

# Cold-Mix Recycling: Ready for Prime Time?

*Doubts remain in most of the Northwest, but an Oregon contractor and Oregon's DOT lead the way on the technique.*

by John M. Watkins

Charlie Valentine calls it "a child of the '80s." Asphalt recycling — especially the cold-mix variety Valentine does — has not been completely accepted in the Northwest, but it is coming of age.

Valentine, a McMinnville, Ore., contractor with more recycling experience than any other Northwest contractor, should know. He does business as far away as New Mexico and developed equipment use that made cold-mix recycling more practical.

Recycled asphalt pavement falls into three categories: hot mix, which may involve only a small amount of recycled material; cold mix

"That's 100 feet of equipment," Valentine said. "The equipment is so expensive, you pretty much have to decide what you're going to do and stick to it." But the trains are most suited to work on highways, while Valentine thinks much of the future market is in recycling city streets.

Trains can recycle 4 to 6 mi. a day. A modified rotomill with a spray bar for additives can recycle about 2 mi. a day, according to Dale Allen, the Oregon Department of Transportation district engineer in Bend.

Allen, who is given most of the credit for making Oregon the Northwest's leader in cold-mix recycling (and for ODOT winning a national energy conservation award for the cold-mix program), said contractors using only modified rotomills are slower because if they go faster the mill digs up pavement in chunks that are too big to use without a crusher.

Modified rotomills may be slower than trains, but they do the work with a much smaller investment. That should get more contractors into recycling and make bidding more competitive, Allen said.

Valentine said the two techniques usually compete for different jobs, however.

"It's worked out so the cutter-mixers really aren't competitive on the highway, and the trains aren't the tool for suburban streets."

## Doubts About Durability

Not everyone is ready to use cold-mix recycling by either technique on any roads. The Washington Department of Transportation has had a moratorium on cold-mix recycling since 1982, when the last of three trial projects was completed, Jim Walter, WDOT bituminous testing engineer, said.

The state is now conducting a study, in conjunction with the University of Washington, on how well those "test roads" are holding up, and the study should be completed in about a year, Walter said. How well those early projects have done in terms of estimated life-cycle cost could determine the future of the cold-mix technique in Washington.

"At the time we built them, we looked at them, looked at the equipment, and there was some dissatisfaction," Walter said. One problem was high mobilization costs, because no equipment to do the work was available locally and the Valentine train had to be brought in, he said.

Idaho's Transportation Department has done no cold-mix recycling.

"The cold mix has a long reputation of being difficult to compact," said Everett Kidner, IDOT's materials supervisor. "It has

a tendency to rut on you if you put heavy trucks on those roads."

Many of Idaho's roads built in the 1940s and '50s were not built well enough to fix with surface milling, he added.

"They just covered gravel roads. The pavement is 30 to 35 years old, and who knows what the subgrade is?"

Montana in 1980 did 15 two-lane mi. of cold-mix recycling, another 7 mi. in 1985 and 10 mi. in 1986, according to Brad Bruce, bituminous mix supervisor for the Montana Highway Department.

The 1980 job was done by road-mixing crushed plant mix using 2-percent CMS 2, 1.25-percent Reclamite and 2-percent free water.

"We used this material for a base, but our voids in place were over 10 percent," Bruce said. The later jobs, done by the Valentine

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*'In the highway business, anything that hasn't been proven for 10 years is pretty radical.'*

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milled from the surface of the road and 100 percent recycled in-place; and base reclamation, in which the full depth of the road is ripped up and used to form a new base.

## Cold Mix Progress

Base reclamation has, in one form or another, been used for about 40 years, and is sometimes called cold-mix recycling, Valentine said.

But when he talks about cold-mix recycling, he means milling the surface, mixing in an asphalt revitalizing agent and laying the surface back down, and putting a chip seal or some other surface on it. Most of this type of cold recycling is 2 in. to 4 in. deep.

The process was first done in about 1979, he said.

"In the highway business, anything that hasn't been proven for 10 years is pretty radical," Valentine added.

But highway departments are slowly accepting asphalt recycling, and the competition is nipping at his heels as more contractors get into the field, he said.

Valentine in 1982 developed the "paving train" — a line of equipment that starts with a tank truck with water and one with binder, a rotomill, a screening deck that routes large pieces to a crusher and, behind the crusher, a pug mill where the additive goes in. The train lays down windrows of pavement ready for spreading and compacting.

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*'One of the real problems in this age of computers and committees is that this is more of an art than a science, and it takes some trained eyeballs on the job.'*

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paving train, were more successful.

"We reliably obtained 95 percent of our target density on both of these projects."

Both hot- and cold-mix recycled material has been used primarily as a base, because doubts remain about the durability of recycled asphalt, especially cold mix, in an area where chains and studded tires are a regular part of the winter scene.

Montana has placed about 120 mi. of hot-mix recycle for quality comparison. Hot-mix recycling seems to work well, and some roads aren't in good enough shape for anything else, he said. Hot mixing allows addition of virgin aggregate to improve the properties of the pavement as the hot mixing proceeds.

But Montana's hot-mix recycling is being monitored by the Environmental Protection Agency, and ecological considerations are making it more difficult to operate hot-mix plants.

"To avoid smoke and halting production, we are having to increase our percentage of virgin aggregate. This change in materials



material at the homeport, then dispose of it in Port Gardner Bay and cap it with uncontaminated material.

The Shoreline Hearings Board approved the dredging permit March 17 and later rejected a Sierra Club bid for reconsidera-

tion. Environmentalists want contaminated dredge spoils disposed of on land.

Meanwhile, Homeport Northwest, an organization of business, labor and government participants, has called for an end to the legal challenges.

Spokesman Reid Shockey said that "at this point, the continuation of legal battles is designed to kill the project and is costing the taxpayer hundreds of thousands of dollars. □

lic officials and businesspeople concerned about transportation needs. Those testifying include governors, mayors, chambers of commerce, highway and transit officials, agricultural groups, and industry and association executives.

Proposed solutions to transportation problems varied, but witnesses agreed that congestion in urban areas is likely to increase in the future and that new or expanded facilities — whether highway, transit or rail — are not being provided in time. The deterioration of rural roads and bridges was cited as a problem and there were calls for high-quality access routes to the interstate highway system and construction of four-lane highways for rural economic development.

There was widespread support for user financing of needed improvements, and full use of available federal and state user-paid revenues for those improvements, according to the report.

Witnesses also said that urban transit should not be allowed to deteriorate and that ways should be found to increase transit ridership. There were calls for protection of rail-freight and railroad-passenger service, and for evaluation of high-speed rail service in heavily traveled corridors.

On highway safety, witnesses advocated expansion and enforcement of safety belt-use laws, stronger drunk- and drugged-driving countermeasures, and compliance with motor-carrier safety regulations of vehicles and drivers. □

## Calendar

**SAFETY WORKSHOP** — "Accident Investigation and Safety Inspection Workshop," a one-day seminar sponsored by the Evergreen Safety Council, 7600 Sand Point Way N.E., Bldg. 32, Bin C-15700, Seattle, WA 98115-0700, will be in Eugene, OR, **Aug. 23**.

**PROJECT MANAGEMENT** — "Getting Project Managers to Think and Act Like Principals," a seminar sponsored by Professional Management Services Journal, 10 Midland Ave., Newton, MA 02158, will be in Denver, CO, **Aug. 26-27**.

**ROAD CONFERENCE** — The American Road and Transportation Builders Association will hold its 34th National Conference on Local Transportation in Colorado Springs, CO, **Aug. 28-31**. Registration number is (202) 488-2722.

**ASPHALT MEETING** — The Asphalt Recycling and Reclaiming Association, Three Church Circle, Ste. 250, Annapolis, MD 21401, will hold its semiannual meeting in Kansas City, MO, **Sept. 13-14**.

**EQUIPMENT EXPO** — The Pacific Northwest Equipment Exposition will be in Vancouver, WA, **Sept. 13-15**. For information call (206) 254-1508 in Washington or (800) 624-2569 outside Washington.

**MARKETING CONVENTION** — The 1988 national convention of the Society for Marketing Professional Services, 801 N. Fairfax St., Alexandria, VA 22314, will be in Dallas, TX, **Sept. 13-16**.

**WOMEN IN CONSTRUCTION** — The national convention of the National Association of Women in Construction, P.O. Box 181068, Fort Worth, TX 76118, will be in Toronto, ONT, **Sept. 14-17**.

**CONCRETE CONFERENCE** — A national conference on concrete design, sponsored by 15 national organizations, will be in Oak Brook, IL, **Sept. 18-20**. For information contact the American Concrete Institute Continuing Education Department, P.O. Box 19150, Detroit, MI 48219-0150.

**TRANSPORTATION CONGRESS** — The Transportation Futures Congress, sponsored by the Highway Users Federation, 1776 Massachusetts Ave. N.W., Washington, DC, will be in Washington, DC, **Sept. 18-20**.

## Public Calls for Better Transportation

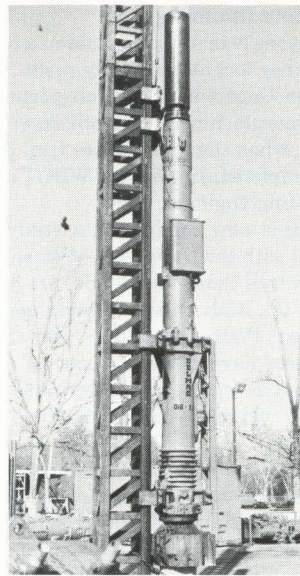
A recently completed series of public forums held throughout the United States shows that both the users and managers of surface transportation systems are concerned with the way unprecedented travel growth is being handled and want improvements, according to a report by the Highway Users Federation.

Titled "Beyond Gridlock: The Future of Mobility As the Public Sees It," the report is part of the 2020 Transportation Program, an effort by public officials, private industry and concerned citizens to build a national consensus for a plan to meet U.S. travel demand through the year 2020.

The report documents testimony from 65 public forums held throughout the country from August 1987 to May 1988 to assess surface-transportation problems and needs.

The forums received testimony from pub-

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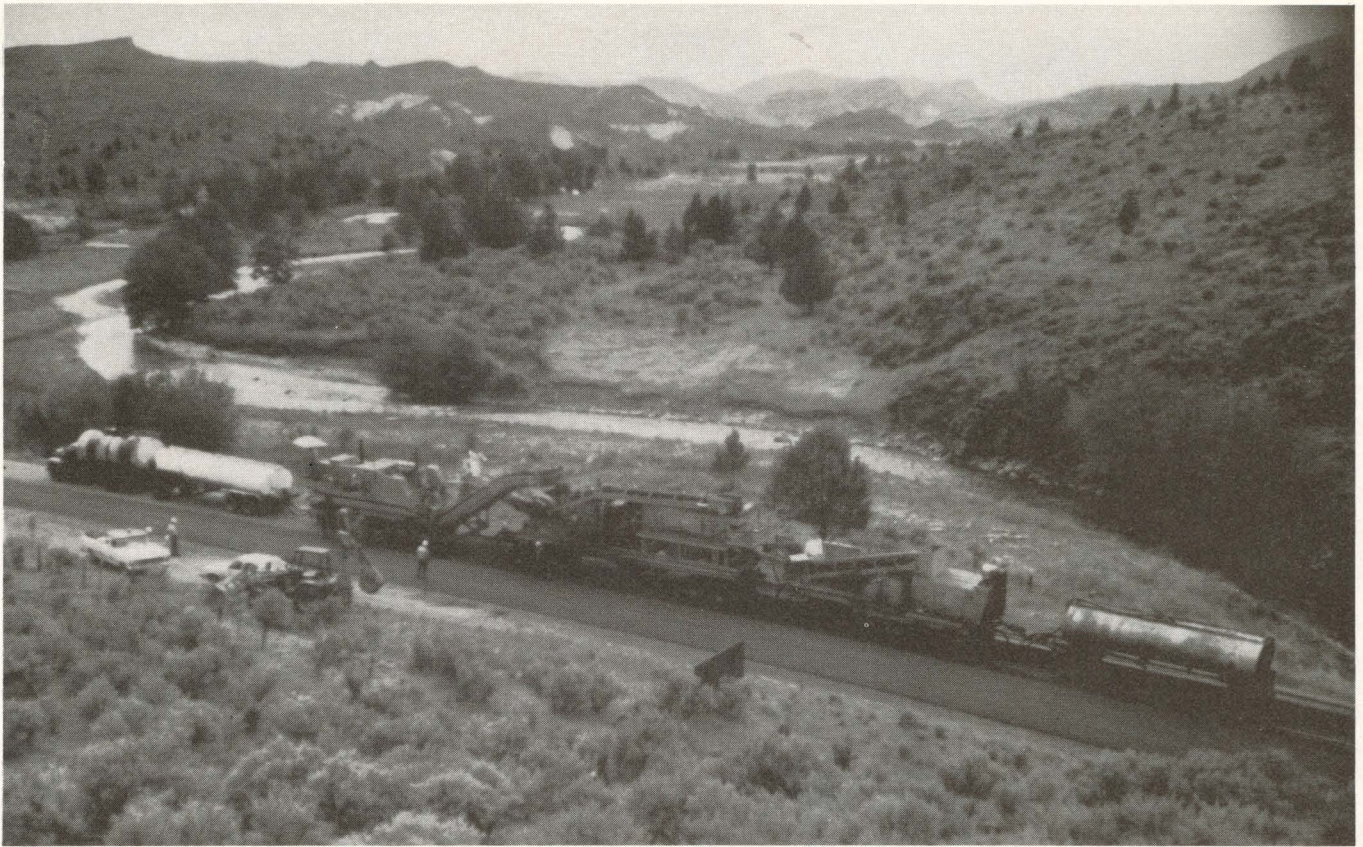
**E**CONOMICAL

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**DELMAG**





**Charlie Valentine's paving train works a 1986 job between Mitchell and John Day. The train consists of a tank truck with binder, a roto mill, screen deck with a crusher and generator under it, with a pug mill on the back of the same trailer. Photo courtesy of the Oregon Department of Transportation.**

proportions makes cold recycling more attractive for future construction," Bruce said.

Valentine said part of the problem in selling highway departments on cold-mix recycling is the difficulty of quantifying the factors that make for high-quality cold-mix recycling.

"One of the real problems in this age of computers and committees is that this is more of an art than a science, and it takes some trained eyeballs on the job."

Specifying specific amounts of additive, for example, doesn't work because roads vary in their composition.

"You're dealing with roads that in some cases weren't even designed," Valentine said. They may also have been built up with layers from years of maintenance. Adjustments have to be made while the recycling is being done.

#### **Oregon's System for Success**

Valentine said part of the reason Oregon has succeeded with cold mix is that the maintenance department has inspected the projects. "They understand cold mix.

"Oregon also accepted the fact going in that they would have some failures," he said.

ODOT's Allen said weather can also influence the success of cold-mix projects.

"We figure we need 90 degrees in the windrows," which takes a sunny day with an air temperature of about 70 degrees, Allen said. At lower temperatures the emulsion may not lose its water, and voids are possible. That, and the fact that Allen is in Bend, explains why most Oregon projects have

been in the central part of the state. West of the Cascade Mountains and in colder areas there are fewer days when the work can be done.

But developing the technique seemed worthwhile even if not all the projects

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panned out, because of the cost savings compared with a new overlay.

"We're talking about a major increase in the number of highway miles we can repair," Allen said. While a new 2-in. overlay 32 ft. wide might cost \$150,000 a mile, the same depth and width of recycled road would cost \$18,000 to \$27,000 a mile. And recycling should get easier as roads are built with recycling in mind, using open-grade paving.

"I think that's the real sleeper," Allen said.

The system also saves on the use of petrochemical resources, a factor that won awards first from the Oregon governor's office, then from the U.S. Department of Energy. In addition to the savings in asphalt and in fuel for a hot-mix plant, no trucks are hauling

asphalt or aggregate to the construction site.

Oregon has used the system on more than 350 mi. of road to date. As recently as 1982 there were only 61 mi. of cold-mix recycling in the 11 western states, Allen said.

Oregon started with projects on low-volume roads, but Allen said cold-mix recycling is ready for prime time. He said there is no evidence of tearout from chains, and the roads seem to survive tough weather conditions without difficulty.

"We have an area south of Bend here that's had 217 freeze-thaw cycles in a year" with no evidence of problems, Allen said.

"We're in our fourth or fifth year on a lot of these jobs . . . it looks like we can expect eight years or more. The life-cycle costs look good."

#### **Compaction Cure**

Problems with compacting cold-mix recycle are often cited by people with doubts about the system's durability. Compaction problems stem from the fact that cold mix takes longer to cure than hot mix. Hot-mix asphalt cures as soon as it is cool. Cold-mix cures for several weeks.

Even after the primary curing some still takes place. "It might go on for a year," Allen said. "That's not necessarily a disadvantage. It gets better with age.

"You don't want to expect 95-percent compaction. These are open graded after recycling," he added. "Rutting is not a problem."

"As soon as we're done rolling it we put traffic on it." Then after three days to a week it is rolled again, Allen explained. The sur-



face is ready for a chip seal or overlay after two or three weeks.

Tony George, ODOT roadway materials engineer, said the state is confident about cold-mix recycling's durability, at least on low-volume roads.

"Based on what we've seen to date, they are holding up very well." The cold-mix projects show less reflective cracking than hot mix, but materials are less uniform, so spot patches have been needed, George explained.

"Dale (Allen) has got it past the trial stage," he added.

While Oregon has done almost no hot-mix recycling, Washington has been doing hot-mix exclusively. Some form of recycling is advantageous not only for financial reasons, but because dumping of asphalt material is restricted in many areas, according to Ed Schlect, district engineer in Olympia for the Asphalt Institute.

"Some people think asphalt is a problem, but I haven't found any leachates from it," Schlect said. Whatever the truth may be, the fact is that many landfills don't want construction dumping.

Valentine said that while people in the Puget Sound area, with gravel often 100 ft. deep nearby, tend to forget that aggregate is in short supply in many areas. Southern California is short of aggregate, which

makes recycling more attractive, he said, and outside the Northwest, "it's nothing to haul aggregate 100 mi."

And while asphalt prices are down now, the next price rise could produce high costs for new asphalt surfaces again.

"It wasn't too many years ago the price of liquid asphalt was \$200 a ton," though it has fallen to the \$100 to \$120 range, Valentine said.

#### Small Governments Jump In

While Washington and Idaho have been waiting for the verdict to come in on cold-mix projects, smaller governments eager to save money have been willing to get their feet wet on the modern version of the older type of cold recycling — base reclamation or stabilization.

Len Montague, an engineer with E/S Allison & Associates, Redmond, Wash., said his company works primarily for counties, rural communities and the Forest Service.

Allison does what Valentine calls base reclamation, in that the road is pulverized to its full depth with a Bros Reclaimer -1. The material is then mixed with asphalt emulsion to create a stabilized emulsion-treated base. A fog seal is added and about two weeks later a chip seal or overlay can finish the job.

Traffic can drive on the road as soon as the surface is finished, but the surface should be

rolled daily to prevent rutting, Montague said. He said that using Allison's techniques, the minimum air temperature is about 50 degrees, and on days when that is the minimum the high is usually 60 to 70 degrees.

"It's seasonal. We need warmer days and relatively dry weather." That's more of a concern in areas like Ocean Shores, Wash., where Allison did some recycling, than in areas east of the Cascades.

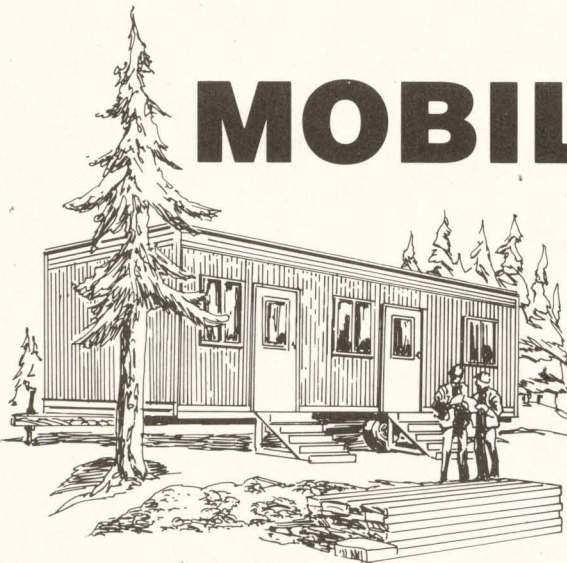
Montague said some local officials are put off by the appearance of recycled pavement, which tends to be more brown than black. And as an engineer, he said, he's glad he's not on the equipment end of the full-depth recycling business.

"Equipment designed to destroy pavement destroys itself," he explained. Using the pulverizing equipment is a high-maintenance business.

#### Calling All Contractors

ODOT's Allen thinks now that the cold-mix process is gaining acceptance, it's time for more contractors to get involved. His agency's acceptance of modified rotomills is intended to get more contractors into the recycling fray.

"I think the contractors that are kind of holding back on this need to get a little more involved. I think there's going to be a good market for it," Allen said. □

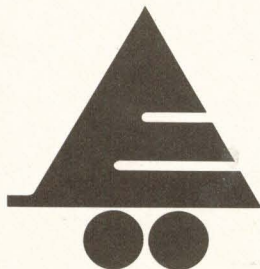


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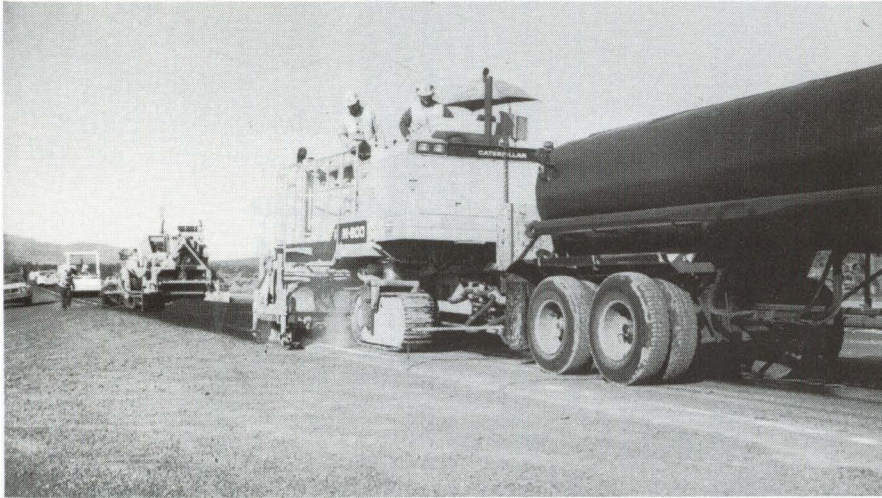
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# Picking It Up and Laying It Down in Oregon



**Overall view of the small recycling paving train used on the Prineville Grade. It starts with the asphalt tank, followed by a Caterpillar PM-800 cold planer, then a combination of a Caterpillar WE-601B windrow elevator and a Blaw-Knox PF500 paver, with an Ingersoll-Rand DA-48 double drum vibratory compactor bringing up the rear.**

Text and Photos by  
**Charles M. Gordon**

**M**other Nature hasn't been especially cooperative east of the Cascades so far this season. *PB&E* recently visited an asphalt recycling project in the Oregon high country near Prineville where the Oregon Department of Transportation, and Gamble and Pyritz Construction Co., of Portland, had been watching the weather reports and scanning the sky. The weather finally permitted them to start working on the 1.8-mile-long stretch of Oregon State Highway 126 known as the Prineville Grade.

The "paving train" working on the Prineville Grade is the smaller of two recycling operations working in the district this summer. Some of the equipment is rented by ODOT, and some belongs to the contractor. Leading the train is an ODOT double-trailer tank truck carrying one tank of asphalt and one of water.

Yoked to the rear trailer is a Caterpillar PM-800 high-production cold planer mounted on four hydrostatic crawler track assemblies. The PM-800 can cut a 147-in.-wide path up to 6 in. deep in a single pass. ODOT is renting the PM-800 from Papé Bros. Inc.

On the Prineville Grade, the PM-800 is cutting about 2 in. deep. Asphalt and water are pumped in from the tankers, emulsified and mixed in the milling chamber with the material carved off the roadway by the tungsten carbide cutters mounted on the machine's 40-in.-diameter cutting drum. The resulting mixture is laid down in a windrow behind the rotomill. ODOT has

added a tack bar to the rear of the PM-800 to lay down a spray before the windrowed cold mix goes into place.

Following behind the cold planer, Gamble and Pyritz' Caterpillar WE-601B windrow elevator picks up the windrowed material and feeds it into a Blaw-Knox PF500 paving machine that lays it back down in the cut left

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*ODOT engineers analyze the existing paving material before undertaking a recycling project, so they can evaluate the asphalt, gradations, etc. Then they prepare a design asphalt content for optimum results.*

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behind by the PM-800. Total elapsed time is just minutes.

Finally, ODOT is using an Ingersoll-Rand DA-48 double-drum vibrating compactor to bring the paving mix level with the existing roadway surface. A Bomag BW-12AS double-drum compactor was also available on the jobsite. The final step in the process is

putting down a seal on the top surface.

According to ODOT District Maintenance Supervisor Dick Nelson, this paving train can produce 2 to 2½ lane mi. per day. Their larger train, with a crusher and pug mill, can run between 4 and 6 mi. a day. On the Prineville job, Nelson was running the train on the grade for a day to finish one lane, then moving the equipment to another job on the opposite side of Prineville to avoid having all three lanes torn up at the same time.

Traffic is heavy on this steep, winding grade on State Route 126, and ODOT was running a pilot car to move traffic around the project. Nelson planned to give each lane some time to "settle down" and avoid damage from the heavy traffic, then return to do the other two lanes, also one at a time. He expected the whole process to take about a week and a half.

ODOT had about 11 people on the job (including flaggers and pilot car drivers), while Gamble and Pyritz had three. Partner Bob Pyritz was an active participant in the job's first-day activities.

ODOT engineers analyze the existing paving material before undertaking a recycling project, so they can evaluate the asphalt, gradations, etc. Then they prepare a design asphalt content for optimum results. On the Prineville Grade, they were adding about 1.8- to 2-percent emulsion, for a total of about 22 tons of mix per lane. The second job, on the opposite side of Prineville, was scheduled to use only about 0.8- to 0.9-percent emulsion because the existing paving in that location was less brittle than the Prineville Grade.

According to Nelson, this cold process has proven economical and effective, although ODOT is still doing significant research to refine the designs and methods.

One innovation begun late in the 1987 season was heating the tanker water to a temperature near the (approximately) 140 degrees Fahrenheit of the asphalt, so the resulting mix is warmer when it is actually placed. Early morning readings on the Prineville grade showed about 85 to 90 degrees in the berm, with temperatures later in the day approaching 110 to 115 degrees as radiant heating from the sun increased.

After four years of research and use on Oregon's public highways, ODOT considers recycling in place to be a cost-effective option for asphalt highway maintenance when conditions indicate its use. High production rates mean that highways are out of service for a shorter time, and continuing investigation along with more and more miles of recycled asphalt highway in daily use are turning the process into a practical engineering alternative rather than a "black art." □



News - JTG

DJC 8/29/79

# Recycled concrete makes grade

Recycled paper and aluminum are not uncommon. Recycled roads, however, are news.

The day is coming, according to Curt Polly, plant superintendent for Twin County Re-Cycling Corp., when recycled roads may be as common as the former two items are today.

Twin County was established in May, 1977 to re-cycle concrete from rebuilt or abandoned roads. The old concrete is converted to road-base material. This is a new field. Twin County is the only such contractor in New York State and one of perhaps four in the U.S.

Contractors building road for municipalities, the state and private customers, break up the old concrete base and truck it to Twin County's plant in Hicksville, N.Y.

## Stockpiles chunks

A Hough Model 120 Payloader, equipped with Bofors teeth, stockpiles chunks of concrete and feeds them to a 1½ ton drop-ball mounted on a small crawler

crane. The drop-ball breaks up the larger chunks and the concrete is fed to a primary jaw crusher.

The 120 loader is also used to load trucks with finished product, which is sold primarily to local contractors, usually the same contractors who bring the old concrete to Twin County. They use the material as base for new roads and temporary base in sewer trenches.

Polly anticipates a growing business. "Like with any new product," he says, "people want to stay with the established item.

But when they use our product, they see it's comparable to and in some cases superior to the standard stone blend. We meet New York state specifications, which is what local municipalities go by. We constantly grade our material to stay within state specifications."

Although the material is being used only as road and sewer base for the time being, Polly expects to adapt his screening techniques to the point where the material can be used as aggregate for concrete.



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# Bureau's director cites ash research

By HUNTER JAMESON  
Albany Democrat-Herald



**TS Ary**  
Visited Albany two days

Research being done in Albany may cut the volume of waste ash from an incinerator in New York state, the director of the Bureau of Mines said Thursday.

TS Ary mentioned the project as an example of cooperation between the agency and American industry, cooperation that makes use of the resources of both.

Ary paid a visit — his first as director — to the Albany Research Center of the Bureau of Mines Thursday and today.

The Albany Research Center has a rare small electric arc furnace it is using in the project to help a municipal trash incinerator in New York.

Ash from the incinerator is buried in a landfill. Tests in Albany suggest the ash can be turned into black glass globules — like obsidian — that would take up only half the space of the ash in the landfill. The glass globs could not contaminate water or ground.

The Albany center also is trying to find a use for the black glass, Ary said.

Ary, 66, has been director of the U.S. Bureau of Mines for nearly four years.

Asked why the letters TS before Ary have no periods, he said his parents gave him the letters in place of names. His friends call him T.

The son of a southern Illinois coal miner, Ary was a Navy pilot in World War II and since then has spent 40 years in the mining industry.

His most recent private sector job was as president, from 1980 to 1987, of Kerr-McGee Corp.'s Minerals Explorations Division in Oklahoma City.

Serving on various industry committees gave Ary the chance to sound off on the Bureau of Mines, which he felt was not doing enough useful research.

"I had been a complainer of what the bureau was not doing."

Mining industry officials, Interior Secretary Donald Hodel and a number of senators including James McClure and Steve Symms of Idaho and Mark Hatfield of Oregon urged Ary to work on changing the bureau from inside.

President Reagan appointed him director on March 31, 1988.

The bureau has 2,500 employees at nine research centers in the country and at its Washington headquarters, where a staff collects and analyzes information on mining worldwide. Its budget this year is \$170 million. The Albany Research Center employs 150.

Ary said his desire to change the bureau's direction picked up support from its career employees after President Bush was elected in 1988 and asked Ary to stay on.

Ary saw his first big task as getting industry to participate again with the bureau.

A Technological Committee brought together representatives of industry, academia and the bureau. A contracted study by the National Academy of Science on what the bureau should do gave a basis for discussion.

Ary pointed to the Oregon Metals Initiative as an example of bureau-industry cooperation.

With money from the bureau, state lottery funds and industry, including Teledyne Wah Chang and Oregon Metallurgical Corp., the initiative undertakes research to aid metals companies in the state. It is directed by a board representing all interests.

Now in its second year of projects, the initiative has provided \$6 million for 24 projects. It has involved 18 metals companies as well as the Albany Research Center, Oregon State University and the Oregon Graduate Institute near Hillsboro.

Nationally, the Bureau of Mines sponsors research at universities as well as doing it at its own centers and is working with industry. Projects to improve mining methods and safety have national and international applicability.

The Bureau of Mines is one of few governmental agencies that actually help to create wealth, he said.

A continuing thrust for bureau research: finding how to develop natural resources while maintaining a high-quality environment. It can be done, Ary said.

"In the last 15 years the mining industry has been a very good environmental citizen," he said. To spread resources, the bureau shares equipment and staff with industry at bureau centers or industrial sites.



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BESSER MANUFACTURING COMPANY  
Mezzanine Floor  
New Washington Hotel  
Second & Stewart Sts.  
Seattle 1, Washington

I am sure that Mr. Flewelling would be most happy to arrange an appointment and discuss the manufacturing process of this material more fully.

After the preliminary discussions have been completed, Mr. Leftwich will be most happy to visit you and give you the balance of the details.

We appreciate very much your inquiry and trust that we may have the pleasure of hearing from you further. Thanking you, we are

Yours very truly,

BESSER MANUFACTURING COMPANY

  
D. R. Fox  
General Sales Manager

DRF:rd



(2) As AGGREGATES AND FILLERS: In concrete and plaster, whether poured, applied manually or by gunite methods, or used as precast masonry shapes; pumice of suitable characteristics and expanded perlite of the proper type make excellent aggregates and have the following advantages: light weight of finished wall or unit, (from one-fourth to two-thirds the weight obtained when sand and rock aggregate is used); very high strength to weight ratio in finished wall or unit, (from 20 to 40, as compared to 15 to 20 for standard concrete); great resiliency and resistance to shock or movement within the structure; little tendency to crack or shatter with impact; excellent bonding properties with most binders; very great resistance to fire or chemical attack; high value as insulating mediums, (from two to ten times equivalent values obtained with sand and gravel aggregates); are inert with respect to attack by insects, fungi, and most chemicals; can be sawed, nailed, and perforated without cracking, spalling, or splintering; result in marked labor saving during construction or application; and walls using these aggregates have much less tendency to "sweat" or condense moisture than ordinary concrete or plastered walls. (See Table V) Pumice and perlite have some disadvantages as aggregates, chief among which are: somewhat higher cost per yard and in some cases lower yields than sand and gravel; somewhat higher moisture absorption and volume change than sand and rock aggregate concrete; and lower compressive strength than can be obtained by the use of sand and rock aggregate. If strength per unit weight is considered, however, pumice or perlite aggregate will compare favorably in compressive strength with sand and rock aggregate. Another present disadvantage in the wide use of pumice or perlite as aggregates in concrete and plaster is the lack of standards and information governing specifications of the material used, mix formulae and techniques of application or use, and precise data upon all properties of specific concretes or plasters using these aggregates; all of which are necessary before engineers and architects will be able to fully utilize the inherent advantages of these materials in structural design.



(3) As an INSULATING MEDIUM, pumice and particularly expanded perlite, are equal to any structural insulating material, and superior to most. Expanded perlite of the proper type is much superior to pumice in this respect. The chief advantages of these materials as a bulk loose fill or (with a binder) as prefabricated shape insulation are: low "k" factor, (as low as 0.22 in the case of perlite, see Table VI); very great resistance to fire or chemical attack; immunity to insect attack; no absorption of odors, very low moisture or gas absorption; light weight compared to most other insulating materials; very little tendency to disintegrate or pack when used as bulk loose fill insulation; and no tendency to decompose or react with binders or materials with which they are in contact.

(4) MISCELLANEOUS USES: Pumice and expanded perlite have been used in the chemical industry as filter aids, as absorbent materials, and as catalyst carriers. Perlite, (low bulk density pulverized) is being experimentally used as a filler in paints and enamels, and in the paper industry as a filler. Pumicite is in use as a carrier for insecticides, especially where a low pH is required, as in the case of a carrier for DDT dust. As extenders in the rubber industry, as fillers and mordants in the textile industry, as ingredients in certain types of glazes in the ceramic industry, and as fillers in the plastic industry; certain types of pumice and pumicite, and the low bulk density expanded perlites should find wide use. As soil modifiers, chicken litter, etc., both pumice and perlite are in present use.

Pumice and Perlite as Industrial Materials in California  
by C. R. King, Associate Metallurgical Engr. State Div. of Mines



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14 min  
Back E 1/2

# CINDER DEPOSITS

BIRCH CR.: Twp 13614 S, R. 43 E.

BAKER CO. 13 MILES  
FROM HUNTINGTON.

LARGES DEPOSIT WT 75 LBS/CU FT.  
DEEDED LAND.

LADDAN BUTTE: SEC 36, T. 16 S, R. 11 E

DESCHUTES CO

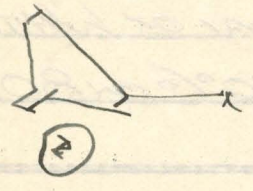
ROBBT BUTTE: SEC 35, T. 19 S, R. 11 E

DESCHUTES CO.

(MAINT OTHER BUTTES  
IN AREA (REMOVAL)

LADD CANYON CINDERS: SECS 17, 20, T. 5 S, R. 39 E

UNION CO. SHANNON,



+



WILLIAMSON CASCADES RUN

7 MILES N OF BEND ON  
DESCUERS ROAD E.T.P.

GUS PIFER SEPT.

BENKER-BELT - VIB SCREEN  
BELTS TO CARS 12" ROLLS

22" BIRD CONCRETE & PLUMICE  
SHIP STRAIGHT CONCRETE ALSO  
CONCRETE NW TUNALO  
PLUMICE FROM RIFLE TRUNGE

WHEELBARROW SHOPPER  $\frac{1}{8}$ " - 20 MESH

Howe Back Agg

MONSIEUR THE PORE

PLASTER SAND (DAGS BOLS)

FLOOR SWEED  $\frac{1}{8}$ " -

AIR DRY - 3 AC TIS SPC 1000  
HARROW (PLASTER SAND - SWEED)

1 CAR ABRASIVE GRADE



LEROY GROTE CINDER HILL  
TRESHON BUTTE REDMOND  
2 MI. N REDMOND W. OK

July 97

HOUGH LOADER

BUCYRUS FINE  $\frac{3}{8}$  IN SNARE



# MILLER PLANTS

5/3 HOUSE DIES

B. RAILROAD SCREENS

"SELF-SERVICE BIKES"

TRUCKS CAN ASK HOW DEARIE NITE

SOME SNAKE & TUNICE

BLENDED TOOMARK

FOR ROCK

RESEARCH ON BEST MIX - UNIV TOLEDO

4.0 TON GORE NO COVERS  
WEIGHED LOCAL

5 CARL DAY

VIBRATING SCREENS

CHANCE  
SCREEN

BELT CONVEYORS

TO SET  
CUSTOMER

30" SHOOT BUND

BLOCK AGG

MONOLITHIC  
ROOF MONO

RISER FILL

RISER ROOF ROOF

PLASTER AGG



# MILLER SHALEX

PIT 4 1/2 IN. S OF BEND

ROCKS COME DOWN CON-  
TACT CRUSHING - PORT<sup>ABLE</sup> EQUIP

LS WT AGG

LOW SHRINKAGE

WASHINGTON SCHOOLS

—  
PUNICE ONLY HIL TO PALS  
FIRE UNDERWATER LAB INL

4 HR RATING

—  
3/8" - , 5/8 - 3/8" , 5/4 - 1/2" AT PIT

—  
CRUSHED & BLENDED TO CUSTOMERS  
SIZES AT PLANT

—  
SCORPIONE LOADER AT SHALEX  
PIT

—  
RED ROCK ROOFING  
SACKED ROOFING (BERMUDA)  
ROOF

1/2 - 1/2" COLLS



MILLER CINDERS

1/2 MI W OF BRIND

SCREEN 3" - TO FINES

BASS RIVER CITY OF

BRIND - BLACKTON

10 MEN ANNUALLY

40 YD TRUCK

3/4 YD SHOVEL

DUNICE  
CINDERS  
SHALEX

40-50 SHAM <sup>DUNICE</sup> PITS W/SHAM

BANK SHAD IS BLOCK AGG

SOME HOWLONTHIN

SOME LOOSE FILL



# COPY

RECEIVED  
FEB 20 1964

STATE DEPT. OF GEOLOGY  
& MINERAL INDS.

*Harkin*

February 18, 1964

William Miller  
Central Oregon Pumice Company  
125 Oregon  
Bend, Oregon

Dear Bill;

The different fractions I screened from the last sample you sent were expanded in a muffle furnace at 1900 degrees F. This is the same treatment given the samples you furnished last fall except that then only material screened to minus 20 mesh, plus 28 mesh was tested. This time the testing was done on screened fractions ranging from minus 20, plus 28 upward to minus 1/8 mesh hardware screen, plus 0.589 mm's with three sized fractions in between.

Expansion results are as follows:

VB-1	minus 0.833 mm	plus 0.589 mm	50%
VB-4	" 1.168 "	" 0.833 "	50%
VB-5	" 2.00 "	" 1.168 "	50%
VB-6	" 2.362 "	" 2.00 "	60%
VB-7	" 1/8 h'dware screen	" 2.362 "	25%

That the coarsest of the above samples, VB-7, expanded only 25% constitutes no great surprise. However, why the finest fraction, VB-1, should have expanded only 50% this time, yet made a 105% expansion when tested last fall, I don't understand as both tests, then and now, were made on material screened to the same size and expanded at the same temperature. In short, I had anticipated that VB-1 would have duplicated the original 105%, that VB-4 would have expanded somewhere in the range of 92 to 96% and that VB-5 would have come out somewhere around 80 percent, etc. I am wondering therefore if the last sample you sent was an actual duplicate of the one which originally yielded the 105% expansion or if there is a possibility that it represents pumice from a different source?

In any event, and as I mentioned in a previous letter, a greater amount of expansion is experienced in commercial plants than is experienced in a muffle furnace. This is probably due to the direct exposure of the raw material particles to the flame and to the continuous feed that takes place in the commercial plants as against expansion in batch lots in a crucible as is necessary in a muffle furnace. I mention this point again merely to remind you that you could figure on realizing a greater expansion with a commercial treatment than any of the present figures indicate.



# COPY

In its expanded form the pumice from the present test is hard, or sharp, as compared to expanded perlite which will pulverize to dust in ones fingers. I am sending you the expanded material so you can judge this characteristic for yourself and I'll be interested in learningg your appriaisal of the expanded material from the standpoint of aggregate properties.

On the face of it this 50 to 100% expansion for pumice doesnt look like much when one considers that perlite expands 500 to 600 percent. However, it is to be remembered that in the instance of your pumice you have it in a semi-expanded form to start with. Thus any additional expansion that is induced serves to pro duce an even lighter weight product than you are accustomed to having. In short, a cubic foot of ~~expanded~~ pumice expanded 100 % would end up as two cubic feet weighing together what the one did originally. At even 50% expansion a given volume that weighed 10 pounds in the raw state would end up weighing only 7½ pounds, expanded.

The pay-off question is how much a cubic foot of expanded pumice would weigh compared with a cubic foot of expanded perlite, both materials being of the same partical mesh in expanded form. Frankly, I don't know the answer to this, but will try to look up some statistics. Anyway, it is entirely possible the weights might be surprisingly close. In other words, pumice expanded 100% might weigh about the same as perlite expanded 500%. And if the pumice in its expanded form retains a greater degree of "sharpness" than the perlite, it might therefore be a truly competitive product. At least the situation seems worth some thought.

Sincerely

Wagner