

COLD - ASPHALT RECYCLING EQUIPMENT

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Following is a general outlook on the history and development of construction equipment for use in the cold-asphalt recycling process:

Mixed in place road construction was first introduced in the United States about 1980, in Southern California. In most cases, standard farm equipment was used. Disk harrows, tow blades and drags mixed the liquid road oil into the road bed. The distribution of the liquid road oil was very poor at that time. With the introduction of liquid distributors around 1920 and SC (slow curing liquid asphalt) around 1925, road mix (mixed-in-place) finally became a widely used procedure in the farm to market type road construction.

Specialized equipment for mixed-in-place (now called cold-in-place recycling) was first developed in 1926 by the Barber-Green Company. Other companies that made stabilization equipment at about the same time were; Iowa Manufacturing, Madsen Manufacturing, Woods (now Pettibone) and Jager Machine Company. All of the aforementioned machines were developed to eliminate the use of liquid distributors for the distribution of liquid asphalt. Construction equipment designed for use in the cold-in-place recycling process is continuing at the present time.

In-Place Equipment

In-Place Crushers

Grid Rollers. Grid rollers in conjunction with grader and scarifiers were first used to breakup existing road beds about 1928 to 1930. The grid roller was made of steel rebar interwoven to a 4" opening. Others were made with smaller openings down to a 2" opening.

Other types of grid or impact crushers are made by Ateco and Gemco. They attach to a motor grader and after the road is scarified, the impact crusher is used by applying down pressure from the grader and the forward speed causes the material to break down. They are mostly used on seal coat roads, or as a pre-crusher for use with a Hammer-mill.

Hammer-mills. Hammer-mills were introduced in the late 1940's by The Brother's Company. They were originally designed as rock crushers to build roads in the heavy rock country of Montana and other mountainous regions. When used in the recycling process, the road bed must first be scarified and placed in a windrow prior to being crushed. The grid in the rear of the machine determines the size of the crushed material. Hammer-mills are still being produced at the present time by Pettibone Company.

Rotary Reduction Machines. The following is the definition of crushing equipment for in-place cold recycling from the Michigan DOT: "When the use of crushing equipment is specified in the proposal, the equipment shall be an approved rotary reduction machine having positive depth control adjustments in increments of one-half inch and capable of reducing material which is at least six inches in thickness. The machine shall be of a type designed by the manufacturer specifically for reduction in size of pavement material, in place, and be capable of reducing the pavement material to the specified size. The cutting drums shall be enclosed and shall be enclosed and shall have a sprinkling system around the reduction chamber for pollution control. The rate of forward speed must be positively controlled in order to ensure consistent size of reduced material. The machine must be equipped with an accurate tachometer which is mounted in full view of the operator. The crushing equipment shall meet the approval of the Engineer." (1.)

Several of the machines presently being produced are Barber-Green, CMI, Barco, Rancho, and several foreign machines.

Advantages and Disadvantages. Advantages and disadvantages of the above machines are as follows: The grid or impact roller, although suitable for tearing up and crushing of seal coat and oil agg roads, is too time consuming to be profitable in crushing of plant mixed roads.

Hammer-mills are very well suited for the crushing of plant-mixed roads, except when the asphalt is in excess of four inches. The problem then becomes not the crushing, but the scarification of the thicker asphalt and the placing of this material in a windrow suitable for the hammer-mill

to crush.

Most Rotary Reduction or Cold Milling machines on the market are suitable for reducing all types of asphalt roads and to most any depth. They also have the advantage of not disturbing the underlying base and traffic disruption is minimal. The one disadvantage to these machines is that their cost of operation does not make it feasible to use on seal coat or thin 3/4" to 1 1/2" of plant-mixed asphalt.

The decision on what type of equipment to be used in cold-in-place recycling should not be specified as to type but rather to an end result spec, such as 1", 2" or 3" maximum size and a percent of over size such as 95% to pass a 2" screen, etc. This end result type specification then becomes the responsibility of the contractor and the type of equipment and the amount of time that he must spend meeting that spec will determine the type, size, and number of equipment pieces he will use.

Single Rotor Stabilizers

Clockwise Rotation. Clockwise rotation machines are made by several companies such as, Rex, Seman, Brothers & Kohring and Pettibone. Most of the machines use an L type tine or mixing tooth. All of these can be adapted to cold-in-place recycling by addition of tachometer wheels to give the operator a Ft/Min reading and an asphalt pump and meter with a Gal/Min meter, therefore, with Ft/Min width of machine and depth of cut, Gal/Min can be easily determined to give the proper percent of liquid asphalt.

Counter Clockwise Rotation. Counter clockwise machines are produced by Raygo-Kohring & Bros. All machines have the same ability as the above to be adapted for cold-in-place recycling with the addition of tach wheel and pump and meter.

Advantages and Disadvantages. The advantages of the down cut (Clockwise) is that the material being mixed remains in the mixing chamber for a longer period of time. The disadvantage of the down cut is the amount of power required to down cut.

The Counter Clockwise machines has less down time for maintenance as the up cut requires less effort.

Multi Rotor Stabilizers

Advantages and Disadvantages. The P & H was sold to Kohring in 1957 and the single pass multirotor machine was produced until 1962 or 1963. There are many of these machines still in use today. With the multirotor machine you are able to cold-in-place recycle using penetration grade asphalt cement, with production rates of two full width road miles per day.

The big disadvantage of the machine is its age and most replacement parts must be made special order.

Traveling Pugmills

Advantages and Disadvantages. Midland machinery produces a self-contained traveling pugmill that includes; asphalt tank, conveyor for loading material and a twin shaft pugmill that discharges the mixed material to an asphalt screed to leave a finished surface.

Pettibone also makes a traveling pugmill that picks up a sized windrow and deposits the material in a windrow behind the machine to be laid out with a grader.

Both of the above machines produce a quality product because the material to be mixed is removed from the grade and therefore the metered material (asphalt and gravel) are proportioned to a predetermined mix design.

The disadvantage is the production per day is less than one mile.

Future Design

Needed Improvements. The future design needed to meet all requirements for cold-in-place recycling would be a machine that would crush the existing road material, (i.e. Seal Coat, road mix, or hot plant-mixed asphalt) remove the material from the grade, meter this material and meter the addition of additional binder, then pave with this material to the proper grade and cross section. The machine should also be capable of changing width where and when needed, such as a screed extension on most conventional asphalt pavers.

Plant

Many companies are using conventional stationary crushers and asphalt plants as well as portable crushers and mixers, however, the cost of removal and replacement of materials from the road bed are very expensive and therefore, impractical. I make this statement with reservation, because for small jobs, it would not be practical for a contractor to invest in cold-in-place recycling equipment when he had stationary equipment suitable to do the job.

1. Michigan Department of Transportation. 1979 Standard Specifications for Construction. Division 4, Section 4.07, b., pg. 171.