

To: All HQ Directors: Operations, Planning and Major Projects
All Regional Directors
All Regional Managers of Engineering
All Regional Managers of Project Delivery
All Regional Geotechnical Managers
All District Managers Transportation

Subject: Use of Reclaimed Asphalt Pavement in Construction and Paving Projects

Purpose:

This T-circular outlines a number of best practices for the use of Reclaimed Asphalt Pavement (RAP) in Construction and Paving Projects.

Background:

Reclaimed Asphalt Pavement (RAP) is produced by milling or grinding existing asphalt pavement surfaces and is regularly generated in Ministry resurfacing and construction projects.

In most jurisdictions, RAP is increasingly recognized as a high-value product with residual asphalt binder that can be incorporated in new paving mixes.

In the 2016 Standard Specifications for Highway Construction, a new Section 505 – Use of Reclaimed Asphalt Pavement in Asphalt Pavement Construction was developed and dedicated to the incorporation of RAP into new paving mixes, along with an included appendix for RAP Best Management Practices.

Policy:

Use of RAP must be given careful consideration for use in rehabilitation and grading projects in a manner that will take full advantage of its residual properties and value.

Where the use of RAP is not considered feasible, a written rationale shall be sent to the Senior Geotechnical Engineer, Pavements with a copy forward to the Director, Geotechnical Engineering by the Project Manager and/or Ministry Representative.

Guidelines for use of RAP

Highway Design and Pavement Engineers need to familiarize themselves with:

- T-Circular on Pavement Structure Design Guidelines; Section 502 (Asphalt Pavement Construction – EPS);
- Section 505 (Use of Reclaimed Asphalt Pavement in Asphalt Pavement Construction);
- Section 511 (Cold Milling) and Section 952 (Contractor Supply Asphalt); and
- Paving Materials for Highway Use to achieve an optimized use of RAP in new pavement mix designs for Ministry Projects.

The following guidance is provided with respect to potential ways to incorporate project-generated RAP in the most useful, cost-effective manner in new paving and construction. Options are listed in order from the most to least value-added use of RAP:

Incorporating High Quality RAP in New Pavement Mix Designs

As per SS505, using RAP in new paving mixes is at the discretion of the contractor.

When there is a high-quality highway asphalt pavement being milled off and we know its properties are suitable (based on original mix testing and long-term performance), we can specify a % of RAP use (up to a maximum of 30%) in a new pavement mix design for either that particular project or a different paving project in the proximity.

Contract Special Provisions need to specify language for the RAP use to ensure a project-generated RAP is re-used by the project at a desired location.

Typically RAP from a project needs to be utilized within the same construction year to prevent consolidation in stockpiles; if RAP sits longer in a stockpile than this period, additional processing may be required prior to its use.

RAP as a Surfacing Material on Low Volume Roads

RAP can be re-heated by itself in an asphalt plant with or without an asphalt rejuvenator (at a very low mixing temperature to limit oxidation of the old asphalt cement binder) and used to repave low-volume roads. The reheating process is rarely utilized because of plant emissions issues, and the asphalt pavement produced in this way is prone to premature cracking due to the highly-oxidized asphalt binder from the heating process.

The most common use of RAP for a low volume roadway is to have RAP mixed cold with a rejuvenating agent in a pugmill, then cold-paver-laid (or straight cold-paver-laid and surface-sprayed with a rejuvenator) and compacted on a side road, highway pull-out, or rest area, or other suitable low-traffic location.

The resulting asphalt pavement from the cold mix process leaves a pavement-like surface with the following properties:

- Somewhat open texture;
- Sufficient density to support lighter traffic without coming apart; and
- Low-enough density to prevent or minimize temperature-related cracking.

Cold RAP pavements require strong base/sub-base support, and should not be placed on weak side roads with inadequate gravel and/or base structure.

When a cold RAP pavement surface starts to ravel (typically after 2 to 10 years of use, depending on traffic and weather conditions), either a sealcoat or thin pavement overlay (37.5mm) can be placed over it to significantly extend road surface life.

Incorporating RAP into Pavement Structure Gravels for Base Strengthening

RAP contains roughly 6% AC and reduces permeability of any gravel it is blended with; the only suitable location for a RAP/gravel blend is at the top of the pavement structure. (i.e. in the base course layer directly beneath the asphalt pavement layer).

An efficient way to use RAP in a pavement structure through an in-situ process is by means of pulverizing (road reclaiming) where the existing pavement is:

- Ground up/pulverized into fractured pieces and combined with an underlying base gravel; then
- Compacted to provide an AC-stabilized base on which a new pavement can be placed.

This pulverized pavement is typically designed for a 50/50 blend of AP (pavement) to crushed base gravel; however, the ratio of pulverized pavement to crushed base gravels can range from 1:3 to 2:3.

Where pulverizing is not an option, RAP generated by milling may be stockpiled on or off site, then blended with base gravel and placed and compacted as the last base course lift immediately below the asphalt pavement layer.

RAP (either by itself or blended with aggregates) should **never** be inserted/placed anywhere else in the pavement structure where either vertical or lateral drainage will be compromised (ie. between the sub-base and base layers or other layers which would then reduce permeability of those layers).

Using RAP for Shoulder Build-Up or Shouldering

Straight RAP can be used directly for shoulder build-up beneath a new shoulder pavement if it is carefully placed and compacted and where it doesn't impede the lateral pavement structure drainage.

RAP blended with shoulder gravel can be used for shouldering after paving; typically this blend is much more stable (less prone to sloughing and erosion) than straight shoulder gravel.

If a given project is unable to incorporate RAP that is generated from the project, District Operations and Maintenance Contractors (MCs) are often eager to obtain RAP.

District Operations staff and MCs in the vicinity of the project should be contacted to see if unwanted RAP can be used for other purposes such as blending with gravel for side road shouldering, surfacing, etc. A nearby stockpile site will usually be identified.

Using RAP as a Type "D" Material

This is the lowest-value application for RAP use, and can make sense where there are no other anticipated uses (distant location, no storage sites, no side roads, etc) for the RAP material.

Type "D" RAP is placed or mixed as low as possible in the subgrade where it will least impede drainage from the grade.

EXAMPLE: MUTIPLE USES FOR RAP MATERIAL IN A SINGLE PROJECT:

This example is a construction project that requires total removal of existing pavement (250mm thick AP). The top 50mm of AP is known to be high-quality (from a 12 year-old overlay), while the bottom 200mm is of variable quality:

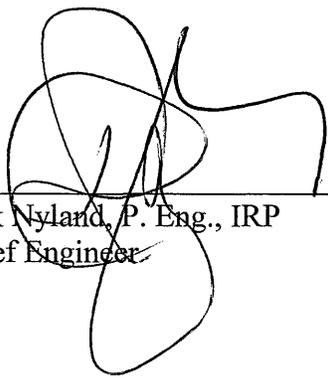
1. The top 50mm of AP is milled off first, taken to the asphalt plant site and set aside in stockpile for future blending into new pavement mixes (see step 4 below).
2. The next 100mm of AP is milled off, and half is used for cold-paver-laid side roads surfacing on a nearby project and half is saved to blend with gravel (at a 50/50 ratio) for shouldering material (step 5).
3. To achieve grade and improve base strength, 100mm of new crushed base course is placed over the remaining 100mm of AP and then pulverized/blended in place to a depth of 200mm (yielding a 50/50 RAP/gravel blend).
4. Following grading and compaction of the pulverized base layer, two 62.5mm-thick lifts of new asphalt pavement are placed (bottom lift with 30% RAP, top lift with 15% RAP) to complete the pavement structure.
5. The shouldering gravel/RAP blend is then placed and compacted to finish the shoulders.

All RAP generated on this project is used in a manner which optimizes its value.

Questions regarding use of RAP or the implementation of these guidelines should be addressed to the Senior Geotechnical Engineer, Pavements.

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