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[Back to Article Index](#)

Cold-in-Place Recycling



Bethlehem Takes on Aging Roads

Cold-in-place recycling lets fast-growing Bethlehem Township, Pennsylvania, restore older pavements faster and much less expensively than traditional rebuild methods.

by Mike Polak

Twenty-five years ago most of Bethlehem Township's residents would have been employed by Bethlehem Steel Company. Today, the behemoth steel company is long gone and this Pennsylvania township has been reborn as a bedroom community. What was once a collection of small hamlets in a thriving agricultural area has now become a haven for commuters from New Jersey and New York.

With these new residents has come a tremendous growth in both residential and commercial development, and with that growth has come the need for new roads and the need to renovate many aging roads that were built years ago for lower traffic loads.

The township covers a 14-square mile area and maintains about 102 miles of local roads. Their pavement maintenance program stresses crack sealing and pothole patching, and they have experimented with microsurfacing, according to Assistant Public Works Director Judy Houck. For aged and damaged roads, they have been primarily using cold-in-place recycling since 1990.

Using CIR

Richard Grube, now Bethlehem Township's Public Works director, discovered CIR in an L-TAP (Local Technical Assistance Program) training seminar in 1988. The program included a cold-in-place recycling presentation given by local Pennsylvania contractor E.J. Breneman LP.



E.J. Breneman's compact cold-in-place recycling train processes the aged asphalt of a Bethlehem Township residential street into a rejuvenated base.

Grube seized on the CIR concept as an alternative to reconstructing older streets by traditional methods. The next year the township installed its first CIR road, then made cold-in-place recycling a major part of the pavement management program the next year. E.J. Breneman is one of several CIR contractors that bid on the township's work, which usually involves 5 or 6 miles of recycling annually.

Three factors sparked Grube's interest in asphalt recycling. First was the dramatic cost increase in paving grade asphalt due to increased crude oil pricing in 1988 — a condition that is with us again today, in 2006.

Second, some of his streets had aged beyond the point where basic maintenance could sustain them; reconstruction was needed. Traditional reconstruction methods were burdensomely expensive. Grube was looking at having to remove all the old material, then placing new subbase material, aggregate, a hot-mix binder course, then a hot-mix wearing course. Adding further to the cost, in those days the old asphalt pavement was hauled to landfills and dumped, while virgin hot-mix asphalt was used for both the binder course and the wearing course.

Finally, cold-in-place recycling promised to save construction time and natural resources, from the aggregate in the old pavement to the fuel needed to renovate the road.

The CIR process

The goal of cold-in-place recycling is to restore the old asphalt and use it to create a new road base which is ultimately sealed with a wearing course of hot-mix asphalt. In the CIR process, a recycling train mills the old pavement, runs the tailings through an on-board screening and crushing operation, mixes the recycled asphalt product with rejuvenating fluids, then places and compacts the mix — all in a single pass.

In Bethlehem Township, CIR usually involves recycling the old pavement to a depth of 4 inches using a down-cutting milling machine. The down-cutting design causes the cutting teeth to chip at the road surface; by carefully controlling the forward speed of the milling machine, it will produce the sizing necessary to make a new asphalt base course.



This view from the top of the recycling machine shows the condition of the roadway: worn pavement, top-down cracking, and multiple pothole patches.



Breneman uses a hot-mix asphalt paver to place the cold-processed recycled pavement coming from the main recycling machine.



A tandem steel-wheel roller compacts the recycled pavement. After a two-week curing period, the township places a hot-mix overlay on the new base.

The milling machine is equipped with a liquid additive system and spray bar. The system controls the amount of liquid added to the mix based on the volume of material being processed which is a product of milling depth and width and machine speed. The cutting width is normally 10.5 or 12.5 feet.

Water is also sprayed into the mixing chamber to help disperse the particles of asphalt around the milled material.

This process turns the brittle, aged asphalt into a sized, workable, homogenous mix. The mixed material is then conveyed to an asphalt paver where it is struck off at the desired depth and scope of the project design.

Cold-in-place recycling allows the recycled base to be shaped to build a cross-slope or adjust profiles to improve storm water run off — a very important feature for Bethlehem Township, says Assistant Director Houck. It can also be worked to maintain super elevations, and it will improve ride and smoothness by taking out depressions and wheel rutting in the old pavement.

The CIR base is compacted immediately using a combination of 12-ton steel vibratory rollers and 25 to 30 ton pneumatic tired rollers.

Cold-in-place recycling causes little disruption to the traveling public and local businesses because traffic moves around the recycling train as it moves along the road. There are no trenches, drop-offs, or open cuts; the only excavation being done takes place underneath the milling machine.

Problem solving

Made up largely of very new roads and very old roads, most of Bethlehem Township's road renovation problems are best solved via cold-in-place recycling.

Simple overlays, used by many municipalities in the past to cover problem pavements, don't solve aging problems and create a buildup of blacktop that can create curb reveal and drainage problems.

Today's more popular tactics such as mill-and-fill — milling off 2 to 4 inches of old pavement, and replacing it with new hot-mix asphalt — and hot-in-place recycling don't correct deeper structural problems in the pavement.

With proper pre-construction testing and careful planning, cold in-place recycling can eliminate deep pavement weaknesses, lower the high blacktop crown of roads, and restore curb reveal to proper elevations. The recycling can re-profile the roadway, directing storm-water runoff into the curb lines where it is held and relayed into the municipal storm water system.

Bethlehem's process

Bethlehem Township has a blueprint for success with CIR projects.

The first step is preconstruction testing, which starts with core-testing the road to its full depth. Based on the thickness of the asphalt, the total depth of the aggregate, and whether or not the subbase material is viable, Bethlehem officials decide whether to use CIR or some other process to renovate the road.

When CIR is indicated, the township tests mix design formulations in the laboratory.

The final preconstruction step is analyzing the constructability of the project and engineering the lines and grade of the roadway. In this phase of the project, the township's road professionals perform a number of practical steps. They examine

the roadway during bad weather to make sure any drainage problems are solved first. They check all utilities and obstructions and accommodate them in their plan of action. And they make sure the new elevations or cross slopes are correct for the safe passage of vehicular traffic.

Once construction begins, key factors include properly compacting the base course, allowing the proper cure period for it — normally about two weeks — then following up with a minimum 1.5-inch hot-mix asphalt overlay. Bethlehem has placed its own hot-mix wearing course for many years with great success. The hot-mix overlay can be placed up to two months after the cold-in-place recycling process has taken place.

In addition to creating a structurally stronger road at an economical cost, cold-in-place recycling has proven to be a customer-friendly tactic in Bethlehem Township’s road program. It uses no heat, so no fumes are created in the process. It impedes very little on traffic. And it minimizes the amount of truck traffic needed to sustain the construction.

Keeping up with growth

Bethlehem Township has been one of the fastest growing communities in its county in recent years. Since 1990, the population has increased by 50%, swelling from 16,000 to 24,000. And the growth is not over. Along with a rash of new commercial and service buildings going up, an 800-home development has been proposed in the area.

To deal with the growing road demands of the area, the township’s road professionals have invested in two very cost-effective pavement management strategies — aggressive preventive maintenance for the new roads, and careful reconstruction with cold-in-place recycling for the aging ones.

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article index](#)

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