MATERIAL SPECIFICATION FOR PERFORMANCE GRADED ASPHALT CEMENT (PGAC) AND PERFORMANCE GRADED ASPHALT CEMENT WITH ELASTIC RECOVERY (PGAC-E)

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TS 1101.01 SCOPE

This Specification covers the requirements for the properties and use of various grades of performance graded asphalt cement (PGAC) and performance graded asphalt cement with elastic recovery (PGAC-E).

TS 1101.02 REFERENCES

This Specification refers to the following specifications and publications:

City of Toronto Specifications

TS 310 – Construction Specification for Hot Mixed, Hot Laid Asphaltic Concrete Paving

TS 1150 – Material Specification for Hot Mixed, Hot Laid Asphaltic Concrete

American Association of State Highway and Transportation Officials (AASHTO), Provisional Standards

AASHTO MP1 – Standard Specification for Performance Graded Asphalt Binder

AASHTO PP6 – Standard Practice for Grading or Verifying the Performance Grade of an Asphalt Binder.

American Association of State Highway and Transportation Officials (AASHTO), Tests and Methods

AASHTO T40 – Sampling Bituminous Materials

American Society for Testing and Materials (ASTM)

ASTM D3665 – Standard Practice for Random Sampling of Construction Materials

Ontario Ministry of Transportation (MTO), Special Provisions

Special Provision No. 111S08 – Material Specifications for Performance Graded Asphalt Cement (PGAC)

Ontario Ministry of Transportation (MTO), Designated Sources for Materials (DSM) List

DSM #3.05.10 – Antistripping Additives
DSM #3.05.22 – Asphalt Cement, Performance Graded (PGAC)

Ontario Ministry of Transportation (MTO), Laboratory Testing Manual (Tests)

LS-208 – Elastic Recovery by Ductilometer

TS 1101.03 DEFINITIONS

For the purpose of this Specification, the definitions given in Toronto Works and Emergency Services Specifications TS 310 and TS 1150, and the following definitions apply:

Liquid Antistripping Additive: means an additive from MTO DSM #3.05.10.

Performance Graded Asphalt Cement, PGAC: means an asphalt binder from MTO DSM #3.05.22, which is an asphalt-based cement that is produced from petroleum residue either with or without the addition of non-particulate organic modifiers.

Performance Graded Asphalt Cement with Elastic Recovery, PGAC-E: means a performance graded asphalt cement with an additional elastic recovery requirement.

TS 1101.04 SUBMISSION REQUIREMENTS

TS 1101.04.01 Submissions

Any required submissions shall be in writing. All information and test data forms must be legible. Faxed copies are acceptable provided the original is submitted to the City within three business days following the receipt of the fax.

TS 1101.04.02 Performance Grade Test Documentation

At least ten business days prior to the commencement of the asphalt paving work, the Contractor shall provide the City with quality control test results and two 1 litre samples for each performance graded asphalt cement (PGAC) or performance graded asphalt cement with elastic recovery (PGAC-E) to be used in the asphalt mix type(s) for the Contract, for use to demonstrate compliance with the requirements of AASHTO MP1.

The PGAC or PGAC-E shall have been graded by conducting the required tests of AASHTO PP6 and MTO LS-208 for PGAC-E.

At the same time the Contractor shall also provide the applicable mixing and compaction temperatures (viscosity temperature relationship) for each PGAC or PGAC-E, and documentation of any specific construction, storage and handling requirements, including the material safety data sheet (MSDS), any hot mix discharge temperature limitations and recommended extraction procedure, if not standard.

> *Contractors should note that the Form of Tender will indicate if the hot mix type item(s) includes or excludes asphalt cement and the grade of PGAC or PGAC-E to be incorporated in the hot mix type.*

TS 1101.04.03 Laboratory Proficiency

The laboratories conducting quality control (QC) and quality assurance (QA) testing of PGAC and PGAC-E shall have satisfactorily participated in the most recent AASHTO Materials Reference Laboratory proficiency sample correlation program for PGAC, and the most recent MTO correlation program. Documentation of the laboratory's participation and proficiency shall be provided to the City at least ten business days prior to the commencement of the asphalt paving work.

TS 1101.04.04 Impact of Liquid Antistripping Additive

When a liquid antistripping additive is to be incorporated into a hot mix type(s), and samples of PGAC or PGAC-E for QC, QA or referee testing purposes are to be taken after the antistripping additive has been added to the PGAC or PGAC-E, the following additional submission requirements shall be met:

The Contractor shall submit a sample of the unmodified PGAC or PGAC-E (without the antistripping additive) and a sample of the antistripping additive, together with the test results of a complete AASHTO MP1 test with and without the antistripping additive, to the City at least ten business days prior to the commencement of the asphalt paving work.

Also, at least ten business days prior to commencement of the asphalt paving work, the Contractor shall assure the City, by way of a technical letter from the quality control laboratory, of the PGAC or PGAC-E compatibility for each hot mix type incorporating a liquid antistripping additive, if any. The specific extent and nature of the testing required to assure the City of compatibility will be the responsibility of the Contractor.

TS 1101.04.05 Quality Control Plan

The Contractor shall provide a quality control (QC) plan to the City detailing the quality control activities related to the use of PGAC or PGAC-E. A Supplier's QC plan may be used for this purpose. The QC plan shall be submitted at least ten business days prior to the commencement of the asphalt paving work.

Hot mix production shall not commence until the QC plan is acceptable to the City.

As a minimum, the QC plan shall provide the following information:

a) The type of facility from which the product(s) will be supplied (refinery, terminal) and its location;

b) The method and frequency for initial testing, specification compliance testing and any other testing employed to either guide the manufacturing process of the PGAC or PGAC-E to ensure the on-going compliance of the product to this Specification;

c) If specification compliance testing is carried out prior to shipping the products from the Supplier's facility to the hot mix plant, the QC plan shall provide an outline of the procedures to be followed for checking transport vehicles before loading to prevent contamination of shipments. The outline shall include a statement that the transport vehicles inspection report, signed by the responsible inspector, shall be maintained in the Supplier's records and shall be made available to the City upon request;

d) The QC plan shall identify the QC laboratory meeting the requirements of Subsection 1101.04.03 and detail control charting or any such statistical procedures which will be used to track the quality of the PGAC or PGAC-E; and

e) The QC plan shall detail the method(s) to be used to identify and provide for the exclusion of PGAC or PGAC-E which does not conform to this Specification prior to incorporation into any hot mix asphalt. The QC plan shall also detail how such PGAC or PGAC-E will be identified and dealt with in the event that it is inadvertently incorporated into any hot mix asphalt for the Contract. The QC plan shall detail how such occurrences will be documented, and the method(s) of disposition of such hot mix asphalt.

TS 1101.05 MATERIALS

TS 1101.05.01 General Requirements

Performance graded asphalt cement (PGAC) and performance graded asphalt cement with elastic recovery (PGAC-E) shall be homogeneous, free of water and any contamination and shall not foam when heated to the temperatures specified by the Supplier for the safe handling and use of the product. It shall be shipped, used and handled at all times in accordance with the Supplier's requirements.

TS 1101.05.02 Physical Requirements

PGAC and PGAC-E shall conform to the requirements of AASHTO MP1, for the performance grade(s) specified in the Contract for each hot mix type, when tested in accordance with AASHTO PP6. Additionally, PGAC-E shall meet the following elastic recovery requirements when tested in accordance with MTO LS-208:

PGAC-E 64-28-E	elastic recovery ≥40%; and
PGAC-E 70-28-E	elastic recovery ≥60%.

TS 1101.05.03 Approved Suppliers

The Contractor shall obtain the PGAC and PGAC-E from a PGAC Supplier listed on the MTO DSM #3.05.22 list.

TS 1101.06 Not Used

TS 1101.07 Not Used

TS 1101.08 QUALITY ASSURANCE

TS 1101.08.01 Basis of Acceptance

Acceptance of PGAC and PGAC-E will be based on QC test results submitted by the Contractor, subject to the conditions given in this Section. The Contractor shall designate a QC laboratory meeting the requirements of Subsection TS 1101.04.03 and be responsible for the testing required to ensure that the PGAC and PGAC-E supplied to the Contract meet the requirements of this Specification. Allowance will be made for the impact of the liquid antistripping additive if the requirements of Subsection TS 1101.04.04 have been met. The City will designate a QA laboratory meeting the requirements of Subsection TS 1101.04.03.

For acceptance purposes, a minimum of one complete AASHTO MP1 test shall be performed by the Contractor for each lot of PGAC or PGAC-E. Samples for this testing shall be obtained in accordance with Subsection TS 1101.08.02, noting that when a lot comprises more than one sublot, only one sublot is required to be tested. Test results shall be submitted to the City within five business days of obtaining the sample.

TS 1101.08.02 Samples for Testing

All test samples shall be obtained in accordance with AASHTO T40 and ASTM D3665. QC samples obtained for acceptance purposes, and those taken for the City's QA testing and for referee testing shall be obtained at the hot mix plant. The random number information pertaining to the hot mix tonnage at which the PGAC or PGAC-E is required to be sampled shall be supplied by the City. The QC sample to be used for acceptance purposes shall be taken at the same time as the QA and referee samples. All sampling will be completed by the Contractor, at no cost to the City, and with the City's designated QA laboratory present to observe the sampling and obtain the QA and referee samples from the Contractor.

The minimum quantity of each of the QA and referee samples shall be one litre.

TS 1101.08.03 Lot Sizes

Lot sizes for PGAC or PGAC-E shall be based on the quantity of each PGAC or PGAC-E incorporated into the hot mix, and shall be determined by the City in consultation with the Contractor. Lot and sublot sizes shall be based on the Form of Tender total quantity of hot mix incorporating each PGAC and PGAC-E. A lot shall be terminated when the source of PGAC or PGAC-E is changed. A lot may be terminated at the City's option when hot mix asphalt production for the contract ceases for a period of 20 business days.

TS 1101.08.03.01 Total Tender Hot Mix Quantity Incorporating the Performance Grade of PGAC or PGAC-E Less than 2000 t

The entire quantity of PGAC or PGAC-E incorporated into the hot mix shall be considered as one lot with one sublot. One set of QC, QA and referee samples shall be taken from this lot.

TS 1101.08.03.02 Total Tender Hot Mix Quantity Incorporating the Performance Grade of PGAC or PGAC-E Between 2000 t and 5000 t

The quantity of PGAC or PGAC-E incorporated into the hot mix shall be considered as one lot with two sublots. Each sublot shall represent approximately half the total quantity of hot mix. One set of QC, QA and referee samples shall be taken from each sublot.

TS 1101.08.03.03 Total Tender Hot Mix Quantity Incorporating the Performance Grade of PGAC or PGAC-E Over 5000 t

The quantity of PGAC or PGAC-E incorporated into each 5000 t of hot mix will be treated as a lot with two equal sublots. The quantity of PGAC or PGAC-E incorporated into the hot mix tonnage after the 5000 multiples have been established can be treated as a single lot, with sublots not exceeding the quantity of PGAC or PGAC-E incorporated into 2500 t of hot mix. One set of QC, QA and referee samples shall be taken from each sublot.

TS 1101.08.03.04 Switching Performance Grades

When switching from the use of one performance grade to a different performance grade, the Contractor may request that the quantity of PGAC or PGAC-E in the first tanker load of new material be considered as a separate lot with one sublot.

This request shall be submitted by the Contractor in writing to the City, and will be considered only once for the duration of the Contract.

TS 1101.08.04 Quality Assurance Testing

Quality Assurance (QA) testing may be carried out by the City for purposes of ensuring that the PGAC or PGAC-E used in the work conform to the quality requirements of this Specification and the Contract, and to assess the QC test results submitted by the Contractor. If a QA test result for any sample indicates non-compliance with this Specification, the City will advise the Contractor of the test results and may arrange for additional testing. At the discretion of the City, this testing may include additional sublots. The additional testing will also determine the actual performance high and low temperatures of the sample(s), rounded to the nearest 0.5 degree Celsius.

Test results for PGAC or PGAC-E sublots which do not comply with the performance grading requirements shall be categorized as Borderline or Rejectable based on the deviation from the individual design maximum or minimum pavement temperature and the sum of the deviations from the design maximum or minimum pavement temperatures defined as follows (noting that actual performance grading which is either higher than the maximum design pavement temperature or lower than the minimum design pavement temperature is not considered in the calculation):

Borderline: Individual deviations are less than or equal to 3°C, and sum of deviations is less than or equal to 3°C;

Rejectable: Not acceptable or borderline.

TS 1101.08.05 Disposition of Hot Mix Constructed with Borderline or Rejectable PGAC or PGAC-E Sublot(s)

The City will review the test results and determine the disposition of the hot mix type(s) constructed using any PGAC or PGAC-E which does not conform to this Specification. This will also include the identification of any trends evident through the analysis of any additional testing. Hot mix constructed using PGAC or PGAC-E for which test results indicate that the product did not conform to this Specification will be dealt with as follows:

Hot mix constructed using PGAC or PGAC-E for which test results are borderline will be accepted into the Work, provided that the Contractor accepts a price reduction, calculated as follows:

Price reduction = 5% of hot mix tender price per tonne x quantity of hot mix in sublot.

This price reduction will be assessed independently of any other price adjustment provisions for the Contract.

If the PGAC or PGAC-E in a particular sublot has been used for the production of more than one hot mix type, the price reduction will be calculated using the actual quantities of the hot mix types constructed with the PGAC or PGAC-E within the sublot.

Hot mix constructed using PGAC or PGAC-E for which test results are rejectable shall be subject to repair or price adjustment. The City will determine if a rejectable sublot may remain in the Work without repair, with a price reduction, calculated as follows:

Price reduction = 20% of hot mix tender price per tonne x quantity of mix in sublot x number of °C that the deviations fall outside of compliance with Borderline requirements.

If the PGAC or PGAC-E in a particular sublot has been used for the production of more than one hot mix type, the price reduction will be calculated using the actual quantities of the hot mix types constructed with the PGAC or PGAC-E within the sublot.

When test results indicate non-compliance with this Specification, any costs to the City to establish the degree and extent of the non-compliance shall be the responsibility of the Contractor.

When the Contractor changes from one performance grade to a different performance grade and the request for the establishment of a separate lot has been accepted (Subsection 1101.08.03.04), hot mix produced with this lot of PGAC or PGAC-E will be administered as follows:

The hot mix payment will not be assessed a PGAC or PGAC-E price reduction for borderline deviations from the performance grading requirements. Hot mix produced with PGAC or PGAC-E which is rejectable may be removed or its price adjusted at the discretion of the City.

TS 1101.08.06 Referee Testing

Testing by a referee laboratory is available to the Contractor for any sublot of PGAC or PGAC-E where there is disagreement in the test results from the QC and QA laboratories.

Referee testing may only be invoked if the cost of the impact of non-compliance, as determined by the City, exceeds the cost of referee testing.

If referee testing is requested, a referee laboratory meeting the requirement of Subsection TS 1101.04.03 will be designated by the City. The City will arrange for the transfer of the product sample(s) to the referee laboratory.

The referee testing will determine the actual performance high and low temperatures, rounded to the nearest 0.5 degrees Celsius, of the PGAC or PGAC-E sample(s) and the outcome is binding on the City and the Contractor.

The cost of the referee testing shall be borne by the Contractor unless the testing confirms PGAC or PGAC-E conformance with this Specification, in which case the costs will be borne by the City.

TS 1101.09 Not Used

TS 1101.10 Not Used