03001 Supply of Aggregates

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03001-1 Description

Work under these specifications shall include the supplying, processing, stockpiling, loading, hauling and dumping or spreading of granular material meeting the requirements shown for each classification. Delivery shall be to anywhere within the City of Saskatoon.

03001-2 Reference to Standard Specifications

Reference in these Specifications will be made to the latest edition of the American Society for Testing Materials (A.S.T.M.) and Canadian Standards Association (C.S.A.) covering aggregate and methods of testing aggregates.

03001-3 Materials

3.1 General

3.1.1 Source

The source of the aggregate shall be the locations specified in Schedule "E" - List of Production Locations in the Tender Form or alternate locations acceptable to the Engineer.

3.1.2 Composition

The aggregate shall consist of fragments of durable rock, free from undesirable quantities of soft or flaky particles, shale, loam, vegetation or other deleterious material.

3.1.3 Reclaimed Asphalt Pavement

Reclaimed Asphalt Pavement (RAP) shall be the product of removed pavement materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for reconstruction, resurfacing, or to obtain access to buried utilities. Specifications for the addition of reclaimed materials in granular base and subbase layers are contained in the Asphalt Specifications Section 03050 for Granular Base Course and 03010 for Granular Subbase Course.

3.1.4 Moisture Content

Except when moisture control is specified, aggregate moisture content (by dry aggregate weight) shall be in the following ranges:

- Maintenance Base Aggregate, 3-6%;
- Dry Maintenance Base Aggregate, 0-3%;
- Street Sanding aggregate, 0 - 4%
- for all other aggregates, 0 - 5%

When moisture control is specified it shall be carried out as a part of processing and stockpiling, and shall be included in the unit costs. Such aggregate (moisture control specified) shall, at time of delivery to site, have a moisture content in the range of 1.5% below optimum to 0.5% above optimum.

All aggregate delivered to the job site, having a moisture content greater than specified in 3.1.3 will be subject to a price adjustment from the contract unit price. The price reduction will be $0.50 per percent moisture for street sand, and $0.40 per tonne per percent moisture for all other aggregate over the maximum specified.

Example 1 – Street Sand

For 2,000 tonnes street sanding aggregate with a moisture content of 6% would be:

Table 1: Moisture Content – Street Sand

Actual	Difference	Rate Reduction
6.0%	6.0% - 4.0% = 2.0%	2,000t x $0.50/t/% x 2% = $2,000.00

Example 2 – Moisture Control

City orders 2,000 tonnes of base aggregate to be supplied at optimum moisture content (use 7.2%), the corresponding payment reduction for material delivered with a moisture content of 8.0% and 4.9% would be:

Table 2: Moisture Content – Moisture Control

Actual	Allowable Difference	Rate Reduction
8.0%	7.2% + 0.5% = 7.7%	2,000t x (8.0%-7.7%)*$0.40/t/% = $240.00
4.9%	7.2% - 1.5% = 5.7%	2,000t x (5.7%-4.9%)*$0.40/t/% = $640.00

3.1.5 Existing Stockpiles

Material stockpiled by the Contractor both prior to and after the award of the Contract will not be accepted unless:

1. testing was carried out by an approved Testing Agency at the minimum frequency specified in Subsection 3.3.1 Tests and Frequency.
2. test results indicate the material meets current specifications and is uniform throughout the stockpile, and;
3. random testing by the City at time of delivery confirms the quality of the material.

3.2 Classification

3.2.1 Subbase Aggregate

Subbase aggregate shall be uniformly graded between the following limits:

Table 3: Subbase Aggregate Grading Limits

Sieve Designation	Percent by Weight Passing
50 mm	100
25 mm	75-100
12.5 mm	52-100
5 mm	30-75
2 mm	20-55
400 μm	8-30
71 μm	3-15

The Plasticity Index of the material passing the 400 um sieve shall not exceed 6.

The organic content of the material passing the 5 mm sieve shall not exceed 3.0% by weight.

The material, when compacted to 100% of the maximum density as determined by the Standard Proctor Compaction Test, shall have a minimum CBR of 25 in the unsoaked condition at 0.1" or 0.2" penetration, whichever is greater (ASTM D1883).

3.2.2 Base Aggregate

Base aggregate shall consist of a homogenous mixture of crushed gravel, sand filler and clay binder with a maximum organic content of 1.0% by weight, and shall be uniformly graded between the following limits:

Table 4: Base Aggregate Grading Limits

Sieve Designation	Percent by Weight Passing
25 mm	100
18 mm	87-100
12.5 mm	72-93
5 mm	45-77
2 mm	29-56
900 μm	18-39
400 μm	13-26
160 μm	7-16
71 μm	6-11

At least 50% by weight of the material retained on the 5 mm sieve shall have one or more fractured faces created by the crushing operation. The organic content of the material passing the 5 mm sieve shall not exceed 3.0% by weight.

The material, when compacted to 100% of the maximum density as determined by the Standard Proctor Compaction Test, shall have a minimum CBR of 65 in the unsoaked condition at 0.1" or 0.2" penetration whichever is greater (ASTM D1883).

3.2.3 Asphalt Aggregate

Specifications for all types of asphalt aggregate are contained in the Asphalt Specifications Section 04010 "Asphalt Mix".

3.2.4 Street Sanding Aggregate

Street sanding aggregate shall consist of clean, hard, durable particles free from clay, loam and other objectionable material.

The aggregate shall contain a minimum 25% crushed and/or angular aggregate particles (by weight) retained on the 2.5mm plus sieve.

The aggregate shall be free from frozen lumps under all weather conditions. It will be the Contractor's responsibility to protect his stockpiles from excessive moisture, to waste frozen material, or to take whatever steps necessary to meet this requirement.

Street sanding aggregate shall meet the following grading limits:

Table 5: Street Sanding Aggregate Grading Limits

Sieve Designation	Percent by Weight Passing
9 mm	100
5 mm	87-95
2.5 mm	50-70
900 um	25-40
400 um	7-22
160 um	0-5
71 um	0-3

The minimum street sanding aggregate requirements are to be met by October 1st.

Sieve analysis and moisture content testing will be performed on samples obtained from the conveyor prior to processing with salt or liquid de-icer. The following payment adjustments for street sand will apply as follows:

Table 6: Street Sand – More than 3% passing by weight on the 71µm sieve

% Passing by Weight	Payment
0% to ≤ 3.2%	100%
> 3.2% to ≤ 3.9%	90%
> 3.9% to ≤ 5.0%	80%
> 5.0% to ≤ 6.0%	70%
> 6.0%	0%

Table 7: Street Sand – Less than 100% passing by weight on the 9mm sieve

% Passing by Weight	Payment
≥ 99.5%	100%
> 99.0% to < 99.5%	90%
> 98.0% to ≤ 99.0%	80%
≤ 98.0%	0%
Note: these adjustments can be applied to samples taken at point of deliver with or without de-icer additives.	

Material meeting specifications for percent passing the 9mm and 71 µm sieve, but out of specification on any other sieve size:

- A payment reduction of $0.10/tonne will be assessed against all of the material processed that day.

3.2.5 Concrete Aggregate

Specifications for concrete aggregate are contained in Concrete Specifications Section 06005 "Ready Mixed Concrete".

3.2.6 Plaster Sand

The aggregate shall consist of fine granular material composed of hard, strong, durable mineral particles which are free of injurious amounts of saline, alkaline, organic or other deleterious substances.

The grading shall be from fine to coarse within the following limits:

Table 8: Plaster Sand Grading Limits

Sieve Designation	Percent by Weight Passing
5 mm	100
2.5 mm	95-100
1.25 mm	85-96
630 µm	68-93
280 µm	27-79
160 µm	0-59
71 µm	0-9

3.2.7 Pipe Bedding Aggregate

Pipe bedding aggregate shall conform to the following gradation:

Table 9: Pipe Bedding Aggregate Gradation

Sieve Designation	Percent by Weight Passing
19.00 mm	100
12.50 mm	75-100
4.75 mm	45-70
2.00 mm	28-50
850 µm	18- 36
425 µm	12- 26
150 µm	7- 15
75 µm	5- 10

3.2.8 Crushed Rock

Crushed rock shall be composed of fragments of durable rock, free from undesirable quantities of soft or flaky particles, shale, loam and other deleterious material.

The material shall conform to the following grading limits:

Table 10: Crushed Rock Grading Limits

Sieve Designation	Percent by Weight Passing
50 mm	100
25 mm	0-80
12.5 mm	0-18
5 mm	0-12
71 µm	0-5

At least 50% by weight of the material retained on the 5 mm sieve shall have one or more fractured faces created by the crushing operation. Crushed rock shall be delivered as required to one of the City of Saskatoon material reclamation yards, or, if so directed by the Engineer, to the City Yards, or other alternate location.

For use as a roadway sub-drainage aggregate permeability of the aggregate must be greater than 1×10^{-4} cm/sec.

3.2.9 Crushed Concrete

Crushed concrete shall be derived from durable fragments of concrete, free from undesirable quantities of soft or flaky particles, shale, loam and other deleterious material.

The material shall conform to the following grading limits:

Table 11: Crushed Concrete Grading Limits

Sieve Designation	Percent by Weight Passing
50 mm	100
25 mm	0-80
12.5 mm	0-18
5 mm	0-12
71 µm	0-5

At least 50% by weight of the material retained on the 5 mm sieve shall have one or more fractured faces created by the crushing operation. Crushed concrete shall be delivered as required to one of the City of Saskatoon material reclamation yards, or, if so directed by the Engineer, to the City Yards, or other alternate location.

For use as a roadway sub-drainage aggregate, permeability of the aggregate must be greater than 1×10^{-4} cm/sec.

3.2.10 Sub-drainage Sand and Natural Fines

Sub-drainage Sand and Natural Fines shall be free from soft or flaky particles, shale, loam and other deleterious material.

The gradation of the sub-drainage sand and natural fines shall be within the following limits:

Table 12: Sub-drainage Sand and Natural Fines Grading 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

Permeability of the sub-drainage sand and natural fines must be greater than 1×10^{-4} cm/sec.

Use gradation to determine suitability, however permeability specification will be used as guide for acceptance of the material.

3.2.11 Pit Run

Shall be of durable aggregate free from deleterious material such as roots, grasses, and topsoil and have a top size of no greater than 150 mm and have a minimum of 35% by weight retained on the plus 5 mm sieve.

3.2.12 Non-Shrink / Unshrinkable Fill

Non-shrink/unshrinkable fill shall conform to the following specifications:

- 28 day Compressive Strength - 0.30 to 0.50 MPa.
- Strength after 24 hours - a minimum of 0.07 MPa.
- Binder - Type 10 Portland Cement - minimum 30 Kg per cubic metre.
- Air entrainment - 5% to 8%.
- Slump - 150 mm to 200 mm.
- Aggregate shall be a type used for concrete, consisting of clean, hard durable stone or gravel free from lumps, soft and flaky particles, organic matter, salt, alkali and adherent coatings. No more than 10% by weight of the aggregate shall be finer than passing the 75 µm sieve.

3.2.13 Bedding Sand

The aggregate shall consist of fine granular material composed of hard, strong, durable mineral particles which are free of injurious amounts of saline, alkaline, organic or other deleterious substances.

The grading shall be from fine to coarse within the following limits:

Table 13: Bedding Sand Grading Limits

Sieve Designation	Percent by Weight Passing
5 mm	95-100
2.5 mm	80-100
1.25 mm	50-85
630 μm	25-60
280 μm	10-30
160 μm	0-15
71 μm	0-5

3.3 Testing

3.3.1 Tests and Frequency

All tests shall be carried out in accordance with current ASTM or CSA Standards. Test frequencies shall apply both to production (quality control) and to delivery (quality assurance).

Table 14: Testing and Frequency

Material	Minimum Frequency of Test	Test Required
Base and Subbase	Every 2,000 tonnes	1. Wash Sieve Analysis 2. Percentage Crush 3. Moisture Content
	Every 6,000 tonnes	1. Standard Proctor 2. CBR Value 3. Plasticity Index 4. Organic Content
Sanding Aggregate	Every 1,000	1. Wash Sieve Analysis 2. Moisture Content
Plaster Sand	Every 200 tonnes	1. Wash Sieve Analysis
Pipe Bedding Aggregate	Every 2,000 tonnes	1. Wash Sieve Analysis
	Every 6,000 tonnes	1. Organic Content
Pipe Bedding Sand	Every 2,000 tonnes	1. Wash Sieve Analysis
	Every 6,000 tonnes	1. Organic Content
Crushed Rock	Every 2,000 tonnes	1. Wash Sieve Analysis

3.3.2 Testing Services

Sampling and laboratory testing will be conducted by an agency appointed by the City. Copies of all test results will be made available to the Contractor.

In addition, the Contractor may choose to employ his own testing agency at his cost. However, in the event of a discrepancy between test results, those obtained by the City's testing agency will govern.

3.3.3 Notification

The Contractor shall notify the Engineer at least one working day prior to the commencement or the resumption of aggregate production. Whenever possible, sampling will be done from the crusher belt.

3.3.4 Costs

The Contractor shall bear the cost of sampling and testing material in the following situations:

1. Initial testing to bring production into specification requirements.
2. Testing as above when source of material is changed.
3. Retesting of material which failed to meet specifications.

Testing for 1 and 2 may be conducted by the Contractor's agency. If the City conducts the testing, the costs will be deducted from any subsequent progress payments.

The cost of other testing initiated by the City during production will be borne by the City. No compensation will be made to the Contractor for testing initiated by the Contractor during current or previous production.

3.3.5 Sieve Analysis

The gradation of the material, when plotted on a semi-log grading chart, shall appear as a smooth curve within the specified band.

The average of the results of any 5 consecutive Wash Sieve Analysis Tests on material sampled at the crusher belt, or any 2 consecutive Wash Sieve Analysis Tests on material sampled at the delivery location, shall be within the grading limits specified for that material. Failure to meet this requirement shall result in the rejection of the material.

3.4 Enforcement of Specifications

Delivery of material to City locations will not be permitted until test results confirm that it meets specifications, and until the stockpile requirements of Section 5.2 have been fully met.

Any deviation from specifications during the production of material shall require the Contractor to take immediate corrective action. Equipment shall be shifted to ensure that there is no contamination of the current stockpile. A new stockpile shall be started adjacent to the former stockpile only after the product has been proven by testing to again meet specifications. Any material of inferior quality, or not in accordance with this specification, brought to, or incorporated into the work shall be immediately removed by

the Contractor, at his own expense. In the event of the Contractor failing to comply with this provision, the Engineer may remove such materials, or cause them to be removed and deduct the cost of same from any subsequent progress payments to the Contractor.

In the event that removal of the inferior material is not required by the Engineer for any reason, then an appropriate payment adjustment as defined by the Engineer shall be applied to all of that material delivered to the site on that day.

03001-4 Equipment

4.1 Weigh Scales

The City will provide weigh scales at no cost to the Contractor at the City Yards at Ontario Avenue and 26th Street on a year round basis.

The Contractor may weigh large and/or continuous deliveries at the scale most convenient to his source. Small or intermittent deliveries outside the normal construction season shall be weighed over Scale at the City Yards.

The Contractor shall, where indicated in the tendering documents, quote on using his own scale, provided that the scale is certified.

4.2 Trucks

The Contractor may use any trucks of any type capable of delivering in accordance with job requirements. Specific conditions to be met include:

1. Certain delivery points are confined areas such as lanes and parking lots which may prevent the use of trucks larger than tandems.
2. Delivery is either spreading for road construction or dumping in a manner suitable for the project.
3. Centre-dump vehicles will only be permitted where base or subbase is to be spread for roadway construction.

Prior to the start of delivery, the Contractor shall supply a complete list of trucks, owner's names, registration numbers, tare weights and licence load limits. This list shall be updated whenever changes occur.

All trucks shall be weighed when delivery commences and at random times during the Contract.

03001-5 Construction

5.1 Production

5.1.1 Blending

Care shall be taken in the selection of material in the pit so as to produce a uniform product.

If blending of materials from more than one source is required to meet specifications, all such blending shall be done in the production equipment.

5.1.2 Sand Elimination

When it is necessary to eliminate sand to meet the grading specifications, the sand shall be removed prior to the crushing operation.

5.2 Stockpiling

5.2.1 Procedure

Each stockpile shall be constructed to contain not less than 10,000 tonnes or one-half of the remaining estimated contract quantity (whichever is less).

The area where the stockpile is to be located shall be shaped to a uniform smooth surface and graded to ensure positive drainage from the stockpile.

The material shall be placed uniformly on a predetermined area, in layers not exceeding 1 m in thickness.

Construction operations shall be controlled to prevent segregation of the various particle sizes.

If material is dumped by vehicles, it shall be spread with a dozer. The construction of each layer shall progress from outer edges toward the centre.

The material shall not be pushed or dumped over the edges or down the faces of the stockpile.

The material may be stockpiled from a stacker or conveyor belt only if all material is transported from the conveyor belt across the stockpile by means of a dozer or loader.

At the end of each day, the top of the stockpile and gravel pit shall be properly levelled and sloped. When stockpiling is carried out in winter, the Contractor shall take precautions that no snow is incorporated into the stockpile.

The completed stockpile shall be neat and regular in form and shall be constructed to occupy the smallest feasible area.

If different types of material are to be stockpiled, the piles shall be located and constructed so that no intermingling of material will occur.

Any rejected material must be placed a good distance away from an approved stockpile.

Material which does not meet specification within 5,000 tonnes of crushing will therefore be rejected and a new stockpile will be started in a new location clearly away from the rejected material.

5.2.2 Minimum Quantities

During the construction season, the Contractor shall, on his site, maintain the following minimum stockpile quantities of stockpiled, tested and approved material:

- Base Aggregate: 15,000 tonnes
- Subbase Aggregate: 15,000 tonnes
- Sanding Aggregate: 10,000 tonnes
- Other Material: 5,000 tonnes

All material supplied shall be loaded from a stockpile. Direct delivery from the crusher will not be permitted.

5.3 Delivery

5.3.1 Rate of Delivery

The Contractor shall be prepared to supply the following approximate quantities at a uniform delivery rate during each working day (including Saturdays when prior notice is given).

5.3.1.1 Granular Base and Subbase

If one Contractor has the contract to supply aggregate to both sides of the river, the Contractor shall be prepared to deliver up to 2,000 tonnes of aggregate per day to each side of the river or a total up to 4,000 tonnes per day. If a Contractor has only to supply aggregate to one side of the river, the Contractor shall be prepared to deliver up to 3,000 tonnes of aggregate per day.

5.3.1.2 Other Materials

The Contractor shall be prepared to deliver up to 1,000 tonnes per day of any other aggregate materials.

The Contractor and the Engineer shall be in close contact with the progress of the projects to determine daily delivery requirements. Whenever an appreciable change in delivery quantities or actual requirements is known in advance by either party, one party shall give reasonable notice to the other party.

5.3.2 Breakdown

Whenever the Contractor is unable to deliver any material due to major stationary plant or equipment (trucks and self-mobile equipment excluded) breakdown, the Contractor shall immediately notify the Engineer when delivery of material shall resume. Non-delivery time period for material required by the City shall not be longer than 24 hours.

5.3.3 Alternate Sources

In the event that the Contractor fails to supply any or only supplies a portion of material required, the Engineer under this Contract, shall be at liberty to purchase the required material so in default from any firm which is willing and ready to supply. The Contractor

shall pay the City, on demand, any increase in the cost of material so purchased, over and above the cost of similar material under this Contract.

5.3.4 Loading Procedure

The Contractor shall provide supervision of the loading operation to ensure correct source and procedures. Material loaded from the stockpile shall be removed in a manner which results in mixing of the full height of the stockpile face.

5.3.5 Load Limits

Maximum gross weight of vehicles operating within the City limits shall conform to Section 7 of the Traffic Bylaw No. 7200 and to any current amendments. In addition, the load limit as established by the Saskatchewan licence for each vehicle shall not be exceeded.

Where rural municipal roads are to be used, requirements established by the R.M. Council must be met. This includes road maintenance and load permits.

5.3.6 Truck Routes

Vehicles operating under this Contract shall be confined to routes shown on Schedule No. 8, Division 0, Section 00705 of General Conditions. For purposes of making a delivery, trucks must stay on a designated route to the point closest to the delivery point. The Engineer has the right to assign the final portion of the route, namely over local streets from the designated route to the delivery point.

5.3.7 Maintenance of Haul Routes

The City will, at its own expense, maintain all haul routes within the City limits.

Haul routes outside the limits of the City of Saskatoon shall, insofar as practical with respect to minimizing haul distance, be on numbered provincial Highways.

Where hauling is required over roads outside the City other than along Provincial Highways, the Contractor shall, prior to commencing this Contract, make formal arrangements for the use of such roads with the municipality having jurisdiction. These shall include the extent of the Contractor's responsibility for maintenance of road

surface, for traffic safety and for dust palliation. A copy of the agreement shall be submitted to the City prior to commencement of the Contract.

03001-6 Measurement

6.1 Aggregate

The unit of measurement shall be the tonne. If City or Contractor's weigh scales are not in operation, the aggregate weight shall be calculated on the basis of actual volume of material delivered and average unit weight determined from previously weighed truckloads of similar material.

6.2 Moisture

The moisture content (dry weight basis) shall be determined by sampling the material at the place of delivery and averaging the results of each one-month period. This average moisture content shall be applied against the total quantity delivered for that same one-month period to calculate a payment reduction.

6.3 Quantity Summaries

The Contractor shall submit monthly statements for each item showing a daily sub-total and a cumulative total for the period.

End of Specification 03001