

1.0 GENERAL

1.1 Related Work

1.1.1 Section 02210 - Site Grading – Rough

1.2 Measure for Payment

1.2.1 Asphalt pathway structures will be measured in square metres in place.

1.3 Testing

1.3.1 All testing shall be done in accordance with current ASTM Standards.

1.3.2 The Contractor shall arrange for all required testing and shall include costs of same in the tender.

1.3.3 Provide one test of base course material for compliance with specification.

1.3.4 Provide one test of surface course material for compliance with specification.

1.3.5 Provide one density test for each 100 linear metres of compacted subgrade or as directed by the Consultant.

1.3.6 Provide one density test for each 100 linear metres of base course or as directed by the Landscape Architect.

1.4 Clean Up

1.4.1 On completion of the work, remove all excess material, debris and equipment.

1.4.2 Make good all damage to other work resulting from work of this Section.

1.5 Final Acceptance

1.5.1 All of the work specified in this Section shall be free of major depressions, scorings, roller marks and irregularities and shall be properly graded to the levels shown.

2.0 MATERIALS

2.1 Base Course

- 2.1.1 When testing according to ASTM Designation C135, Method of Test for Sieve Analysis, the material shall meet one of the following gradation requirements as specified by the Consultant.

SIEVE DESIGNATION	PERCENT PASSING BY WEIGHT			
	Size	Type 32	Type 33	Type 34
25 mm	100			
20 mm	93 - 100	100	100	100
12.5 mm	72 - 93	81 - 100	91 - 100	91 - 100
5 mm	45 - 77	50 - 80	70 - 85	70 - 85
2 mm	29 - 56	32 - 52	45 - 65	45 - 65
800 µm	17 - 38	18 - 33	27 - 42	27 - 42
400 µm	13 - 26	15 - 25	20 - 30	20 - 30
160 µm	7 - 16	11 - 21	11 - 18	11 - 18
80 µm	6 - 11	8 - 13	8 - 12	8 - 12
Plasticity Index	0 - 6	0 - 6	0 - 6	0 - 6

The percentage passing the designated sieve size for any representative sample, when plotted on a semi-log grading chart, shall show a free flowing 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.

- 2.1.2 The aggregate shall consist of hard, durable particles free from injurious quantities of soft or flaky particles, loam organic matter, or other deleterious matter. The gravel shall be crushed gravel passing a 25 mm sieve.
- 2.1.3 Granular material retained on the 5 mm sieve shall have a minimum average of 45% of the aggregate with at least one fractured face. Average will be defined as the average of all tests for each working shift.
- 2.1.4 Clay binder 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 Consultant.
- 2.1.5 Filler material shall be fine sand (minimum 100% passing 630 µm sieve) and free from rocks or any deleterious material.

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

2.2 Asphaltic Surface Course

2.2.1 Aggregate 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.

2.2.2 When tested according to ASTM Designation C136, Method of Test for Sieve Analysis, the material shall meet the following gradation requirements.

SIEVE DESIGNATION Size	PERCENT PASSING BY WEIGHT	
	16 mm Max. Aggregate	20 mm Max. Aggregate
20 mm		100
16 mm	100	85 - 100
14 mm	94 - 100	80 - 95
12.5 mm	90 - 100	75 - 93
10 mm	79 - 92	65 - 90
5 mm	50 - 72	40 - 65
2 mm	32 - 51	25 - 46
800 um	20 - 35	15 - 32
400 um	15 - 27	13 - 25
160 um	7 - 15	7 - 15
80 um	4 - 11	4 - 11

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

2.2.4 From a sieve analysis of the aggregate, including adding mineral filler if required, the percentage passing the designated sieves, when plotted on a semi-log grading chart, shall give a smooth flowing curve, without sharp breaks, within the limits given above.

2.2.5 The coarse aggregate must conform to the requirements of Standard Specifications for Coarse Aggregate for Bituminous Paving Mixtures, ASTM Designation D692.

2.2.6 The fine aggregate must conform to the requirements of the Standard Specifications for fine aggregate for Bituminous Concrete Pavements, ASTM Designation D1073.

- 2.2.7 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 Landscape Architect. Mineral filler shall have a plasticity index of zero.
- 2.2.8 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	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	See table below		See table below	
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	-

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

	LIMITS			
	150 - 200 (A)	150 - 200 (A)	300 - 400 (A)	300 - 400 (A)
Viscosity	<u>155</u>	<u>78</u>	<u>50</u>	<u>92</u>
Penetration	150	150	200	200
Viscosity	<u>45</u>	<u>26.5</u>	<u>17</u>	<u>27</u>
Penetration	300	300	400	400

- 2.2.9 Recycled mixes of 300-400(A) may be used for recycle applications upon approval of the Consultant. The mixed binder from the recycle and the 300-400(A) shall fall within the conditions outlined above.
- 2.2.10 The Contractor shall be responsible for the asphaltic concrete mix design and for the production of a final product meeting the requirements of these specifications. Prior to the commencement of any work, he shall employ a testing laboratory to produce a mix design and recommendations concerning blending of aggregates. Throughout the project he shall obtain

such other laboratory tests as are required to assure compliance with the specifications. All copies of such design mix and test results shall be forwarded to the Consultant as soon as possible. Such tests shall include field density tests, asphalt contents, aggregate sieve analysis, air voids, stability, retained, stability, V.M.A. and flow. The above mentioned tests and mix design shall be at the expense of the Contractor.

2.2.11 The Contractor shall arrange laboratory tests on materials and the finished product. Such tests shall be for the purpose of assuring compliance with the specifications. If any test results indicate non-compliance, all work shall cease until corrective action can be taken.

2.2.12 The Marshall Method of mix design shall be used and the mix shall conform to the following criteria:

- .1 Minimum 50 Blow Marshall Stability: 5700N
- .2 Minimum Retained Stability: 70% of Initial Stability
- .3 % Voids of Total Mix: 3-5
- .4 Minimum V.M.A.: 15% (for 16 mm) / 14% (for 20 mm)
- .5 Maximum Flow in mm: 5
- .6 Minimum Flow in mm: 2

2.2.13 The mineral aggregate gradation shall be within the limits as set out above, and the maximum permissible variation from the job mix formula gradation shall be as follows:

- .1 5 mm sieve $\pm 5\%$
- .2 2 mm sieve $\pm 4\%$
- .3 800 μm sieve $\pm 3\%$
- .4 160 μm sieve $\pm 2\%$
- .5 80 μm sieve $\pm 1.5\%$

3.0 EXECUTION

3.1 Subgrade Preparation

3.1.1 The top mm of subgrade shall be scarified and recompact to obtain 95% of Standard Proctor Density of the material for the full depth .

3.1.2 Water shall be added to the compacted material to achieve optimum moisture content for maximum density.

3.1.3 The completed, compacted, subgrade surface shall not vary more than 15 mm from the design grades.

3.1.4 Subgrade shall be prepared to a width of 300 mm beyond the outside extremities of the completed asphalt surface.

3.2 Granular Base Course

- 3.2.1 The base course shall consist of an intimate mixture of coarse aggregate, sand, clay and water. These materials shall be properly combined, compacted and finished on the previously prepared subgrade to a compacted thickness of 300 mm.
- 3.2.2 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 Consultant. 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.
- 3.2.3 Granular base course is to be supplied, placed and delivered by the Contractor. The method of processing and delivery must be satisfactory to the Consultant.
- 3.2.4 The rolling and compacting shall begin at the outer edges of the pathway 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 top 15 mm is stable and tightly knit throughout.
- 3.2.5 The surface of the granular base course shall be such that when tested with a 3 m straight edge placed on the surface, the maximum deviation of the surface from the edge of the straight edge shall nowhere exceed 10 mm.
- 3.2.6 The base course shall be compacted to at least 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 Consultant.
- 3.2.7 The final moisture content of the base course mixture in each layer just before compaction shall not be 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 Consultant.
- 3.2.8 Traffic over base course will not be permitted except by permission of the Consultant. If hauling is permitted over base course, the Contractor will at this 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 for the works and the safety of the public.

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

3.3 Asphaltic Surface

3.3.1 The asphaltic paving plant shall be capable of turning out a uniform mix of previously designed proportions and to maintain this mix. The machine shall be equipped with screens and bins. Proportioning 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.

Penetration Asphalt	Max. Temp. of Dry Aggregate	Asphalt Storage Temp.	Bituminous Mix at the Pugmill
150 – 200 (A)	160°C	120 - 150°C	125 - 135°C

3.3.2 The bituminous aggregate, immediately before entering the pugmill, shall not contain more than 0.5% moisture by weight. In the case of recycled mix, the maximum temperature of the aggregate mix just prior to adding binder shall be 160°C.

3.3.3 The amount of asphaltic binder in the mix shall not vary by more than one-half of one percent (0.5%) from the mix design and the average asphaltic binder shall not be consistently high or low.

3.3.4 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 Consultant, 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.

3.3.5 The mixture shall be laid with a mechanical self-powered 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.

3.3.6 The Bituminous Mixture shall not be spread when the air temperature is less than 2°C. The mixture shall be delivered at a minimum temperature of 110°C.

3.3.7 The asphaltic concrete mixture shall only be laid on a base which has been approved by the Landscape Architect. The Contractor shall remove all loose and foreign material and water.

- 3.3.8 The mixture shall be laid and rolled to the widths as shown on the drawings and to the thickness of 50 mm or as directed by the Consultant. The finished surface shall have no longitudinal joints.
- 3.3.9 Pavement 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 in advance by the Consultant.
- 3.3.10 Areas which are inaccessible to the spreading machine may be paved by other methods, as directed by the Consultant. When authorized by the Consultant, 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.
- 3.3.11 A continuous well-sealed bond is required between old and new surfaces. The contact surface of all joints shall be painted with a thin and uniform coat of hot asphalt primer before placing the new mix. When the work is resumed after a lapse of several hours, one end shall be cut back approximately 150 mm to a new and clean vertical surface before paving is started and heat shall be used as necessary to ensure a proper bond.
- 3.3.12 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.
- 3.3.13 All rolling shall proceed as directed by the Consultant, but in general, shall be longitudinal. Alternate trips of the rollers shall be slightly different lengths.
- 3.3.14 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 repaired.
- 3.3.15 Areas inaccessible to the roller shall be compacted by tamping with mechanical or hand tampers.
- 3.3.16 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 600 kPa. Pneumatic rolling is to be completed before the temperatures of the placed mix falls below 95°C.

- 3.3.17 Steel tire rolling – for final rolling, a steel roller shall be used. Final rolling shall be carried on until all roller marks are eliminated and no further compaction is possible.
 - 3.3.18 Sufficient rollers must be maintained on job site to insure full compaction of asphalt mix before temperature of mix falls below 65°C.
 - 3.3.19 The finished surface shall be true to the required profile and cross-section, with a tolerance of ± 5 mm from the required elevations and thickness. The surface shall show no depressions or bumps exceeding 10 mm under a straight edge 3 m long, placed parallel to the pathways centre line. The finished grade and thickness shall neither be consistently high or low from the design grade or thickness.
 - 3.3.20 The completed pavement shall not have a density of less than 95% of the laboratory compacted density as determined by ASTM Density D1559 using a compaction of fifty blows for each face.
 - 3.3.21 When deviations in excess of the above tolerances are found the pavement surface shall be corrected by the addition of asphalt concrete mixture to low places or removal of material from high places by methods satisfactory to the Landscape Architect.
 - 3.3.22 No traffic shall be allowed on the finished surface until it has cooled to 60°C or until permitted by the Consultant.
- 3.4 Unforeseen
- 3.4.1 Should Contractor encounter areas or pockets of unstable sub-grade materials during preparation of sub-grade, he shall immediately notify the Landscape Architect before proceeding further. Corrective measures will be as instructed by the Landscape Architect.
 - 3.4.2 Contractor shall include with his tender unit prices for additional excavation per cubic metre and for compaction utilizing a vibratory sheep's foot compactor.