

# Recycling Alternatives



**Traffic Range:**

Varies from AADT < 400 to no limitations, depending on the recycling alternative and application.

**Life Expectancy:**

Varies with recycling alternative.

**Unit Price:**

Material and installation costs vary widely with recycling alternative.

**Appearance:**

Many recycling products are not used as surfacings. HACP recycled surfacings generally appear black with fine to medium coarse surface texture. PCCP recycled materials generally have an appearance similar to crushed aggregate with a coarse texture.

**Advantages:**

Most alternatives are in situ processes; Allows materials to be reused; Reduces construction energy requirements; Reduces trucking requirements.

**Limitations:**

Surfacing quality may be lower than if virgin materials were used; Product quality may be more difficult to control.

**Product Description:** These recycling alternatives are methods developed to recycle/reuse PCC and HACP materials in roadway construction. By reusing the materials, disposal costs and environmental impacts are reduced and the energy requirements for roadway construction are often reduced. Many of these alternatives are in situ processes that require specialized equipment or paving trains.

# Cold In-Place Recycling

# 8.1



Cold in-place recycled material.

Photo Courtesy of: FHWA-CFLHD

### Traffic Range:

Typical AADT < 1,000. Usually overlain by HACP or surface treatment.

### Life Expectancy:

6 to 8 years (12 to 20 years with HACP overlay).

### Unit Price:

Material & Installation: \$4.20 to \$4.80/m<sup>2</sup> (\$3.50 to \$4.00/yd<sup>2</sup>) for 75 mm (3 in.) recycling depth.

### Appearance:

Appearance is generally black with a medium coarse texture.

### Advantages:

In situ process; Recycles existing HACP; Reduces energy requirements.

### Limitations:

Not typically used as surface course; Experienced personnel and equipment required; Construction weather limitations; Will not remove full depth cracking in original HACP.

**Product Description:** Cold in-place recycling (CIR) is an in situ process used to recycle up to 100 mm (4 in.) of an existing asphalt concrete layer to construct a rejuvenated cold mix asphalt concrete layer. CIR is the rehabilitation of asphalt pavements without the application of heat during the recycling process.

# Cold In-Place Recycling

# 8.1



**CIR equipment train.**

Photo Source: Nevada DOT



**CIR construction.**

Photo Source: Nevada DOT

# Cold In-Place Recycling

# 8.1

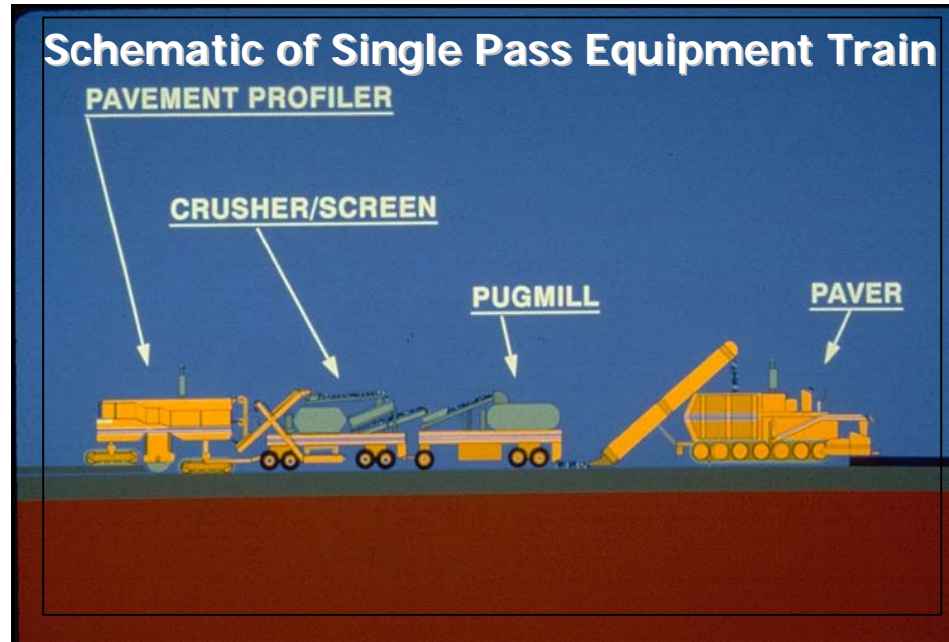


Photo Source: National Highway Institute

# Hot In-Place Recycling

## 8.2



Hot in-place recycled pavement on right.

**Product Description:** Hot in-place recycling involves (1) milling and softening the existing asphalt concrete to a specified depth, (2) mixing the loosened asphalt concrete with a recycling agent and possibly virgin asphalt and (3) placing and compacting the mixture with conventional asphalt paving equipment.

**Traffic Range:**

Typical AADT < 400 for heater-scarification process. No limitations on traffic volume for remixing or repaving process.

**Life Expectancy:**

2 to 4 years for heater-scarification process. 6 to 10 years for heater-scarification with surface treatment. 7 to 14 years for remixing process. 6 to 15 years for repaving process.

**Unit Price:**

Material & Installation: \$0.90 to \$1.60/m<sup>2</sup> (\$0.75 to \$1.35/yd<sup>2</sup>) for heater-scarification. \$1.50 to \$2.40/m<sup>2</sup> (\$1.25 to \$2.00/yd<sup>2</sup>) for remixing. \$2.40 to \$3.90/m<sup>2</sup> (\$2.00 to \$3.25/yd<sup>2</sup>) for repaving. Unit prices are for 25 mm (1 in.) recycling depth.

**Appearance:**

Appearance is black with fine surface texture.

**Advantages:**

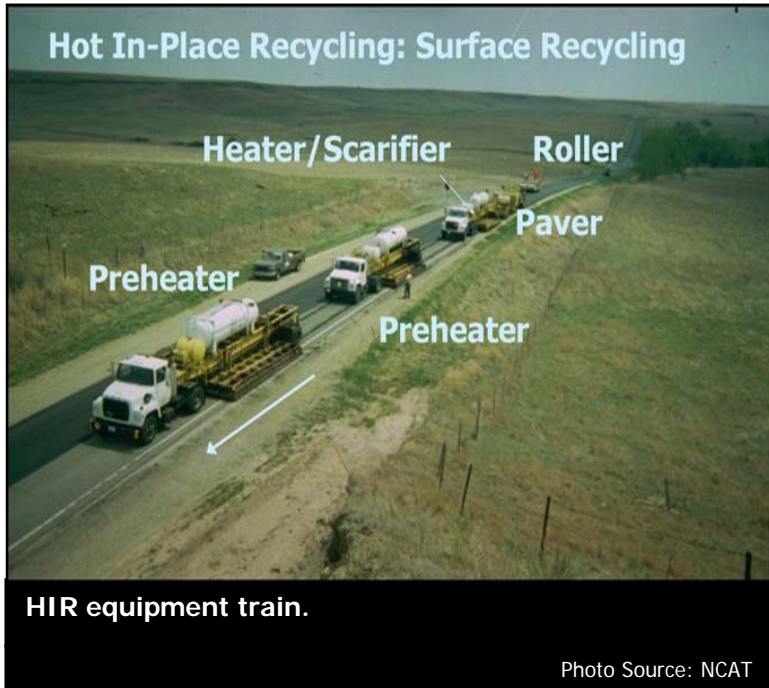
In situ process; Recycles in-place HACCP; Reduces energy requirements.

**Limitations:**

Specialized equipment required; Only recycles a maximum of 50 mm (2 in.) of existing HACCP.

# Hot In-Place Recycling

# 8.2





PCCP rubblization.

Photo Source: Golder Associates Inc.

**Traffic Range:**

No limitation on traffic volumes when used as a base or subbase layer.

**Life Expectancy:**

Typically lasts for the life of the pavement when used as a base or subbase layer.

**Unit Price:**

Material & Installation: \$15.00 to \$30.00/m<sup>3</sup> (\$12.50 to \$25.00/yd<sup>3</sup>) for reclaimed concrete aggregate, depending on location and availability.

**Appearance:**

Appearance is similar to unbound crushed aggregate.

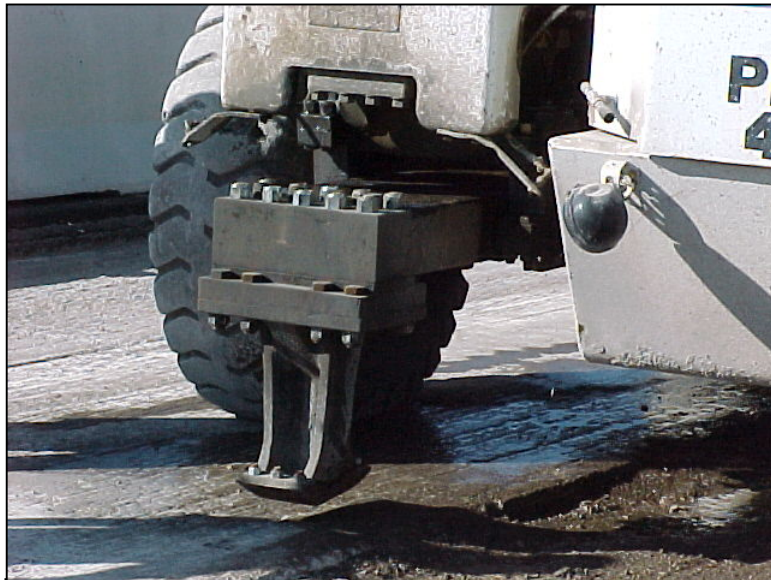
**Advantages:**

In situ process; Recycles in-place PCCP.

**Limitations:**

Specialized equipment required; Reflective cracking when concrete is not sufficiently broken into pieces.

**Product Description:** Reclaimed concrete aggregate (RCA) is a high quality aggregate produced by crushing old PCC. It can be used as an unbound base or subbase layer. Rubblization and crack-and-seat are two methods for fracturing concrete slabs in-place, using specialized equipment, for use as a base or subbase layer.



PCCP rubblizing equipment.

Photo Source: Golder Associates Inc.



Concrete aggregate reclamation process.

Photo Source: American Concrete Pavement Association



# Recycled HACP

# 8.4



Recycled HACP.

Photo Source: FHWA-WFLHD

**Traffic Range:**

No limitations on traffic volumes.

**Life Expectancy:**

15 to 20 years, similar to HACP.

**Unit Price:**

Material & Installation: \$28 to \$39/Mg (\$25 to \$35/ton).

**Appearance:**

Appearance is black with fine surface texture, similar to HACP.

**Advantages:**

Recycles old HACP; Provides a use for cold milling product; High quality surfacing.

**Limitations:**

Adversely affects the quality of HACP when used in too high a proportion. Many agencies prohibit the use of RAP in wearing course mixes and strictly limit the proportion allowed in base course layers. Mix quality becomes more difficult to control as the RAP content increases.

**Product Description:** Recycled hot asphalt concrete pavement is HACP that contains a mixture of virgin asphalt binder and aggregate combined with cold milled HACP from old pavement structures. This cold milled product is generally referred to as reclaimed asphalt product (RAP).