HOT IN-PLACE ASPHALT RECYCLING

1. INTRODUCTION

Hot In-Place Asphalt Recycling (HIPAR) is carried out by a mobile recycling unit that heats, removes, modifies, re-paves and compacts the asphalt surface in a single pass.

The purpose of this technical note is to provide a brief description of the process and a guide to its use.

Critical factors in the success of HIPAR work are site selection, site investigation, design of mix and construction by appropriately skilled contractors.

2. RECYCLING TRAIN

A typical recycling train (see Figure 1) consists of:

- Pre-heater(s);
- Delivery truck (Add Mix);
- Main unit (Remixer)
  - receiving hopper for add-mix
  - hoppers for storing materials
  - scarifier
  - pugmill mixer
  - augers and conventional asphalt tamping screed
  - binder / rejuvenator tank
  - distribution auger and screed;
- Rollers.

Where an extra layer of asphalt is added, the recycler is fitted with an additional levelling screed in front of the tamping screed.

3. RECYCLING PROCESS

3.1 Recycling Operation

A typical HIPAR operation includes the following operations:

- The existing asphalt surface is heated to between 140°C and 170°C by propane gas fired infrared preheaters;
- The bituminous binder is softened sufficiently to permit the asphalt to be loosened by scarifiers without binder degradation;
- Rotating scarifiers precisely skim off the loosened material to the required depth. The effective thickness of hot in-place recycling is normally about 40 mm using one heater bank and about 60 mm using two preheating units;
- The asphalt is mixed with binder and/or rejuvenator (and add-mix if required), to restore the desired properties in the asphalt. Mixing the materials may be either in-place or in a pugmill depending on plant used;
- A variation to the process is the addition of further fresh asphalt that is placed over the remixed layer rather than incorporated into it. Both layers are compacted together;
- The recycled asphalt is spread to the required profile and compacted. When a thin layer of fresh mix is laid over the recycled mix, the new asphalt forms a thermal bond with the recycled layer.

4.2 Surface Preparation

Before work commences all distressed areas of underlying pavement should be rectified.

Sprayed-on marking may be left but thermoplastic line markings must be removed before recycling commences to avoid fuming. Sprayed seal surfaces may need to be removed to avoid fuming and a binder rich mix. Areas containing excessive crack sealing may also lead to excessive binder content in finished surface.

Recycling runs should be the full width of traffic lanes, with longitudinal joints located along lane lines.

Recycling efficiency is affected by temperature and moisture. Surfaces should be dry and air temperatures above 10°C.

3.3 Output

An average machine speed of 2 to 3 m/min is normal, however for small depths up to 5 m/min is possible.

Typical daily outputs are:
- 3500 to 4000 m^2 at 40 mm depth;
- 2000 to 3000 m^2 at 60 mm depth.

Figure 1 Recycling Train

4. SITE SELECTION AND PRELIMINARY INVESTIGATION

In-place recycling is only effective if a pavement is structurally sound and where deterioration is in the asphalt layer only.

Recycling is generally limited to about 50 mm depth but can be combined with additional materials to increase surface layer thickness.

A preliminary assessment should be carried out to determine:

- Structural condition;
- Pavement type and history;
- Existing condition of asphalt materials;
- Subgrade characteristics;
- Surface conditions.

In-place recycling may be appropriate where there is a need to:

- Restore riding quality of the surface where there is no need for structural improvement;
- Remove ruts from asphalt;
- Restore surface characteristics (e.g. surface texture, skid resistance and waterproofing);
- Rejuvenate the oxidised binders in asphalt;
- Rehabilitate asphalt layers that deteriorate due to poor asphalt quality;
- Add a thin layer of asphalt to an existing pavement.

In-place recycling is generally not suitable, if:

- Any of the lower courses are not stable or are structurally inadequate;
- There is substantial variation in the asphalt due to patching etc.;
- There is less than about 75 mm total thickness of asphalt;
- The surface has been covered by a sprayed seal (unless sprayed seal is removed) because it causes excessive fuming;
- The pavement contains tar, rubber, polymer binder, or geotextile fabric because this may result in toxic fumes;
- Tight curves or other traffic restrictions prevent effective operation of recycling train.

Preliminary assessment should also include an analysis of the cost effectiveness of recycling and other alternatives. In-situ recycling is generally not cost effective for short sections.

5. DETAILED SITE INVESTIGATION

Detailed site investigation should be used to characterise the insitu materials. Generally, at least one core should be taken for about every 1000 m^2 of pavement (more if materials are variable or fewer for long lengths of uniform materials).

Cores are analysed for grading, binder content and binder properties (viscosity or penetration and softening point).

Figure 2 Recycling operation

6. MIX DESIGN

In general terms, the mix design properties should match that of asphalt manufactured with virgin materials (grading voids, stability, etc.). This may require the addition of new hot mix asphalt to correct grading and binder content deficiencies (see process options below).

An essential element of hot in-place recycling is the use of bitumen rejuvenating agents or softer binder in the add-mix to correct hardening of bitumen in the insitu asphalt. A guide to the use of rejuvenating agents and blending of binders is provided in the Austroads Asphalt Recycling Guide.

7. PROCESS CONTROL

It is more difficult to achieve the same control of quality in recycling work compared to plant manufactured hot mix asphalt. However, with careful project selection and evaluation, and strict control of procedures, quality materials can be produced that are cost effective for appropriate applications.

8. ADDITIONAL READING

AUSTROADS (1997) Asphalt Recycling Guide (AP-44/97)

AUSTROADS (2000) Framework Specifications for Asphalt Recycling (AP-T02)

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