be scarified and re-compacted or removed as required by the Engineer. Where directed by the Engineer unsuitable material shall be removed and replaced with approved material at a cost to the contractor.

3.1.6 All subgrade and embankment fill materials shall be compacted in layers not exceeding 150 mm. The 150 mm layers shall be brought to within the limits of plus or minus three percent (± 3%) of optimum moisture content. Water shall be added and thoroughly mixed if required for proper compaction. If the soil contains excess moisture, it shall be aerated until the moisture content has been reduced to within the limits stated above.

3.1.7 The 150 mm layers shall be compacted to between ninety-eight percent (98%) and one hundred percent (100%) of its maximum standard proctor dry density as determined by ASTM Test Designation D698.

3.1.8 Measurement of the field density and moisture content shall be in accordance with ASTM Test Designations D2922 and D3017, for determination of Density and Moisture content of soil in place by Nuclear Methods.

3.1.9 Field density and moisture content tests will be made by the Engineer to ensure that the material is being compacted to the moisture content and density specified.

3.1.10 All soft, spongy or yielding spots and all organic or other objectionable material shall be entirely removed and the area recompacted with approved native material. Proofroll the subgrade with available construction equipment or optional vehicle as approved by the Engineer.

3.1.11 Where final trimming of surface is required – blade grader shall be used to grade the surface to within plus or minus 25 mm (± 25 mm)

3.1.12 Where topsoil is required it shall be placed and spread by means of a blade grader or approved equipment to a depth specified by the Engineer. Seeding shall be in accordance with Section 2645.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the shaping watering or drying and compacting existing subgrade or fill material to obtain the grades lines and cross-sections as shown on the Plans or as designated by the Engineer.

2.0 PRODUCTS

3.0 EXECUTION

3.1 Construction

3.1.1 All soft, spongy or yielding spots and all organic or other objectionable material shall be entirely removed and the area recompacted with approved native material. Proof-roll the subgrade as required with available construction equipment or optional vehicle as approved by the Engineer.

3.1.2 The subgrade surface shall be trimmed to ± 20 mm vertically and 100 mm horizontally. The final subgrade shall be tight and smooth surface, true to grade and cross-section, and free from irregularities caused by compaction equipment. The average level of the finished grade shall neither be consistently high or low from the design grade. Before approval by the Engineer, the subgrade surface shall be true to cross-section and grade.

3.1.3 The top 150 mm of the subgrade shall be brought to within the limits of moisture content and compacted in accordance with Section 2120 for Embankments. Reconstruction of trenches is to be in accordance with Section 2120 for Embankments.

3.1.4 After preparing the subgrade as above specified, it shall be the Contractor's responsibility to maintain the required density at his expense, and all unnecessary traffic must be kept off. Should it be found necessary to haul over prepared subgrade, prepared base or existing asphalt, all cuts, ruts and breaks in the surface so resulting shall be repaired in a manner satisfactory to the Engineer immediately preceding the placement of surface or base materials.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of preparing the subgrade for granular base pavement structures. The requirements for compaction and moisture density control is waived for granular base pavement structures if the conditions set forth in this specification are met.

2.0 PRODUCTS

3.0 EXECUTION

3.1 Excavation and Shaping

3.1.1 The Contractor shall not excavate to final subgrade level unless perforated drainage pipe and sub-drainage sand are to be placed on the subgrade within 24 hours. Otherwise the subgrade shall be left a minimum of 100 mm high of final grade until the placement of sub-drainage sand can follow.

3.1.2 Shaping tolerances for the completed subgrade surface shall be ± 20 mm vertically and 100 mm horizontally. The average level of the finished grade shall neither be consistently high or low from the designed grade.

3.2 Subgrade

3.2.1 Areas encountered in the construction of the subgrade which have not consolidated sufficiently to properly support the subgrade and traffic shall be compacted as required by the Engineer. Where directed by the Engineer, unsuitable material shall be removed and replaced with suitable native material in accordance with Section 2120 for Embankments.

3.2.2 Reconstruction of trenches are to be in accordance with Section 2120 for Embankments.

3.3 Placement of Subdrainage Sand and Sub-base

3.3.1 The placement of subdrainage sand will be carried out in a manner such that hauling and placing operations do not deform the subgrade or over compact the surface along defined routes, resulting in non uniform density. In general the hauling operation should be carried out in such a manner that traffic on the subgrade is limited to unloaded vehicles.

3.3.2 Ideally the placement would involve a dump and doze operation from a working pad of subdrainage sand and sub-base, with no equipment travelling across the prepared subgrade. The contractor shall place the sub-base in a manner such that rutting of the in place sub-drainage sand does not occur.

3.3.3 The Contractor will be required to reinstate the subgrade to proper line and grade should the hauling or placing operations deform or rut the subgrade.

3.3.4 If the Contractor's operations results in a continual problem of deformation of the subgrade the Engineer may direct that either, full subgrade preparation and compaction be undertaken, or that the placement be undertaken in a manner that will not deform or over compact the subgrade.

3.3.5 It is the intention of this specification that the Contractor provided a subgrade which, as close as possible, matches the natural moisture and density conditions found in the area, and that the subgrade be true to line and grade after placement of sub-drainage sand and sub-base course.

1.0 GENERAL

1.1 Scope

1.1.1 This specification governs all operations necessary for, and pertaining to, the supply and installation of geotextile fabrics for separation and reinforcement and under riprap.

2.0 PRODUCTS

2.1 Geotextiles

2.1.1 These specifications apply to woven and non-woven geotextiles.

2.1.2 Employ medium weight woven geotextile Propex 2006 or prior approved equivalent when and where specified for separation and reinforcement.

2.1.3 Employ medium weight non-woven geotextile Propex 4553 or prior approved equivalent when and where specified for rip rap.

2.1.4 Each geotextile roll shall be labelled or tagged to provide product identification sufficient for inventory and quality control purposes.

2.1.5 Geotextile rolls shall be furnished with suitable wrapping for protection against moisture and extended ultra-violet exposure prior to placement. If stored outdoors, they shall be elevated and protected with a waterproof cover.

3.0 EXECUTION

3.1 Separation and Reinforcement

3.1.1 Surface Preparation

.1 Prepare the surface, in advance of placing the geo-textile, to achieve a smooth, even surface, clear of any aggregates or debris, and constructed to the cross section and profile indicated on the plans.

3.1.2 Geotextile Placement

.1 The geotextile shall be rolled onto the surface free of wrinkles, rolls, or bulges. All seams shall be sewn by an approved method or overlapped a minimum of 700 mm.

.2 The geotextile shall not be dragged across the surface. Geotextile

shall not be rolled out more than 40 m ahead of the placement of the fill material and shall be overlapped both side to side and end to end in the direction of the fill material placement. The required width of geotextile and the minimum overlap shall be maintained during road construction.

.3 Should the surface be required to remain open, installation of the geotextile shall be on one-half of the surface at a time.

3.1.3 Damage to Geotextile

.1 If the geotextile is damaged, torn, or punctured during installation or placement of the fill material, the damaged section shall be repaired at the Contractor's expense. The damaged section shall be exposed and a patch of geotextile placed over the damaged section. Where the patch is not sewn it shall be large enough to overlap 700 mm onto the undamaged geotextile. Any fill material on the damaged area shall be replaced and compacted to the required standard.

.2 Fill material shall be placed, spread, and compacted on the geotextile. The fill material shall be end-dumped onto the ground in front of the leading edge of the geotextile and levelled using a track type dozer to a uniform lift thickness of no less than 150 mm or as directed by the Engineer. Initial compaction shall be achieved by walking a track dozer back and forth over the lift. Subsequent loads shall be dumped onto previously spread fill material. Dumping of fill material directly on the geotextile will not be permitted. The use of "bellydump" type trailers or any other vehicles will not be allowed on the geotextile.

3.2 Geotextile Under Rip-Rap

3.2.1 Surface Preparation

.1 The ground surface shall be shaped neatly and trimmed to the lines as shown on the plans or as staked by the Engineer in the field prior to the placing of any geotextile. Ground surface preparation shall be incidental to the Supply and Installation of Geotextile Fabric.

3.2.2 Geotextile Placement

.1 The geotextile shall be placed and temporarily anchored in such a manner that placement of the riprap will not excessively stretch or tear the fabric and such that seam overlaps will be maintained. Stones, staples, steel pins with washers, or other means approved

by the manufacturer or Engineer shall be used as necessary to temporarily anchor the geotextile. Temporary anchoring shall be incidental to the Supply and Installation of Geotextile Fabric.

.2 Where geotextile may be exposed to high velocity flows such as an overflow or chute structure, geotextile shall be permanently anchored using a keyway trench.

.3 All seams shall be sewn by an approved method or overlapped a minimum of 700 mm in the direction of the flow of water (shingle style).

.4 Terminal sides and ends of the geotextile shall be anchored as shown on the plans or as directed by the Engineer in the field.

.5 Riprap shall be placed on the geotextile in such a manner that the geotextile is not damaged, torn, excessively stretched, or punctured. Any geotextile damaged during installation or placement of the riprap shall be repaired at the Contractor's expense. The damaged section shall be exposed and a patch of geotextile placed over the damaged section. The patch shall be large enough to be sewn, or, overlapped 700 mm onto the undamaged geotextile.

.6 Riprap placement shall begin at the toe and shall proceed up the slope.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of installing perforated drainage pipe to the lines, grades, and cross-sections shown in the plans or as directed by the Engineer.

2.0 PRODUCTS

2.1 Perforated Drainage Pipe

2.1.1 Shall be 100 mm diameter, perforated and corrugated as manufactured by the Big "O" Drain Tile Company or equivalent as approved by the Engineer. Pipe shall be enclosed in a fabric filter.

2.2 Granular Material

2.2.1 Shall conform to Section 2210.

3.0 EXECUTION

3.1 Construction

3.1.1 The pipe shall be placed in a surround of sub-drainage sand in a 150 mm deep trench excavated prior to the placement of the subdrainage sand lift. All major tears and rips in the filter fabric shall be repaired. All couplings or fittings shall be enclosed in filter fabric. The drainage pipe shall be covered with subdrainage sand prior to the placement of sub-base. Where the drainage pipe is connected to catch basins the end of the pipe shall not extend more than 150 mm into the barrel of the catch basin and shall be securely mortared in place.

3.1.2 Capped clean-outs shall be provided where access to the perforated drainage pipe is not readily available in a catch basin or manhole.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the grading and gravelling of roads and lanes. The material shall consist of natural aggregate/reclaimed asphalt/granular material.

2.0 PRODUCTS

2.1 Granular Material

2.1.1 The gradation of the Roadway gravel shall be within the following limits:

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT
14 mm	100
5 mm	50 - 80
2 mm	30 - 60
400 µm	15 - 30
80 µm	5 - 15

2.1.2 The minimum percent of fractured faces retained on the 5.0 mm sieve shall be 25% by weight.

3.0 EXECUTION

3.1 Construction

3.1.1 Construction shall be completed and trimmed during each phase, so as to conform to the proper grades and lines with tolerances of ± 20 mm vertically and ± 100 mm horizontally. The average level of the finished grade shall neither be consistently high or low from design grade.

3.1.2 Following grading to the above mentioned specification the application of gravel shall be carried out to the specified width and shall be placed uniformly to a depth as specified or in accordance with Standard Drawing R-2D.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the placement of sub-drainage sand for granular based structures. The uncompacted sub-drainage course shall be placed to the lines, grades and cross-sections shown on the plans or as directed by the Engineer.

2.0 PRODUCTS

2.1 Granular Material

2.1.1 The gradation of the sub-drainage sand shall be within the following limits:

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT
28 mm	100
12.5 mm	90 - 100
5 mm	75 - 100
2 mm	55 - 100
800 μm	35 - 75
400 μm	20 - 50
160 μm	0 - 15
80 μm	0 - 5

2.1.2 Minimum Permeability is 1×10^{-4} cm/sec

2.1.3 Use gradation to determine suitability but that permeability specification will be used as guide for acceptance of the material.

3.0 EXECUTION

3.1 Construction

3.1.1 The placement of sub drainage sand will be carried out in a manner such that hauling and placing operations do not deform the subgrade or over compact the surface along defined routes, resulting in non uniform density. In general the hauling operation should be carried out in such a manner that traffic on the subgrade is limited to unloaded vehicles.

3.1.2 Ideally the placement would involve a dump and doze operation from a working pad of subdrainage sand and sub-base, with no equipment travelling across the prepared subgrade. The contractor shall place the sub-base in a manner such that rutting of the in place sub-drainage sand does not occur.

3.1.3 Construction shall be completed and trimmed to ± 20 mm vertically and ± 100 mm horizontally deviations shall be neither consistently high nor consistently low.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the placement of sub-base course immediately following the placement of the sub-drainage sand and conforming to the lines, grades and cross-sections shown on the drawings. It shall consist of a layer of screened or crushed sand or gravel with or without binder added.

2.0 PRODUCTS

2.1 Granular Material

2.1.1 The sub-base aggregate is to be supplied by the Contractor. The method of processing and delivery must be satisfactory to the Engineer. The sub-base material shall be weighed at the Contractor's expense on scales provided by the Contractor. The sub-base aggregate shall be composed of fragments of durable rock, free from injurious quantities of soft or flaky particles, shale, loam and organic or other deleterious material.

2.1.2 The gradation of sub-base aggregate shall be within the following limits:

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT
56 mm	100
80 μm	5 - 15
Plasticity Index	0 - 6

3.0 EXECUTION

3.1 Construction

3.1.1 If pneumatic tire rollers are used, the lift of sub-base course shall not exceed 120 mm in depth. The depth of lift may be increased if mechanical vibratory rollers, approved by the Engineer are used, provided that adequate compaction can be obtained.

3.1.2 The maximum lift thickness shall not exceed 300 mm unless approved by the Engineer.

3.1.3 Sub-base course shall be compacted until no further settlement is apparent and the particles are well-keyed into place. The sub-base course shall be free from any rutting or deformations before the placement of the next course. If the natural moisture content of the sub-base course is insufficient for proper compacting, water may be added as directed by the Engineer.

3.1.4 Traffic over sub-base course will not be permitted except by permission of the Engineer. If hauling is permitted over subbase course the Contractor will, at their expense, maintain and repair the subbase course as to cross-section and compaction. The Contractor shall provide at his own expense, all necessary protection of works and the safety of the public.

3.1.5 The placement of subbase course will be carried out in a manner such that hauling and placing operations do not deform the subgrade or over compact the surface along defined routes, resulting in non uniform density. In general the hauling operation should be carried out in such a manner that traffic on the subbase is limited to unloaded vehicles.

3.1.6 Ideally the placement would involve a dump and doze operation from a working pad of subbase, with no equipment travelling across the prepared subgrade. The Contractor shall place and protect the subbase in a manner such that rutting or mixing of the in place subdrainage sand does not occur.

3.1.7 Construction shall be completed and trimmed to ± 20 mm vertically and ± 100 mm horizontally.

3.1.8 Deviations shall be neither consistently high nor consistently low.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of the placement of granular base course materials to the grade lines and cross-sections as shown on the Plans or as designated by the Engineer.

2.0 PRODUCTS

2.1 Gradation

2.1.1 When tested according to A.S.T.M. Designation C135, Method of Test for Sieve Analysis, the material shall meet one of the following gradation requirements as specified by the Engineer:

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT		
Size	Type 32	Type 33	Type 34
25 mm	100		
20 mm	93 - 100	100	100
12.5 mm	72 - 93	81 - 100	91 - 100
5 mm	45 - 77	50 - 80	70 - 85
2 mm	29 - 56	32 - 52	45 - 65
800 μm	17 - 38	18 - 33	27 - 42
400 μm	13 - 26	15 - 25	20 - 30
160 μm	7 - 14	11 - 19	11 - 16
80 μm	7 - 11	7 - 11	7 - 11
Plasticity Index	0 - 6	0 - 6	0 - 6

2.1.2 The percentage passing the designated sieve sizes for any representative sample, when plotted on a semi-log grading chart, shall show a free flowing concave curve without sharp breaks, within the limits specified above. The material passing through the 400 μm sieve shall have a Liquid Limit not greater than 25 and a Plasticity Index not greater than six (6).

2.2 Aggregate

2.2.1 The aggregate shall consist of hard, durable particles free from injurious quantities of soft or flaky particles, loam or organic matter, or other deleterious material. The gravel shall be crushed gravel passing a 25 mm sieve.

2.2.2 Granular material retained on the 5 mm sieve shall have a minimum average of forty-five percent (45%) of the aggregate with at least one fractured face. Average will be defined as the average all tests for each working shift.

2.3 Clay Binder

2.3.1 Shall consist essentially of fine particles of sand, silt and clay containing no particles larger than will pass a 25 mm square opening screen, and shall be free from injurious amounts of organic matter or other deleterious material. It shall have a Plasticity Index of not more than 15. The clay shall be broken down by a shredder or pulverizer before being added to the mixture if required by the Engineer.

2.4 Filler

2.4.1 Filler material shall be fine sand (minimum 100% passing 630 μm sieve) and free from rocks or any deleterious material.

2.5 Water

2.5.1 Water shall be reasonably clean and free from substances which might render it unfit for use.

3.0 EXECUTION

3.1 Construction

3.1.1 The base course shall consist of an intimate mixture of course aggregate, sand, clay, and water. These materials shall be combined, compacted and finished in a true workmanship like manner on the previously prepared sub-base or subgrade to a compacted thickness as shown on cross-sections and plans, and in these specifications.

3.1.2 All tools, machinery, plant and equipment used in handling material and executing any part of the work, shall be subject to the approval of the Engineer. All such equipment shall be maintained in efficient working order, and where any machinery, plant or equipment is found to be unsatisfactory, it shall be improved or replaced.

3.1.3 Granular base course is to be supplied, placed and delivered by the Contractor. The method of processing and delivery must be satisfactory to the Engineer.

3.1.4 The rolling and compacting shall begin at the gutter edges of the roadway and progress toward the centre parallel to the centre line with such overlapping of successive passes as may be required to produce the required density. A blade grader shall be used in conjunction with the compaction equipment to maintain an even and uniform compacted surface shaped to the required lines. Any irregularities or depressions in the final surface that develop under rolling, shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform. The final surface of the granular base course shall be compacted in such a manner as to ensure the granular base course structure is stable and tightly knit throughout.

3.1.5 The surface of the granular base course shall be such that when tested with a 3 m straight edge placed on the surface of the roadway, the maximum deviation of the surface from the edge of the straight edge shall nowhere exceed 10 mm.

3.1.6 Each layer of base course shall be compacted to at least one hundred percent (100%) of the maximum Standard Proctor dry density for the material comprising the layer. While spreading or rolling, water shall be applied to the base course if required, and as instructed by the Engineer.

3.1.7 The final moisture content of the base course mixture in each layer just before compaction shall be not more than optimum moisture in order to obtain maximum density. The optimum moisture for the base course mixture and the maximum density of the compacted layers shall be determined by the Engineer.

3.1.8 Traffic over base course will not be permitted except by permission of the Engineer. If hauling is permitted over base course, the Contractor will, at his own expense, maintain and repair the base course as to cross-section and compaction. The Contractor shall provide at his own expense, all necessary protection of works and the safety of the public.

3.1.9 Construction shall be completed and trimmed to ± 10 mm vertically and ± 100 mm horizontally. Deviations shall be neither consistently high nor consistently low.

1.0 GENERAL

1.1 Scope

1.1.1 The items or work covered by the section are those required for the supply and application of asphaltic material as a prime or tack coat for a compacted base course.

2.0 PRODUCTS

2.1 Bituminous Material

2.1.1 The bituminous material shall be MC70 to MC250, RC70 to RC250 or SS-1. Where SS-1 is used, the dilution with water shall be 1:1.

3.0 EXECUTION

3.1 Preparation

3.1.1 Asphalt Primer

.1 Immediately prior to applying the asphalt primer, the surface of the base course shall be brought to uniform cross-section by patching all depressions and defective areas using an approved patching material and by removing all bumps and irregularities. All loose and foreign material shall be removed by light sweeping.

3.1.2 Tack Coat

.1 The pavement shall be clean and dust free. When thoroughly set, the tack coat shall be covered immediately or protected from traffic until covered.

3.2 Application

3.2.1 Upon the prepared surface, the asphalt shall be applied uniformly, at a rate of 1.5 litres per square metre for asphalt primer, at a rate of 0.5 litres per square metre for tack coat, and a rate of 1.0 litres per square metre for cure coat as directed by the Engineer. The asphalt primer shall be applied only when the surface is dry or slightly damp unless otherwise allowed by the Engineer in writing, and only when the air temperature in the shade is above +2 ^{o}C. The application temperature of the asphalt primer shall be specified by the Manufacturer.

3.2.2 To ensure uniformity of application, a drip pan shall be inserted under the nozzles when the application is stopped, and building paper shall be

spread over the treated surface to allow sufficient distance on restarting so that the nozzles are operating at full force when the untreated surface is reached. The building paper shall then be removed or destroyed. A narrow spout pouring pot or hand spray shall be used to apply primer material necessary to touch up any spots unavoidably missed by the distributor.

3.2.3 Concrete work adjacent to the roadway shall be completely protected from the application operation by a covering approved by the Engineer. Any unnecessary splashing of the concrete shall be cleaned at the Contractor's expense. The Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

3.2.4 The pressure distributor used for applying asphaltic materials shall be equipped with pneumatic tires and shall be so designed and operated as to distribute the asphaltic material in a uniform spray without atomization, in the amount and between the limits of temperature specified. It shall be equipped with a fifth wheel speed tachometer registering metres per minute and so located as to be visible to the truck driver to enable him to maintain the constant speed required for application at the specified rate. The pump shall be operated by a separate power unit, or by the truck power unit. It shall be equipped with a tachometer registering litres per minute passing through the nozzles and readily visible to the operator.

3.2.5 Suitable means of accurately indicating at all times the temperature of the asphaltic material shall be provided. The thermometer well shall be so placed as not to be in contact with a heating tube. The distributor shall be so designed that the normal width of application shall not be less than 2 m, with provision for the application of lesser width when necessary.

3.2.6 If provided with heating attachments, the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

1.0 GENERAL

1.1 Scope

1.1.1 The asphaltic concrete shall consist of a homogeneous mixture of mineral aggregate, filler and asphaltic binder, combined in accordance with these Specifications.

1.1.2 Where a standard, specification or test method is referenced in this specification, the current version shall apply.

2.0 PRODUCTS

2.1 Aggregate

2.1.1 Shall consist of hard, durable, uniformly graded, crushed gravel or steel slag and shall not contain organic or soft materials nor materials that break up when alternately frozen and thawed or wetted and dried, nor other deleterious materials.

2.1.2 When tested according to ASTM Designation C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates, the material shall meet the following gradation requirements:

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT		
	12.5 mm Max. Aggregate	16 mm Max. Aggregate	20 mm Max. Aggregate
20 mm			100
16 mm		100	85 - 100
12.5 mm	100	90 - 100	75 - 93
10 mm	90 - 100	79 - 92	65 - 90
5 mm	55 - 85	50 - 72	40 - 65
2 mm	30 - 65	32 - 51	25 - 46
800 µm	20 - 45	20 - 35	15 - 32
400 µm	10 - 30	15 - 27	13 - 25
160 µm	5 - 15	7 - 15	7 - 15
80 µm	2 - 10	4 - 11	4 - 11

2.1.3 The maximum aggregate size for type of roadway shall be in accordance with the following table:

TYPE OF ROAD	MAXIMUM AGGREGATE SIZE
Local/Residential	12.5 mm or 16.0 mm
Collector/Bus Route	16.0 mm
Arterial/Industrial	16.0 mm or 20.0 mm

2.1.4 If aggregate has insufficient material passing the 80 μm sieve, the Contractor shall supply mineral filler, approved by the Engineer, in the proportions required.

2.1.5 The minimum sand equivalent value shall be 45 when tested in accordance with ASTM D2419, Test Method for Sand Equivalent Value of Soils and Fine Aggregates.

2.1.6 The coarse aggregate must conform to the requirements of Standard Specification for Coarse Aggregates for Bituminous Paving Mixtures ASTM Designation D692.

2.1.7 The fine aggregate must conform to the requirements of the Standard Specification for Fine Aggregate for Bituminous Paving Mixtures, ASTM Designation D1073.

2.1.8 The aggregate must exhibit an affinity for asphalt cement, and meet the Saskatchewan method for Aggregate Stripping Potential, and ASTM D4867. If the material has greater than 25% stripping potential, then a suitable anti-strip agent shall be utilized upon approval by the Engineer.

2.1.9 If an anti-strip agent is required it shall be at the Contractor's expense.

2.2 Mineral Filler

2.2.1 When the mineral aggregate is deficient in mineral filler, the Contractor shall add in the weigh hopper of the asphalt plant, mineral filler in such quantities as will be required to meet the gradation of aggregate as specified above. Mineral filler shall consist of Portland Cement, Pozzolan, commercially ground stone dust, or other mineral dust approved by the Engineer. Mineral filler shall have a plasticity index of zero.

2.3 Asphaltic Binder

2.3.1 The asphaltic binder shall be uniform in character, free of water and shall not foam when heated to 175 °C. It shall meet the following specifications:

ASTM CHARACTERISTICS	ASTM TEST METHOD	SPECIFICATIONS 150-200(A)		300-400(A)	
		MIN	MAX	MIN	MAX
Penetration, @ 25 °C, 100 g, 5 sec.	D5	(see table below)		(see table below)	
Viscosity @ 60 °C, MPa's	D2171				
Flash Point (Cleveland Open Cup), °C	D92	205		175	
Thin Film Oven Test Weight Loss, max. %	D1754	-	1.0	-	2.0
Penetration @ 25 °C of residue, % of orig.	D5	50	-	-	-
Ductility: @ 25 °C	D113	100	-	-	-
Solubility in Trichloroethylene, min. %	D2042	99.5	-	99.5	-

2.3.2 The limits of the viscosity and penetration shall be as follows:

		LIMITS			
150-200(A)	Viscosity	55	78	50	92
	Penetration	150	150	200	200
300-400(A)	Viscosity	45	26.5	17	27
	Penetration	300	300	400	400

2.3.3 PG Graded asphalt cements may be used upon approval of the Engineer.

2.4 Recycled Mixes

2.4.1 300-400(A) may be used for recycle applications upon approval of the Engineer. The mixed binder from the recycle and the 300-400(A) shall fall within the conditions outlined above.

2.5 Mix Design Procedure

2.5.1 Prior to the commencement of any work, the contractor shall employ a testing laboratory to produce a laboratory mix design and make recommendations concerning blending of mineral aggregates.

2.5.2 The asphalt cement and mineral aggregates shall be uniformly combined in such proportions as to produce a suitable mixture that produces the properties called for in this specification.

2.5.3 The laboratory mix design is to comply with the requirements for Section 2325 for Supply of Asphaltic Concrete, clauses 2.1, 2.2, 2.3 and 2.4 and follow the Marshall Method of mix design.

2.5.4 The Marshall Method of mix design shall be used in accordance with ASTM Designation D 1559 or AASHTO T245, Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus. The mix, for Minimum 50 Blow Marshall Stability, shall conform to the following criteria:

.1	Local Residential	5,700 Newtons
.2	Collector/Bus Route	7,000 Newtons
.3	Arterial/Industrial	10,000 Newtons
.4	Minimum Retained Stability	70% of Initial Stability

The retained stability test is to ensure that the asphaltic mix has reasonably good durability. One of the Marshall specimens is soaked in a water bath at 60 ^{o}C for twenty-four hours. A Marshall stability performed on this specimen shall have retained a minimum of 70% of the initial stability.

.5	Meet ASTM D4867 upon request of the Engineer.	
.6	% Voids of Total Mix	3 - 5
.7	Minimum V.M.A. (Max. Agg.)	15% (12.5 mm) 14.5% (16 mm) 13.5% (20 mm)
.8	Maximum Flow in mm	5
.9	Minimum Flow in mm	2
.10	Minimum Film Thickness	7.5 μm

Film thickness shall be determined in accordance with Saskatchewan Highways and Transportation Standard Test Procedure STP 204-19.

2.5.5 When a 75 blow Marshall Design is required approval and specification will be provided by the Engineer.

2.5.6 Mix design shall also include test results from ASTM Designation D 6928 Test Method for Resistance of Coarse Aggregate to Degradation by Abrasion in the Micro-Deval Apparatus.

2.5.7 Representative samples of all aggregates proposed for use shall be submitted, when requested, to the Engineer sufficiently in advance of the commencement of operations or during operations to permit the Engineer to carrying out Quality Assurance tests.

2.5.8 No asphalt concrete shall be supplied or placed until the Engineer has received copies of the mix design and has given written approval of its use.

2.6 Job-Mix Formula

2.6.1 The job-mix formula is the target aggregate gradation and asphalt cement content for plant production.

2.6.2 The Contractor's quality control laboratory will test a trial batch of the proposed job-mix formula to verify the laboratory mix design. If the initial trial batch fails, the Contractor will submit results of further trial batch tests performed by its laboratory until successful results are obtained. The laboratory mix design and proposed job-mix formula will not be approved until successful results are obtained.

2.6.3 The approved job-mix formula shall comply with the requirements of Section 2325 for Supply of Asphaltic Concrete, clauses 2.1, 2.2, 2.3, 2.4 and 2.5.

2.6.4 The maximum permissible variation in the aggregate gradation of the actual hot mix produced from the job-mix formula shall be as follows:

20 mm sieve	± 5%
16 mm sieve	± 5%
12.5 mm sieve	± 5%
10 mm sieve	± 5%
5 mm sieve	± 5%
2 mm sieve	± 4%
800 µm sieve	± 3%
160 µm sieve	± 2%
80 µm sieve	± 1.5%

2.6.5 Hot mix asphalt shall not be supplied until the Engineer gives permission in writing to proceed with a specific job-mix formula. The job-mix formula shall remain in effect until changes are approved in writing by the Engineer. The job mix formula must meet the gradation specifications of section 2.1.2.

2.6.6 The Quality Control and Quality Assurance testing shall be reported according to the job mix formula on all reports. Any changes to the job mix formula shall be reported immediately to the Engineer.

2.6.7 The three point moving average of asphaltic binder in the mix shall not vary by more than zero point three percent (0.3%) from the job-mix formula design.

2.6.8 All of the above mentioned tests, laboratory mix designs and job mix formula confirmations shall be at the expense of the Contractor.

2.6.9 Quality Assurance testing shall be at the expense of the Engineer.

3.0 EXECUTION

3.1 Plant Operation

3.1.1 The asphalt plant shall be capable of turning out a uniform mix of previously designed proportions and to maintain this mix. The plant shall be equipped with screens and bins.

3.1.2 Proportioning may be done by weight or volume and must be accurate. The asphalt may be done by weight or volume and must be accurate. The asphalt storage tanks shall be protected from open flame and be equipped with an easily read thermometer.

3.1.3 Temperatures shall be controlled in accordance with the following limits:

PENETRATION ASPHALT	MAXIMUM TEMPERATURE OF DRY AGGREGATE	ASPHALT STORAGE TEMPERATURE	BITUMINOUS MIX TEMPERATURE AT THE PUGMILL
150-200(A)	160 ^{o}C	120 - 150 ^{o}C	115 - 150 ^{o}C

3.1.4 The bituminous aggregate, immediately before entering the pugmill, shall not contain more than one-half percent (1/2%) moisture by weight. In the case of recycled mix, the maximum temperature of the aggregate mix just prior to adding binder shall be 160 ^{o}C.

3.1.5 The hot mix will be compared to the job-mix formula and the Marshall properties to determine the acceptance of the asphalt concrete product.

3.2 Quality Control

3.2.1 Before commencing hot mix production, the Contractor shall submit to the Engineer a quality control plan. This plan shall include: what tests shall be performed, by whom, and at what frequency. The job mix formula shall be presented and any changes shall be immediately presented to the Engineer.

3.2.2 Contractor shall be responsible for the final product of asphaltic concrete production meeting the requirements of these specifications including the approved job mix formula.

3.2.3 The Contractor shall provide copies of all quality control testing to the Engineer within seven days of placing material.

3.3 Acceptance

3.3.1 The Engineer may reject the asphaltic concrete if it does not meet the specifications.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of placing asphaltic concrete to a compacted thickness conforming to the lines, grades, and cross-sections as shown on the plan or as designated by the Engineer.

2.0 PRODUCTS

2.1 Materials

2.1.1 As specified in Section 2325.

3.0 EXECUTION

3.1 Construction

3.1.1 The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. When directed by the Engineer, the vehicle shall be suitably insulated and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions. The inside surface of all vehicles may be lightly lubricated with a thin oil or soap solution prior to loading, but excess lubricating will not be permitted.

3.1.2 The mixture shall be laid with a mechanical selfpowered spreader capable of spreading the mixture true to line, grade and crown as required. The paver shall be equipped with hopper and distributing screw of the reversing type to place the mixture evenly in front of adjustable screeds. The paver shall be equipped with an adjustable strike off screed of such design that drag marks will be eliminated and with built-in tamping bars for compaction during spreading.

3.1.3 The Bituminous Mixture shall not be spread when the air temperature is less than 2 ^{o}C. The asphaltic concrete mixture shall only be laid on a base which has been approved by the Engineer. The Contractor shall remove all loose and foreign material and water. The mixture shall be delivered at a minimum temperature of 110 ^{o}C and a maximum temperature of 150 ^{o}C.

3.1.4 The mixture shall be laid and rolled to the widths and thicknesses shown on the drawings or as directed by the Engineer. The finished surface shall have the minimum number of longitudinal and transverse joints practicable.

3.1.5 The minimum lift thickness of hot mix asphalt shall be 2.5 times the largest specified aggregate. Where a pavement thickness greater than or equal to 80 mm is specified, it shall be laid in two lifts. The second lift shall not be placed over the bottom layer until the temperature is 60 ^{o}C. Where a pavement which is less than 80 mm in thickness is specified, it may be laid in one lift and rolled to the required thickness. Before rolling is started, the surface shall be checked, inequalities in depth adjusted and fat spots or sandy accumulations replaced and irregularities in alignment or grade along the outside edge shall be corrected. The Contractor shall provide competent workmen to correct irregularities as outlined. The paver shall operate on a schedule approved by the Engineer, but in no lane for more than one day before the adjacent lane is placed.

3.1.6 A constant supply of hot asphalt must be supplied so that there is no delay in work. Otherwise, if the temperature of the uncompacted mat cools below 110 ^{o}C, the Contractor shall cut back the mat to the graded and compacted area.

3.1.7 Areas which are inaccessible to the spreading machine may be paved by other methods, as directed by the Engineer. When authorized by the Engineer, motor graders or approved types of truck attached spreaders shall be used to pave inaccessible or irregularly shaped areas. Hand raking shall be kept to a minimum.

3.1.8 Except when otherwise required to fill the complete concrete gutter section, remove asphalt entirely from the gutter section and round out the edge of the asphalt mat adjacent to the face of gutter before the mat is rolled or compacted.

3.1.9 A continuous well-sealed bond is required between old and new surfaces. The contact surface of all longitudinal and transverse joints shall have a thin, uniform coat of hot asphalt tack applied before placing the new mix. Where the asphaltic concrete material is placed in two layers, longitudinal joints in the two layers shall be staggered by a minimum of 150 mm.

3.1.10 When matching a longitudinal joint to a previously laid mat, an overlap of not less than 25 mm or more than 75 mm shall be made. The depth of the overlapping mat should be enough so that subsequent compaction after rolling will bring the new mat down only to the level of the adjacent mat.

3.1.11 When possible, paving in echelon (two pavers moving in a staggered fashion) is recommended.

3.1.12 The rollers shall be kept in continuous motion while on the hot mat in such a manner that all parts of the pavement receive equal compression. Rollers shall be operated by competent and experienced personnel. Vibratory rollers shall not be used on soil cement base.

3.1.13 All rolling shall proceed as directed by the Engineer, but in general, shall be longitudinal. Alternate trips of the rollers shall be slightly different lengths.

3.1.14 The motion of the rollers shall be slow enough at all times 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 be corrected immediately by the use of lutes and fresh mixture when required.

3.1.15 Where new pavement structure abuts the existing pavement surface that is 100 mm thick or greater, the Contractor shall cold plane 50 mm of existing surface for a distance of a minimum two (2) metres to allow the top lift to be placed across the construction joint. The end of the milled joint shall produce a straight line across the paved surface with a vertical face to pave to. For existing pavement surfaces less than 100 mm thick, sawcutting is acceptable. The finished surface across the joint shall be smooth, such that when a three (3) metre straight edge is placed across the joint, no gaps appear between the straight edge and the pavement edge.

3.1.16 Areas inaccessible to the roller shall be compacted by tamping with mechanical or hand tampers.

3.1.17 The breakdown rolling shall take place as closely behind the laying machine as the temperature and condition of the mat will allow. If used, pneumatic tire rolling will be made with the tire pressure at a level such that only light rutting is evident. Maximum densities are attained when tire pressures are raised as rapidly as the mix stability will permit. Pneumatic rolling shall continue until two complete coverages have been made by the roller with the tire pressure at 850 kPa for collector, industrial and arterial roads and 600 kPa for residential roads. Pneumatic rolling is to be completed before the temperature of the placed mix falls below 95 ^{o}C.

3.1.18 Steel tire rolling - For final rolling, a steel tire roller shall be used. After final rolling of the surface course, the asphalt shall meet the gutter at an elevation of 10 mm above and along the entire lip of the gutter except on the high side of superelevation curve where it shall be flush with the lip of the gutter. Final rolling shall be carried on until all roller marks are eliminated and no further compaction is possible.

3.1.19 Sufficient rollers must be maintained on job site to insure full compaction of asphalt mix before temperature of mix falls below 95 ^{o}C.

3.1.20 The asphaltic finished surface shall be true to the required profile and cross-section, with a tolerance of ± 5 mm from the required elevations. The finished grade shall neither be consistently high or low from the design grade. The surface shall show no depressions or bumps exceeding 5 mm under a straight edge three 3 m (minimum) long, placed parallel to the road centre line. Where specified in contract documents, surface smoothness pay adjustment will be made in accordance with the methods employed by the Ministry of Highway and Transportation Department.

3.1.21 Where water valve boxes or manholes are rebuilt, constructed, raised or lowered and/or adjusted in conjunction with surface construction or renewal, adjust the appurtenances such that the top surface of the appurtenance is flush with the finished grade of the pavement, sidewalk or boulevard.

3.1.22 After placing, rolling and compacting the asphalt, depressions or bumps measured centerline to the top of the appurtenances under a straight edge, a minimum of 3 m long, placed parallel to the road are not to exceed:

APPURTENANCE	DEPRESSION	BUMP	PENALTY
Water valve boxes	10 mm	5 mm	$2000 each
Floating manholes	5 mm	5 mm	$2000 each
Solid manholes	10 mm	5 mm	$2000 each

*Depressions exceeding 15 mm and bumps exceeding 10 mm shall be repaired at the Contractor's expense.

3.1.23 Any uplifting or settlement of water valve boxes and/or manhole frames shall be corrected to conform to this specification.

3.1.24 Core samples for density and thickness shall be taken every 500 m² and shall be used to calibrate the nuclear density results. Core density values shall govern over nuclear density. In the event that an area is removed and replaced, or of low density receiving additional compaction, the area shall be re-cored and retested with a new calibration factor applied to the nuclear results.

3.1.25 The average asphalt concrete thickness must meet or exceed the required thickness and if any individual core thickness is less than the required thickness the following pay reductions shall apply:

THICKNESS DEFICIENCY (mm)	PAY FACTOR (%) NEW CONSTRUCTION	PAY FACTOR (%) REHABILITATION CONSTRUCTION
Up to 3	100	100
3 to 5	98	100
6	95	95
7	90	90
8	80	80
9	70	70
10	50	50
Over 10	Remove and replace	Remove and replace

* The minimum area for pay reductions, including removal and replacement, shall be the full width of the paved lane and a minimum length of 10 lineal meters.

3.1.26 When deviations in excess of the above tolerances are found the pavement surface shall be corrected by methods satisfactory to the Engineer.

3.1.27 The completed pavement shall have an average density of ninety-eight percent (98%) and in no case shall any individual density test be less than ninety-six percent (96%) of the laboratory compacted density as determined by ASTM Designation D1559 or AASHTO T245, Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus, using a compaction of fifty blows for each face. The intent is that a long term durable product be provided. The following table represents payment reduction based on average density of cores not meeting minimum values.

COMPACTED DENSITY % OF MARSHALL	PAY FACTOR (%)
98 to 100	100
97.6 to 97.9	98
97.0 to 97.5	96
96.6 to 96.9	93
96.0 to 96.5	90
94.0 to 95.9	75
92.0 to 93.9	50
Less than 92%	Remove and replace

If a core density on any individual test is less than 96%, a pay reduction of 90% will be applied to a minimum area of 100 m².

3.1.28 The use of Electromagnetic Surface Contact Methods (Pavement Quality Indicator (PQI) to measure density of Bituminous paving mixtures in place - ASTM D 7113-05 is permitted on a trial basis. Three to Five (3 to 5) shots are to be taken at each test site. The results are to be averaged and reported as the in-place density. Field cores must be taken to confirm and calibrate the PQI. Field core results must accompany field test readings taken by the PQI. Alternatively, field density may be taken in accordance with ASTM D2950, Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.

3.1.29 No traffic shall be allowed on the finished surface until it has cooled to 60 ^{o}C or until permitted by the Engineer.

3.2 Quality Control and Quality Assurance Testing

3.2.1 Before commencing hot mix production, the Contractor shall submit to the Engineer a quality control plan. This plan shall include by whom the tests will be performed and shall state which of the following components of the test will be performed and at what frequency.

3.2.2 Contractor shall be responsible for the placement of asphaltic concrete meeting the requirements of these specifications.

3.2.3 The Engineer shall be responsible for the Quality Assurance testing.

3.2.4 Testing for Quality Control and Quality Assurance shall not be performed by the same agency.

3.2.5 Quality Control and Quality Assurance testing for nuclear and core measurements shall be completed within 20 days of the completed paving.

3.2.6 The contractor shall be responsible for payment of any additional testing by the Quality Assurance Agency for an area that is re-tested.

3.2.7 Any area that requires removal and replacement for any deficiency shall require removing the full width of the paved lane, and a minimum of length 10 lineal meters.

3.3 Completion Inspection Criteria

3.3.1 The acceptance criteria for Asphalt Concrete shall conform to sections 2325 and 2350 of the City of Regina Standard Construction Specifications.

3.3.2 Longitudinal and Transverse construction seams shall conform to section 3.1.9, and 3.1.10 as well as be subject to a penalty of $15.00 / lineal metre of joint based on segregation or uneven height or open texture at the seam.

3.3.3 The finished asphalt surface shall be free of but not limited to: segregation, pop outs, stripping, roller marks, cracking, tearing and excess or insufficient asphalt cement. A pay reduction or repair shall be required based on a minimum area according to the following table:

Deficiency Item	Action Required	Corresponding Pay Reduction
Clay ball pop-out	• Core hole and remove pop-out and repair with asphalt concrete	Must be repaired
Segregation	Deficient areas measured • Penalty applied, or • remove and replace, or • surface treatment based on severity	50% pay based on deficient surface area
Cracking, Tearing or Waves	Deficient areas measured • Penalty applied, or • remove and replace	50% pay based on deficient surface area
Stripping or Ravelling	Deficient areas measured • Penalty applied, or • remove and replace, or • surface treatment based on severity	50% pay based on deficient surface area
Joint deficiency	Length of joint measured • Penalty applied	Reduction of $ 15.00 / lineal metre of deficient joint
Excess or insufficient asphalt cement	Deficient areas measured • Penalty applied, or • remove and replace, or • surface treatment based on severity	50% pay based on deficient surface area
Roller marks	Length of roller marks measured • Penalty applied	Reduction of $ 15.00 / lineal metre of mark

3.3.4 When a contractor chooses to remove and replace a deficient item, they shall conform to minimum areas of repair and re-testing of the final product for conformance to this specification.

3.3.5 Surface treatments as referred to in the previous table are to be approved by the Engineer.

3.3.6 When a deficiency is present, the minimum area for penalty shall be the full width of the paved lane and a minimum length of 10 lineal meters. If the area is greater than 50 m^2, the penalty will be based on the deficient area.

1.0 GENERAL

1.1 Scope

1.1.1 The work shall consist of preparing and sealing cracks an excess of 2 mm width of as determined by the Engineer. All decisions concerning the extent of sealing required are final.

1.1.2 An inspection shall be made in late spring of the year following completion of the pavement. Any cracks which warrant sealing at the time of inspection, plus any cracks which develop and warrant sealing until the time of sealing, shall determine the extent of the sealing required.

2.0 PRODUCTS

2.1 Crack Sealant

2.1.1 The crack sealant shall be a high quality asphalt - rubber sealant which meets requirements of ASTM D-3405 such as Crafco Asphalt Rubber Plus or approved equal capable of providing long life, healability, low service temperature flexibility and high service temperature resistance to flow.

3.0 EXECUTION

3.1 Construction

3.1.1 Cracks and joints shall be cleaned using appropriate routing, sawing, brushing, blowing, or other techniques to provide intact bonding faces which are free of moisture, dust, or other contaminants.

3.1.2 Cracks shall be widened using a router to form a sealant reservoir which is 10 mm wide and 20 mm deep. The routed cracks should then be cleaned with compressed air heated to 815 ^{o}C to remove all dust and free all moisture and then sealed in such a manner that the sealant is surface level upon cooling.

3.1.3 The sealant shall be applied using a melter-applicator unit. The melter-applicator unit shall be a self-contained double boiler device with the transmittal of heat through a liquid having a minimum flash point of 315 ^{o}C. It must be equipped with an on board automatic heat controlling device to permit the attainment of a pre-determined temperature, then, maintain that temperature as long as required. The unit shall also have a means to vigorously and continuously agitate the sealant. The sealant shall be applied to the pavement under pressure supplied by a positive displacement pump.

3.1.4 The cracks must be sufficiently dry to permit bonding of the sealant. The contractor shall ensure traffic is not permitted on the newly sealed surface for a period of one (1) hour from completion of the crack sealing.