

## **04020 Reclaimed Asphalt Pavement**

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**04020-1     General**

This section covers the best practice for the use of Reclaimed Asphalt Pavement (RAP) material in asphalt mix production and construction. A best practice is a method or technique that when followed results in an end product superior to those achieved with other means and that is used as a benchmark process. A "best" practice may evolve to become better as improvements are discovered.

Best practice is the process of developing and following a standard way of doing things that are commonly achieved in the industry. The Contractor's development and processing of RAP into an end paving product must meet City of Saskatoon Specifications 04005, 04010 and 04015.

**04020-2     Definitions****2.1           Reclaimed Asphalt Pavement (RAP)**

Cold milling material and/or removed and reprocessed pavement materials containing asphalt and aggregates. These materials are generated when asphalt pavements are removed for reconstruction and/or resurfacing. When cold milled and/or properly screened and crushed, the RAP consists of high quality aggregate coated by asphalt cement.

**2.2           RAP Binder**

The asphalt binder that is present in the reclaimed asphalt pavement.

**2.3           Rheology**

Rheology is the study of deformation and flow of matter. For asphalt binder rheology, it refers to the flow characteristics of the asphalt binder. Deformation and flow of the asphalt binder in asphalt mix is important in asphalt pavement performance.

**04020-3     Materials****3.1           RAP**

The Contractor shall fulfil or exceed the requirements of this Best Practice for the management of RAP materials from the time of collection through processing, mix

design and quality control practices during the production of asphalt mixtures containing RAP. The Contractor shall provide documentation to the City of Saskatoon Representative that best practices have been followed in the handling, characterization, and storage of RAP material, prior to being allowed the use of RAP.

### **3.2 RAP Sources**

**Cold Milling** – This is the most common process to provide of RAP. The milling process should be closely examined to make sure that the milled material is not contaminated with soil, base materials, paving geotextiles or other foreign material (sulphur, asbestos, rubber, etc.). The milled material that becomes contaminated should be stockpiled separately from RAP to be used in asphalt mix.

**Full Depth Pavement Removal** – RAP can also be obtained from the removal of the existing pavement using a bulldozer or a backhoe. This process typically results in large chunks of pavement that may be contaminated with underlying soils. This contaminated material should be stored in a separate stockpile and not to be used in the hot mix asphalt. Uncontaminated materials should be processed using a combination of crushing and screening to provide an acceptable RAP material.

**RAP Processing** – Best practice for RAP processing involves one or more steps to create consistent materials. Screening is used to separate sizes. In some cases, it may be desirable to screen or fractionate RAP to coarse and fine fractions. RAP separation based on sizes increases quality and reduces variability in the RAP properties.

For stockpiles of RAP from multiple sources, particularly stockpiles containing oversize fragments of RAP or pavement slabs, the material should be processed to produce RAP with a maximum size of 25 mm for use in hot mix asphalt.

### **3.3 RAP Sampling and Testing**

Best practice for sampling aggregates applies to the sampling of RAP as well. RAP stockpiles should be sampled as they are being built at the location where they will be fed into the asphalt plant. Sampling at the time the stockpile is built is the best practice and will be easier and more representative of the stockpile compared to samples taken later after the formation of the crust on the face of the RAP stockpile.

Proper sampling procedures normally used for virgin aggregates should also be used to sample RAP aggregates as included in “AASHTO T2: Sampling of Aggregates”, Standard Specifications for Transportation Materials and Methods of Sampling and Testing, 30th Edition.

### **3.4            Basic Tests**

The following basic properties shall be determined for the proposed RAP:

- Moisture Content (ASTM C 566);
- Asphalt Content (ASTM D 2172);
- Gradation (ASTM C 136);
- Percent Fracture; and
- Specific Gravity of coarse and fine fractions (ASTM C 127 & C 128, for mix design purposes).

Individual representative RAP samples shall be tested to determine moisture content, gradation, percent fracture and asphalt content.

Tests to determine the specific gravity of the coarse and fine fractions of RAP shall be completed on the combined aggregates (obtained by combining the individual reclaimed aggregates retained after the extraction of the asphalt cement).

#### **3.4.1            Asphalt Binder Rheology Testing**

For RAP binder rheology testing, the extracted RAP binder is tested for penetration and viscosity. Rheology is measured in terms of penetration at 25°C and viscosity at 60°C (ASTM D 5 & D 4402).

### **3.5            Quality Control**

The Quality Control testing requirements for RAP shall be based on the requirements and minimum test frequency guidelines.

Table 1: Guidelines for Minimum Quality Control Test Frequencies

<b>Test</b>	<b>Minimum Frequency</b>
Asphalt Content	One per 500 tonne
Gradation	One per 500 tonne
Percent Fracture (%)	One per 500 tonne

<b>Test</b>	<b>Minimum Frequency</b>
Specific Gravity of coarse fraction of RAP	Minimum of one per 3000 tonne or three per stockpile
Specific Gravity of fine fraction of RAP	Minimum of one per 3000 tonne or three per stockpile
AC Rheology	Minimum of one per 10,000 tonne or one per stockpile

All RAP aggregates retained after extraction should be combined together into one sample. The combined sample should then be sieved and split into coarse and fine fractions and used to determine the specific gravity of the recycled aggregates.

### **3.6 RAP Stockpiling**

Best practice for RAP stockpiles is to keep them free from contaminants. RAP stockpiles should be treated as a valuable material. Truck drivers bringing the material on the site should ensure that unwanted debris or contaminated material does not end up in the RAP stockpile.

The best practice to minimize the accumulation of moisture in stockpiles is to cover the stockpile with a shelter, tarp or building to prevent precipitation from getting to the RAP.

RAP stockpiles should be placed on a base with adequate drainage and constructed with minimal segregation. Arc-shaped, conical, uniform stockpiles are preferred for storing processed or unprocessed RAP.

The plant Quality Control personnel and the loader operators should continuously monitor processed and unprocessed RAP stockpiles to make sure that they do not contain deleterious materials. If any contaminants are found, they should be removed immediately so that they are not covered up with other RAP brought on to the yard.

Use of heavy equipment on top of the RAP stockpile should be minimized to avoid compaction of the RAP. It is also recommended that the RAP stockpiles be limited to 4m in height to reduce the potential for self-consolidation of the stockpile.

**3.7            Stockpile Management**

When a stockpile reaches the desired quantity and has been sampled and characterized, no additional RAP material should be added to it. Subsequent RAP material should be stockpiled in a separate stockpile and characterized in the same manner. This process should continue such that characterized stockpiles are not compromised by new RAP materials.

Samples from the RAP stockpile should be taken during stockpiling and testing completed as per the minimum test frequencies specified in Table 1.

**3.8            RAP Quality Management Documentation**

The Contractor shall document all testing required in this best practice in the form of spreadsheet or other suitable means. The documentation should be “stockpile specific” with a tracking name reference. Once a stockpile is submitted for use in asphalt mixes, no additional RAP will be allowed in that stockpile, and a new stockpile and tracking reference name established.

**04020-4      Asphalt Mix Design**

RAP shall be included at the proposed addition rates during the mix design. The Contractor shall submit a mix design to the City of Saskatoon Representative for review, as specified in Section 04010- Asphalt Mix.

In addition to the information required in Section 04010- Asphalt Mix, the following information shall be provided in the mix design submittal for the asphalt mixes containing RAP:

- All RAP aggregate gradations for each RAP product;
- Asphalt Content for RAP;
- Specific gravity of the combined aggregates (when applicable); and
- RAP Rheology test results.

Should a change in the source or addition rate of RAP be made after the mix design has been approved, a new mix design and/or job mix formula shall be submitted to the City of Saskatoon Representative.

**End of Specification 04020**