S-4
GRANULAR BASE and AGGREGATES

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4.01 SCOPE OF WORK

The work shall consist of supplying, weighing, delivering, placing, and compacting as directed, select base course material of a nature that will conform to this specification.

4.02 RELATED DOCUMENTS AND REFERENCES

- City of Windsor General Conditions
- City of Windsor S-13,
- City of Windsor Recycled Aggregate Quality Control Program (RAQCP)
- OPSS.MUNI (314, 501, 1001, 1004, 1010)
- MTO Laboratory Testing Manual (LS-602, LS-623, LS-706, LS-704, LS-625, LS-607)

4.03 MATERIALS

Materials shall be selected or processed so as to conform to the requirements of this specification unless otherwise specified and pre approved by the City of Windsor. The Contractor shall submit their intended sources of materials to be used on their project to the City Engineer prior to delivering any materials to site. The City Engineer reserves the right to test the materials from the source or request specific test results from the Contractor for the materials intended to be supplied prior to approving use of these materials.

Like materials shall come from the same supplier and source for the entire project.

A change in supplier or source, should it be necessary must be pre-approved by the City Engineer. Changes in suppliers or sources without pre-approval may result in a request for third party sampling, laboratory testing and field compaction testing at Contractor's expense.

4.04 GENERAL REQUIREMENTS

4.04.01 Granular "A"

Granular A shall be according to OPSS.MUNI 1010 and satisfy all requirements of Table 1 and Table 2 in the OPSS.MUNI 1010 unless otherwise directed or specified and pre-approved by the City Engineer.

The use of Granular A for sewer trench backfill will require full depth compaction testing by a third party geotechnical consultant.

4.04.02 Granular "B"

Granular B shall be according to OPSS.MUNI 1010 and satisfy all requirements of OPSS.MUNI 1010 Table 1 and Table 2 unless otherwise directed or specified and pre-approved by the City Engineer. Granular B Type I shall not be used without approval by the City Engineer and will require additional testing requiring third party geotechnical consultation at the expense of the contractor. Additional testing includes but is not limited to laboratory gradation and standard Proctor testing of the granular A and granular B Type I. Also, compaction testing of the granular A separation barrier and compaction testing of the granular B Type I trench backfill throughout its entire depth. In addition to testing requirements drainage of the mainline trench cut, at the surface, is to be maintained to avoid any ponding or pooling of water in the trench cut prior to road excavation. Should tracking of the granular material take place during construction, the truck routes must be kept clean of tracked material and if necessary, catch basins on adjacent roadways need to be maintained and cleaned prior to demobilization from the site.

The use of Granular B Type II for sewer trench backfill will require full depth compaction testing by a third party geotechnical consultant.

4.04.03 Clear Stone

Unless otherwise directed or specified and pre-approved by the City, clear stone shall be according to OPSS.MUNI 1004 Table 1 and Table 2 for 16mm clear stone.

Alternatively, subject to the pre-approval of the City Engineer, 19mm nominal size clear stone can be used if the material meets the following requirements:

- Table 1 Physical Property Requirements for Clear Stone in OPSS.MUNI 1004 and Revised Table 2 of Gradation Requirements (herein) including City of Windsor 19mm nominal size clear stone.

Table 2 (Revised) Gradation Requirements for Clear Stone

Sieve Designation	*Nominal Maximum Size*			
	16 mm	*19 mm Type I*	*19 mm Type II*	*19 mm City of Windsor*
	% passing			
26.5 mm	---	*100*	*100*	*100*
19.0 mm	*100*	*90-100*	*90-100*	*70-100*
16.0 mm	*96-100*	---	*65-90*	*45-100*
13.2 mm	*67-86*	---	---	*28-86*
9.5 mm	*29-52*	*0-55*	*20-55*	*0-55*
4.75 mm	*0-10*	*0-10*	*0-10*	*0-10*
75 μm	*0-2*	*0-2*	*0-2*	

4.04.04 Open Graded Drainage Layer (OGDL)

OGDL shall be of the type specified in the contract drawings. For asphaltic or Portland cement stabilized OGDL refer to City of Windsor S-41. In the case of standalone granular OGDL, the material shall satisfy the physical requirements of OPSS 1010 Table for Granular 'O'. Said material is to be comprised of 100% crushed and non-recycled material and have the following gradation:

Sieve Designation	*% passing*
37.5mm	*100*
26.5mm	*95 - 100*
19.0mm	*90 - 100*
16.0mm	*65 - 100*
13.2mm	*40 - 86*
9.5mm	*20 - 55*
4.75mm	*0 - 10*
2.36mm	*0 - 5*
75um	*0 - 2*

Granular OGDL shall be placed in the location and at the thickness and grade specified in the contract documents and be consolidated be means of a smooth drum roller so as to satisfy the finished grade tolerances of this specification.

4.04.05 Reclaimed / Recycled Aggregate

The use of recycled materials will not be permitted for road base or any frost susceptible application without specific source and stockpile control and written pre-approval from the City Engineer.

All material produced of a reclaimed or recycled source shall be according to OPSS 1010 and The City of Windsor Recycled Aggregate Quality Control Program (R.A.Q.C.P).

All of the requirements of The City of Windsor Recycled Aggregate Quality Control Program (R.A.Q.C.P.) must be completely satisfied, including all testing, analysis, remedial actions, paperwork, and approvals prior to delivery of any reclaimed aggregate whatsoever.

Prior to the use of recycled aggregate materials on any project, the following procedures are to be implemented:

A) Application to use recycled aggregate is completed and submitted to the Field Services Office.

B) The City of Windsor will no longer require Bill of Lading Tickets.

C) Environmental testing (leachate) to be submitted for approval annually per source pile under procedures for leachate extraction in Ontario Regulation 347 of the Environmental Protection Act. If additional material is added to the tested stockpile or a new stockpile is generated, a new submission and approval will be required.

D) Sieve analysis testing, percent asphalt coated particles, percent wood, clay brick, gypsum/gypsum board, plaster (deleterious materials) and plasticity index analysis shall be submitted for approval from the stockpile specifically for that project.

E) When a stockpile is scheduled to be sampled for environmental and/or physical property testing the City shall be given 24 hours advance notice to arrange their own site observation and sampling. Should such notice not be given, the City reserves the right to require re-testing of the said stockpile.

F) The City shall be granted the access to the stockpiles for monitoring purposes throughout the construction season.

Any reclaimed material delivered without such approval will be immediately removed from the project at the contractor's expense.

The gradation requirements for City of Windsor 0-75 mm recycled shall be:

Sieve Designation	*% passing*
75.0mm	***100***
50.0mm	***80-100***
37.5mm	***68-95***
26.5mm	***50-90***
16.0mm	***34-80***
9.5mm	***28-75***
4.75mm	***20-55***
1.18mm	***10-40***
300um	***5-22***
75um	***0-10***

The physical requirements that apply to recycled aggregate shall be:

1. Plasticity Index (LS-704) required.
2. Asphalt Coated Particles (LS-621) required.
3. Determination of Amount of Contamination (LS-630) required.
4. Percent Crushed (LS-607) when requested.

All delivered suspect materials will be refused. Any load of recycled material may be rejected in the field based on visual detection of deleterious materials. Such a rejection may result in the requirement for additional testing of the source stockpile.

The Ministry of the Environment may be notified by the City of Windsor of the location of any reclaimed aggregates not classified as inert and recyclable by Ontario Regulation 347.

4.05 HAULING AND PLACING

It is the responsibility of the contractor to consistently deliver the approved granular material to the work site in an appropriate manner and with suitable equipment and to deposit it there in such a way that no contamination or segregation takes place.

Delivered material may be placed directly into the work or be stockpiled on site for use but should not be moved excessively. Material will not be permitted to be stockpiled off site unless approved by the City Engineer.

All road base material shall be placed in uniform lifts not more than 300mm thick (after compaction) and according to plan grades.

All granular trench backfill shall be placed in uniform lifts not more than 1.0 m thick (after compaction)

The underlying lifts must be completely and uniformly compacted, be free of contaminants and approved by the City Engineer prior to placement of additional material.

Material shall be free of frost and frozen clumps.

Material shall not be placed on frozen material or ground.

Material shall not be transported to the site in a state of excessive moisture.

Should the site inspector observe that the material delivered to the site is being handled or placed in such a manner that the material is being contaminated or segregated, the Contractor shall be notified to modify their handling and placing practices to eliminate segregation or contamination to the satisfaction of the City Engineer. Should the improper handling and placing practice continue after discussions and documentation with the Contractor, any material so compromised may be subject to removal or other remedial action at the contractors' expense on the instructions of the City Engineer under GC 5.03.

4.06 QUALITY ASSURANCE

Setting as a standard testing frequency, Granular A and Granular B Type II materials shall be tested for gradation at a minimum of one sample for every 2500 tonnes delivered to site. Projects in which granular quantities for road base are less than 2500 tonnes may have additional sampling carried out in order to avoid a single sample representing all material in the Work. **Testing of materials at the source shall not replace the requirement of testing**

the materials delivered to site for conformance to the specifications. The City Engineer has the right to verify and confirm the quality of delivered Granular A and Granular B Type II source materials through visual inspection and necessary testing at any time during the construction. Not withstanding standard testing frequency, sampling and testing of granular materials shall be carried out at the start of trench work (i.e. watermain, storm sewer or sanitary sewer) and at the start of road cut activities regardless of the quantity of material that has been delivered to site.

Quarried clear stone shall be tested as requested by the City Engineer. Clear stone that are not 100% quarried material shall meet Table 1 Physical Property Requirements for Clear Stone in OPSS.MUNI 1004 and the Revised Table 2 – Gradation Requirements for Clear Stone in the Section 4.04.03. The Contractor shall be responsible for assuring conformance to the specifications and shall provide the required clear stone test results at the Contractor's expense. The material shall be tested and a report shall be provided prior to delivery of the material to site for each project respectively. Current test results (within the month for local quarried/crushed material and each time a new shipment is received at the docks) are required and out of date testing reports are not acceptable. Clear stone shall be pre-approved prior to the start of the project.

The City will give 24 hours notice to the Contractor when the City Engineer is to be on site taking specific material samples. The Contractor can elect to sample themselves, have an independent third party carry out sampling on their behalf. Note that a dual agent shall not be allowed in the project QA/QC testing.

The Contractor will make available all necessary equipment and personnel to prepare a sampling pad of the end dumped delivered materials in order to obtain representative samples of the granular materials. If the Contractor elects to sample or have a third party sample the material(s), the Contractor or third party representing the Contractor shall direct the blending and preparation of sampling pad of the site delivered material such that representative samples can be obtained. If the Contractor elects not to sample themselves or not to have a third party sample the material(s) the City shall direct the sampling operations to obtain representative samples of the material(s).

Should the Contractor elect to sample the material, the QC, QA and referee sample shall be obtained by the Contractor or Contractor's third party representative, unless otherwise requested by the Contractor. The QC sample will be held by the Contractor or their third party representative. The QA and referee sample will be held by the City Engineer. If the Contractor elects not to sample, the representative of the City Engineer will only obtain QA and referee samples.

Note that the final decision on the acceptance/rejection of the material will be made based on the QA and referee sampling results.

The time period for completing QC and QA testing shall be a maximum of three (3) working days from the date of sampling. When referee testing is required the Contractor and City Engineer shall mutually agree upon a CCIL certified testing laboratory within a maximum of three (3) working days after the completion of the QC and QA testing.

Referee testing shall be completed within a maximum of three (3) working days from the date of delivery of the sample to the referee testing laboratory. The agreed upon referee testing laboratory shall allow both the Contractor and the City Engineer the opportunity to witness the referee testing. If for specific reasons, in person witnessing of the referee testing cannot be accommodated, the referee testing laboratory shall provide a recorded video record of the testing throughout its entirety which shall include documentation that records the laboratory technician performing all aspects of the work, dates and times of testing. The results of referee testing shall be reported, clearly indicating whether results meet OPSS or applicable City of Windsor gradation requirements or any other test requirements for which the sample was tested. Results shall be forwarded to the City Engineer and the Contractor.

The referee test results shall be binding on both the owner and the Contractor. When a referee test result shows that the Granular A and Granular B Type II granular base aggregates do not meet the requirements of this specification, the aggregates represented by the test result, including aggregates in existing stockpiles or in the Work, shall not be accepted. Both the City and the Contractor shall review, agree, and identify limits of the affected area that has been placed as well as stockpiles affected. The contractor shall remove the aggregates from the Work at no cost to the Owner. Alternatively, the City may accept a payment reduction if a mutual agreement can be made through discussions between the Project Manager and the Contractor.

Regardless of the negotiation of a reduced price payment, the warranty provisions in the contract shall apply.

When the referee test result shows that the aggregates meet the requirements of this specification, the aggregates represented by the sample shall be accepted.

The City shall be responsible for the cost of the referee testing provided that the referee test results show that the aggregates meet applicable specifications. Otherwise, the Contractor shall be responsible for the cost.

4.07 COMPACTION

The rate of placing material shall be controlled by the contractor’s ability to achieve the required degree of compaction.

The type of compaction equipment used shall be suited to the material, degree of compaction required and space available.

Water for the purpose of compaction shall be according to OPSS 506 and free be of any contaminants that would adversely affect the material or the environment unless pre-approved and accepted by the City of Windsor (in the case of brine).

The contractor shall be aware that the cost of any water used in compaction is to be included in the Unit Price bid in the Form of Tender.

All road base material shall be placed and graded in uniform lifts not more than 300mm thick (after compaction) and is to be compacted to its target density over its entire depth and cross section and approved prior to placement of subsequent lifts or pavement structures.

4.08 COMPACTION REQUIREMENTS

The frequency and locations of compaction tests shall be determined by the City Engineer.

The degree of compaction of granular base materials shall be specified in the contract and will be measured by means of a portable nuclear density gauge that satisfies the requirements of OPSS 501

Target densities for compaction tests shall be determined by:

1. A specified percentage of a standard proctor density as determined by MTO LS-623 and LS-706
2. A density achieved through the completion of a test strip as per OPSS 501.07.04.01 When a test strip is required the contractor will facilitate the equipment and personnel as required and at no cost to the City of Windsor in accordance to City of Windsor GC 5.02

4.09 FINAL ROLLING AND GRADING

Once overall material thickness has been attained, the surface shall be further shaped and compacted so as to be smooth, true to proposed grade and be free from ruts or waves.

The tolerance for the finish granular grade shall not be more than 10mm at any place along a 3.0m straight edge in any direction except across the crown or at design grade changes.

Any area of the granular base that is found to be soft and yielding or is comprised of segregated or contaminated material shall be removed and replaced with suitable material to the satisfaction of the City Engineer.

4.10 MAINTENANCE OF BASE

It is solely the contractor’s responsibility to completely maintain the base course to the required cross section, free from ruts, potholes, segregation, contamination or any adversities and at the required level of compaction until pavement or structure is placed.

The City of Windsor will incur no costs or responsibilities associated with final grade base maintenance.

Final acceptance of the base course is at the authority of the City Engineer and will immediately precede paving.

Any pavement or structure placed on a base course without expressed City approval is subject to removal at the contractor's expense.

4.11 MEASUREMENT FOR PAYMENT

Measurement for payment of selected Granular Base Course Material will only be made of those materials acceptable for use under this specification.

The unit of measurement will be that as provided for in the Tender.

4.12 BASIS OF PAYMENT

Payment will be made at the unit prices bid on the Tender and for the quantities determined by the collected delivery tickets. The delivery tickets must be supplied to the City Engineer within 24 hours of delivery or the City Engineer reserves the right to refuse acceptance of the delivery tickets.

Such payment shall constitute full compensation for supplying, weighing, and hauling the material; for placing, spreading, blading, compacting, maintaining, and any other cause whatsoever for all work performed in connection with the supply of the materials and any other incidentals necessary to complete the items that are not herein specified for payment otherwise.