PERMA-ZYME USA

"The Best in Soil Stabilization"

Soil Stabilization
For
Road Construction
& Natural Liners

Distributed in the USA Exclusively by: ENFRA, LLC

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PERMA-ZYME

APPENDIX I

****

SALES BROCHURES

AND

TESTIMONIALS

PERMA-ZYME 11X

WHAT IS PERMA-ZYME 11X?

One of the worlds finest products for road stabilization and pond sealing.

PERMA-ZYME 11X is a proprietary concentrated liquid multi-enzymatic formulation. It alters the properties of earth material to produce superior road base stabilization compared to all other road treatment materials now in use.

Developed and proven through years of field testing, PERMA-ZYME 11X provides additional advantages to road builders, communities and the ecology by being **non-toxic, non-corrosive and environmentally safe.**

When mixed with water and applied prior to compaction, PERMA-ZYME 11X acts upon organic fines contained in the soil through a catalytic bonding process, producing a strong "cementation" action. Unlike inorganic or petroleum based products which temporarily hold soil materials together, PERMA-ZYME 11X causes the soil to bond during compaction into a dense permanent base which resists water penetration, weathering and wear. This process takes place in 72 hours under ideal conditions.

In addition to creating a new and better way of building and maintaining roads, PERMA-ZYME 11X is being used successfully in construction of take beds, mine leach pads, ponds and earth enclosures for toxic waste containment -wherever there is a need to increase the load-bearing capacity of the soil and to reduce plasticity and permeability.

PERMA-ZYME 11 X IS VERSATILE!

- PERMA-ZYME 11X is used to stabilize roads inside the deepest mines to the highest mountains.
- PERMA-ZYME 11X is used to seal ponds for everything from pure spring water to toxic waste.
- PERMA-ZYME 11X is used from the frozen north to the hot south with wet or dry climate.

PERMA-ZYME 11 X IS ENVIRONMENTALLY SAFE!

- **PERMA-ZYME 11 X** will not harm humans, animals, fish or vegetation and is **biodegradable.**

PERMA-ZYME 11 X'S ADVANTAGES

Increases Soil Density

PERMA-ZYME 11X lowers the surface tension of water which promotes fast and thorough penetration and dispersal of moisture. This action causes hydrated clay particles to be pressed into and to fill the voids throughout the soil, thus forming a tight, dense permanent stratum.

Reduces Compaction Effort

The increased lubricity of soil particles allows the designated soil density to be reached with less compactive effort.

Requires Less Water

PERMA-ZYME 11X reduces, by as much as 25%, the amount of water required to reach the optimum moisture level of the soil because it promotes rapid saturation and inhibits surface evaporation.

Better Load Bearing Capacity

The PERMA-ZYME 11X "cementation" action increases the soil bearing characteristics by promoting a closer binding of soil particles. This reduces the tendency of the soil to expand after compaction and results in a strong stable earth layer.

Lowers Permeability

By achieving greater bonding density, soil materials resist migration of water. A properly treated **PERMA-ZYME 11X** base becomes almost impervious to water penetration and much more resistant to frost heaving.

Eliminates Need For Importing Aggregate

Road builders can now construct a new road base using existing soil materials - without trucking in additional aggregate (if sufficient cohesive fines are present). Mixing **PERMA-ZYME 11X** with the top 5 or 6 inches of soil will produce a road base that has more strength and less permeability than can be attained with any other treatment.

Use Less Expensive Dirty Aggregate

If new material is needed, less expensive, dirty aggregate is a requirement. The dirty fines are needed to bond the material together. Dirty meaning 15 to 20% cohesive fines passing a 200 screen.

Weather and Locale Compatible

PERMA-ZYME 11X can be applied over a wide weather and locale range. From near freezing to hot summer, from rainy climate to dry desert, from lake bottom to earthen dam, from mountain top to deepest mine.

Reduces Labor And Maintenance

New or existing roads treated with **PERMA-ZYME 11 X** to the recommended depth will retain a tough, ruptureresistant surface that requires minimal maintenance, often requiring no additional "dressing" for a number of years.

Easy To Store

PERMA-ZYME 11X is sold in liquid concentrate form. This eliminates the bulk storage, pre-mixing and handling of large amounts of materials. It will not corrode equipment.

Safe Handling

PERMA-ZYME 11X is non-toxic. It requires no special handling equipment and no special containment procedures as required with toxic and/or corrosive agents. It does not irritate skin tissue and causes no rash or bum.

Non-Flammable

PERMA-ZYME 11X contains no combustible materials, is non-explosive and can be used near open flame. It is non-gaseous and can be stored in poorly ventilated areas.

Environmentally Safe

PERMA-ZYME 11X will not harm humans, animals, fish or vegetation under normal use and is biodegradable.

Only <u>three</u> 5-gallon drums of

PERMA-ZYME 11X

needed to treat one mile

25 feet wide, 6 inches deep

Remember, there is only one PERMA-ZYME 11X

- Proven Soil Stabilization for over 20 Years! –

PERMA-ZYME 11X IS EASY TO APPLY

ROAD BUILDING

PERMA-ZYME 11X is easy to apply and requires no special equipment or application procedures. It can be used with recycle machines or applied with regular road building machines. **PERMA-ZYME** 11X should be used with soils that contain approximately 20% cohesive fines. It is mixed with water used for compaction during normal road building techniques. A typical application to stabilize a 6-inch existing or new road base is given below.

1. If the existing road bed is too hard to blade, scarify to the required depth. Usually do this dry for better traction.

2. Add 1 gallon of **PERMA-ZYME** 11X concentrate to the required amount of water needed to bring 165 cubic yards of material up to optimum moisture. The amount of water-needed **will** depend on how wet or dry your material is. A general starting rule for dry material is 1 gallon to 1,000 gallons water. With top loading water tanks - **always** fill tank with water first, then add **PERMA-ZYME** 11 X. Failure to do this **will** result in a tank full of foam.

3. Spray **PERMA-ZYME** 11X water solution over road surface and start blade mixing. Continue adding **PERMA-ZYME** 11 X and water while mixing until required amount of **PERMA-ZYME** 11 X is distributed evenly throughout the material. During this time you should learn if **PERMA-ZYME 11X** to water ratio should be changed. 15 gallons **PERMA-ZYME 11X** will treat 1 mile 25 feet wide, 6 inches deep.

If you misjudge the water and get it too wet, blade to dry. If too dry, add plain water. After thoroughly mixing, leave the soil material in a windrow overnight to promote total moisture absorption. We recommend this whenever possible for better compaction results with less effort.

4. If the road base is dry the next morning, or after material is thoroughly mixed and ready to lay, spray the surface with a **PERMA-ZYME** 11X water mixture of 1 gallon to 10,000. (Approximately 1 pint to 1,200 gallon) before you pull it out of the windrow. Always start to lay material on a damp floor. Pull material out and lay in 2 or 3 inch lifts and start compaction immediately. In sub-base fill, or pond areas, a sheepsfoot works fine, but usually a steel or pneumatic works best for finished roads. Continue compacting while you shape and dress the surface with a blade. Be sure to crown the surface to promote water drainage.

Even while laying and compacting, if your material dries too fast on a hot day, a light mist of **PERMA-ZYME 11X treated** water (1 - 10,000 gallon) can be applied. Continue to compact until desired density is reached. Vibratory rollers may be used, but turn the vibrator off when finishing so that no fracturing occurs. The road is now ready for use.

If you foresee heavy, high-speed traffic, involving spinning or skidding wheels, you might consider closing the road until material has had a chance to cure 2 or 3 days. Normal traffic **will** not harm it.

5. If an asphalt or other permanent wearing surface is to be added, a better bond can be obtained by moistening the surface with a spray of **PERMA-ZYME** 11X and water solution (1- 10,000 gallon). This permanent surface can be applied any time after a 3 to 5 day curing period under ideal weather conditions.

FOR SEALING LAKES & PONDS

New Pond Construction

Add **PERMA-ZYME** 11X to water used to compact soils containing approximately 25 - 30% cohesive, colloidal fines (200 mesh). Blade or disc the soil to blend in the **PERMA-ZYME 11 X** and water, grade and shape, then compact at optimum moisture using a compactor, tractor or truck. Generally the top 10 - 12 inches is treated for most ponds.

Existing Ponds

When pond is filled with water and less than 8 feet in depth, use one gallon of **PERMA-ZYME** 11X for every 6,000 square feet of surface area (or 8 gallon per surface acre). Pour **PERMA-ZYME** 11X into the water from windward side and around perimeter, or across the surface if a boat or pump can be used. Stir up silt from the bottom of the pond any way possible dragging chains sometimes works. Fines placed into suspension together with **PERMA-ZYME 11X** will then migrate to seepage areas. Do not add water for 3 days. **PERMA-ZYME** 11X disperses clay and colloidal materials into the voids between each grain of soil and causes a catalytic bonding process, creating a strong, tightly compacted stratum that resists water penetration.

Success with this method will depend on the soil composition of your pond. If loss by seepage does not stop within 10 to 14 days, you can let the pond dry and re-treat using new pond construction method, or consult your dealer for other options.

PERMA-ZYME 11X will not harm fish life if used properly.

PERMA-ZYME 11X is effective in sealing soils in ponds **when at least** 25% of the material contains fines that will pass a 200 screen. The fines should be cohesive clays.

OTHER ENZYMES AVAILABLE FOR
Odor Control - Sewage - Waste Water Treatment - Agricultural Use

CAMINOS

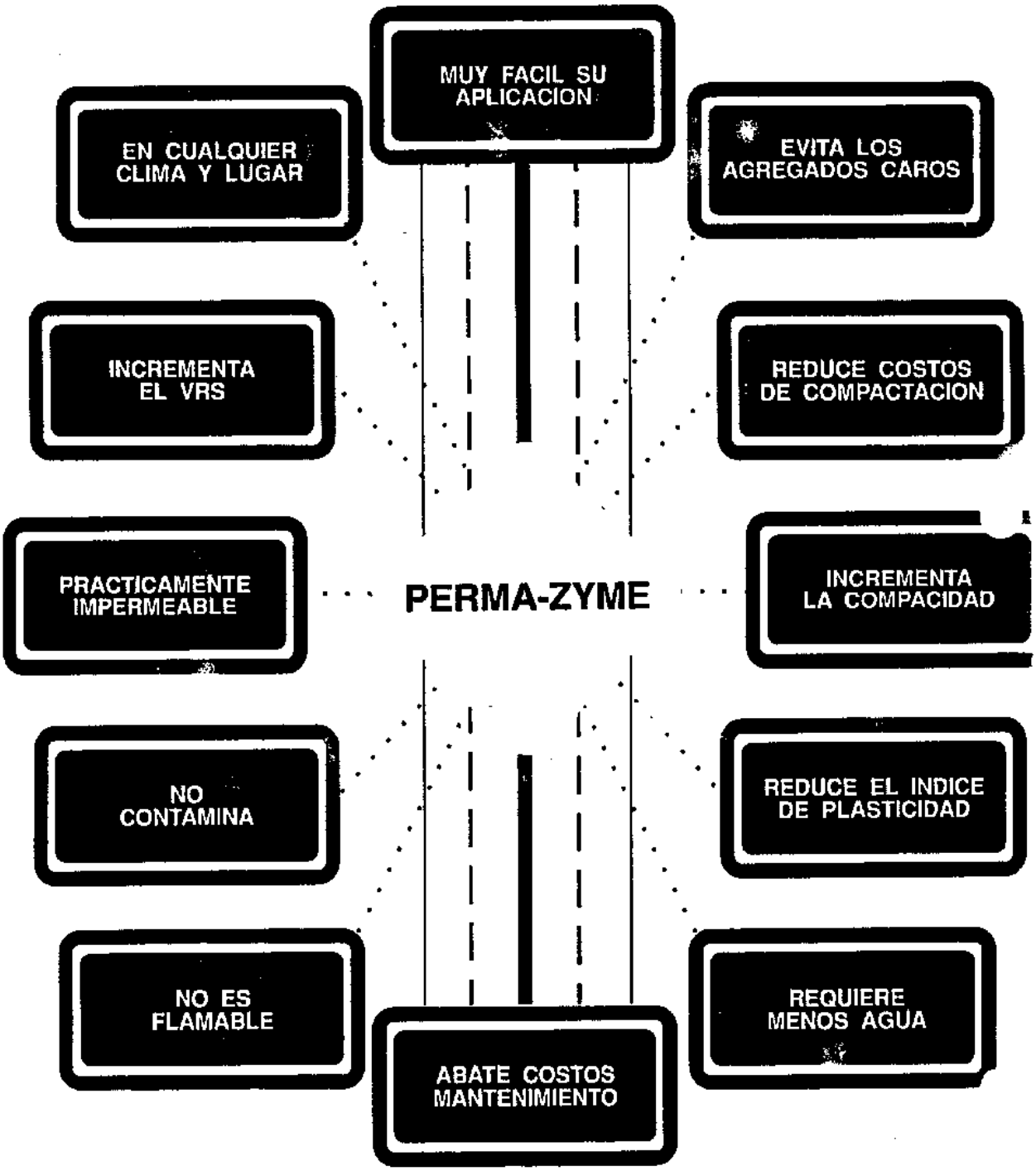
TAN FACIL COMO....

PERMA-ZYME

BASES FUERTES

CAMINOS FUERTES
CAMINOS DURADEROS
CAMINOS RESISTENTES
CAMINOS PERMANENTES

EN EL MANTENIMIENTO Y CONSTRUCCION DE CAMINOS



ES LA SOLUTION

VENTAJAS PERMA-ZYME

PZ MUY FACIL APLICACION

No requiere de ningún tratamiento especial al usarlo y es muy fácil de aplicar. Simplemente se añade a razón de un litro por cada 30 metros cúbicos de material, al agua necesaria para obtener la humedad óptima para compactar.

PZ ABATE COSTOS DE MANTENIMIENTO

Nuevas o ya existentes terracerías tratadas con PZ al espesor recomendado, mantendrán una fuerte y altamente resistente superficie que requerirá de un mínimo mantenimiento y a menudo ni siquiera de un sellado adicional por más de tres años.

PZ EVITA LOS AGREGADOS CAROS

Los constructores de carreteras pueden ahora construir una nueva base usando el material existente sin necesidad de acarrear agregados adicionales (siempre que existan suficientes materiales finos orgánicos presentes). Mezclando PZ en la superficie a tratar a unos 15 o 20 cms de profundidad se obtendrá una base con más resistencia y menos permeabilidad que cualquiera que se pueda obtener por otro medio.

PZ EN CUALQUIER CLIMA Y LUGAR

Puede ser usado en cualquier rango de temperatura. Desde el punto de congelamiento al más caliente verano, desde lo más lluvioso al más seco desierto, desde el fondo de un lago a la cortina de una presa, desde lo alto de una montaña hasta la más profunda mina.

PZ REDUCE GASTOS DE COMPACTACION

Al incrementar la lubricación de las partículas se alcanza con menos esfuerzo la compactación de diseño. El equipo de compactación deberá de ser el apropiado según el tipo de terreno que se esté trabajando, pero de no ser así PERMA-ZYME de todas maneras actuará dejando una compactación, muy por encima de la que normalmente se obtiene y con menos "pasadas" de la máquina.

PZ INCREMENTA EL VRS (Valor relativo soporte)

La acción de cementación de PZ incrementó las características de compacidad de terreno logrando una unión más compacta de las partículas. Esto reduce la tendencia expansiva del terreno después de la compactación, dejando una carpeta fuerte y estable.

PZ PRACTICAMENTE IMPERMEABLE

La unión cerrada de las partículas inorgánicas del material compactado evita la transmigración de el agua. Una base que ha sido tratada apropiadamente con PZ se vuelve prácticamente impermeable.

PZ REDUCE EL INDICE DE PLASTICIDAD

Abate la tensión superficial del agua lo que significa una más fácil penetración y dispersión de la humedad. Esta acción causa una hidratación de las partículas orgánicas las cuales son comprimidas dentro de los espacios vacíos, formando un altamente denso y permanente estrato.

PZ NO CONTAMINA

No es tóxico. No requiere de equipo de manejo o procedimientos especiales. No irrita la piel o los ojos y no causa salpullido o quemaduras. No es dañino a los seres humanos, animales, peces o vegetales y es biodegradable.

PZ REQUIERE MENOS AGUA

Reduce hasta en un 25% la cantidad de agua necesaria para alcanzar la húmedad óptima, porque promueve la rápida saturación e inhibe la evaporación superficial.

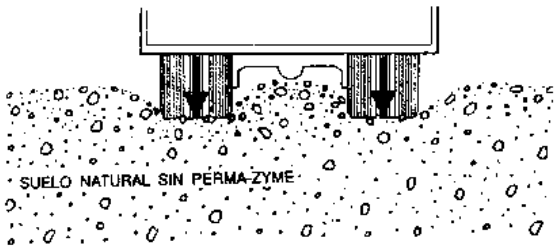
PZ NO ES FLAMABLE

No contiene materiales combustibles, no es explosivo y puede ser usado junto al fuego. No emite gases por lo que puede ser almacenado en lugares poco ventilados.

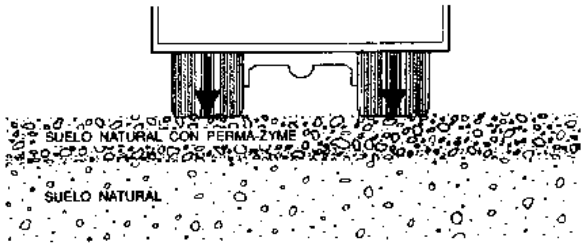
MODO DE APLICACION

Se recomienda escarificar a 15 cm de profundidad y mezclar la solución mencionada lo más equitativamente posible, haciendo hincapié que la dosificación es con respecto al material y no con respecto al agua, pues esta sólo es el medio para aplicar el producto y en el caso de que después de aplicar la solución, hiciera falta más humedad se deberá aplicar más agua ya sin producto. Si por el contrario se hubiera obtenido una humedad por encima de lo requerido para compactar, sólo deberá dejarse orear hasta obtener la óptima y entonces aplicar el equipo de compactación. Como comentario adicional a este respecto les mencionamos que hemos aplicado la misma dosicificación con 10,000 litros de agua así como con sólo 1,000 litros, dependiendo de las condiciones de humedad existentes en el material. El equipo de compactación debeá de ser el apropiado según el tipo de terreno que se este trabajando, pero de no ser así PERMA-ZYME de todas maneras actuará dejando una compactación, muy por encima de la que normalmente se obtiene y con menos "pasadas" de la máquina.

PERMA-ZYME se recomienda, para ser usado sobre el terreno tal como se encuentra, pues en todos los casos incrementará grandemente las características de compacidad del mismo. Sin embargo, como sabemos que actúa sobre las partículas orgánicas que pasan la malla 200, (se requiere de un mínimo del 20% de material fino) se deberá buscar el mejorar las condiciones granulométricas hasta donde económicamente se permita, ya que es claro que mientras mejores condiciones tenga el terreno, mejores serán los resultados.



ANTES (SIN PZ)



DESPUES (CON PZ)

Emery County Road Department

P.O. Box 889
Castle Dale, Utah 84513

Phone (801) 381-5450 or 381-2550
Fax (801) 381-5239

November 5, 1993

Mr. Y. Y. Chan
2717 Sunset Blvd.
Los Angeles, CA 90026

Dear Mr. Chan;

I hope that you enjoyed your short visit to Emery County. We were pleased to show you some of the PermaZyme roads conveniently located near our headquarters. I felt that it would be important to show you PermaZyme roads having no seal or asphalt top surfaces. This of course allows you to observe roads actually having the treatment but which receive very infrequent grader maintenance. In each instance you observed roads which had not been bladed for months. Our records of course support our argument for using PermaZyme. As mentioned during our tour of the Ferron Canyon road, after 7 years of normal activity we should have expected to have had to regravel this roadway two additional times, had we not used PermaZyme. This road had required usual blading about every 2-3 weeks and now is bladed perhaps four times each year which is significant. Incidentally the Ferron Canyon road was our first attempt at using PermaZyme and obviously still seeing the original gravel in place and the stability of the roadway has been encouraging to us not to mention cost effective for Emery County.

I mentioned records keeping earlier and this is an important issue to focus on for a moment. It is human nature to forget important things after a relatively short period of time so records are valuable. for reference. There have. been. comments from PermaZyme users in other areas indicating that the dirt roads were still slick, though improved, when wet. They observed that vehicle tires still left tracks perhaps 1/2-1" deep in the roadway. I asked them what was the condition of the roadway before the use of PermaZyme? They would often comment that the roads were impassable or very difficult to drive on with numerous occasions when vehicles had to be pulled out of the mud by 4-wheel drive trucks or tractors. I would then ask isn't that a significant difference using PermaZyme? They of course agreed that there was a very notable benefit using PermaZyme. Again I emphasize the importance of keeping good records simply because people often forget past experiences.

There is another point that comes to mind and that is PermaZyme does not turn a dirt or gravel road into concrete. This seems to be everyone's expectation at first use. It does not turn the roads into concrete however our observations have been that it does bind the materials in mass creating greater stability and load bearing quality to our roadways. You can still expect gravel to work loose on the surface, which is usual, but in our region the roads retain their structural integrity.

Another thought that most user have is does PermaZyme prevent water from soaking into the roadway? -Again our-observations have been that because PermaZyme tightens soils (if properly compacted) water penetration is reduced. Some have asked if we recommend PermaZyme where ground water is close to the surface? I would say no unless you observe the fundamentals of good road building first. You must provide drainage to conduct the waters away from the roadway. We use many culverts and take the extra steps necessary to channel the waters away from the road. In areas where subsurface waters prevail we construct that portion of the road with heavy aggregate before laying the PermaZyme treated road base on the surface.

Often in our industry it is necessary to create "French drains" under the roadway by depositing heavy rock underneath in order to allow the water to pass through while preserving the strength of the road structure above. These features are best determined by an engineer however I am sure in your provinces there are many ancient roads where your ancestors filled the swamp areas with rock where roadways crossed before placing the dirt surface on top of the road. The basics of road budding makes allowance for past experience and science; we should learn from former mistakes.

Several years ago Emery County had serious road-problems. Our 1100 miles of road network represented primarily 900 miles of native soils that required very frequent maintenance activity because of increased recreational visitors and general _population increases. Our budget would not allow for extra employees or equipment. I learned of PermaZyme through a very knowledgeable road supervisor from Jerome, Idaho. He told me of his successful use of PermaZyme and invited me to visit his district to see for myself. I did so and was so impressed that I purchased PermaZyme that year. In two years we were enabled to eliminate one district motor grader station and use that man in the other areas where we were not permitted to hire additional employees. This reduced the size of our necessary equipment fleet by one motor grader! PermaZyme is a very cost effective program for Emery County. During your visit I indicated that the local engineers were so impressed with our successes with PermaZyme that they have specified its use in the Emery County Service District #1 road projects.

I understand that a video has been released abroad that has an interview with myself regarding our use of PermaZyme. I stated that it is a poor road supervisor who cannot find a little money to try PermaZyme on a test strip of road for personal observations. This product has worked very well in our region in various soils. I am confident that it will work well in many regions if properly applied.

You had asked if I would contact our local road contractor regarding his sending a crew of workers to China to build 10 miles of roadway with PermaZyme. I called Mr. Wayne Nielson of Nielson Construction Company (801-687-2494) and conveyed your message and he said that he would contact you. I hope that he does.

You also asked what type of equipment that we recommend to mix and lay PermaZyme. The answer is relative to how much you wish to accomplish each day and that of course includes availability of resources providing manpower, equipment and materials. On our limited budget we use 3-20 cubic yard bottom dump truck/trailers, 2 motor graders (model 140G Caterpillar), 1-12 ton rubber tire roller, 1-14 ton tandem steel drum vibratory roller; one or two 5000 gallon water truck/trailer(s) as needed. Naturally you would need a water pump to load the water trailer or truck. The PermaZyme is added to the water and dispensed into the road materials being mixed by the graders then piled up in a windrow for the night to be laid down and compacted the following morning. This size of our work force allows us to lay about one mile of PermaZyme per day. You will want the materials to be ready the day before you mix the PermaZyme, that way there will be no unnecessary delays waiting for delivery of the dirt and gravel. This also keeps the truck crew busy and ahead of the mixing and lay down crews.

Again we allow the PermaZyme treated base materials to sit overnight in the windrow which allows the PermaZyme to thoroughly penetrate the base materials before lay down and compaction. For a normal roadway we plan to lay 6" of PermaZyme treated base material. After mixing, the graders then pull the treated materials out of the windrow (situated on the road shoulder) and onto the roadway. We do this in several passes pulling out and laying 1-11/2" of thickness each pass with a grader. As the grader lays the material the rubber tire and vibratory rollers compact the materials.

On the very final layer the steel drum roller finishes compaction and the vibrator feature is not used. We typically continue to lightly moisten and roll the top surface for 2-3 additional hours as needed or until there is a sealed "concrete looking" appearance then we are finished. The road should then be allowed to dry 72 hours even though traffic can use the roadway immediately after the PermaZyme is laid. The field formula remains 1 gallon of PermaZyme solution to 15 cubic yards of dirt materials.

Remember that optimum moisture must be maintained at all times. You do not want the materials too wet or too dry. As mentioned engineering supervision is very beneficial. In the field if the PermaZyme has been properly mixed into the materials at the rate of 1 gallon per 15 cubic yards of material and the material is still too dry you can add straight

material to optimum moisture. When we lay the material the following day (after the PermaZyme materials have been windrowed the night before) we often moisten the roadway moderately before laying the mixture down and compacting. We moistened the road using a solution of a gallon PermaZyme to 1000 gallons of water.
1 gallon PermaZyme mixed in 1000 gallons of water as wetting agent to bring the

I hope this information is helpful for you. I cannot speak regarding use of PermaZyme in your region I simply advise that you do a portion of road and make your observations before a large project. As stated PermaZyme is a very good product for Emery County and has saved us thousands of dollars in maintenance and materials costs.

If I can provide further information I will be glad to do so. I apologize for being late in writing to you we are quite involved in our 1994 budget processes.

Sincerely,

Rex Funk,
Road Supervisor

Vanderbilt Gold Corporation
3301 West Spring Mountain Road, Suite 13
Las Vegas, Nevada 89102
702-362-3152

April 21, 1987

Re: Perma-Zyme treated Heap Leach Pad

Dear Mr. Battistoni,

Enclosed you will find three test reports which were prepared in conjunction with the construction of our 11 acre Heap Leach Pad and 'Pregnant Ponds' used at the Morning Star Mine (Cactus Hill Project managed by Heavy Metals Development Corp.).

We looked at the feasibility of using existing soil, adding Clay and possible use of bentonite. All test work was done using Perma-Zyme, which was used in the construction of the Pad. We decided to use only alluvial soil in place plus a blend of local clay. After constructing the pad a test was performed on core samples of the finished pad. Results of the permeability test showed permeability in the range of 6 x 10 -6 which was in excess of design requirements.

The finished pad will hold approx 1.5 million tons of processed gold bearing rock which will be treated with Cyanide solution. The pad has HDPE liners over the Perma-Zyme treated soil to facilitate collection of gold bearing solution.

It was noted during construction that the soil was easier to compact and work. Densities were easily achieved.

We were very pleased with the results that Perma-Zyme made possible. We have included a picture of the Morning Star Mine showing the Pad which was on the cover of a recent issue of the California Mining journal.

Thank you for your able assistance.

Best Regards,

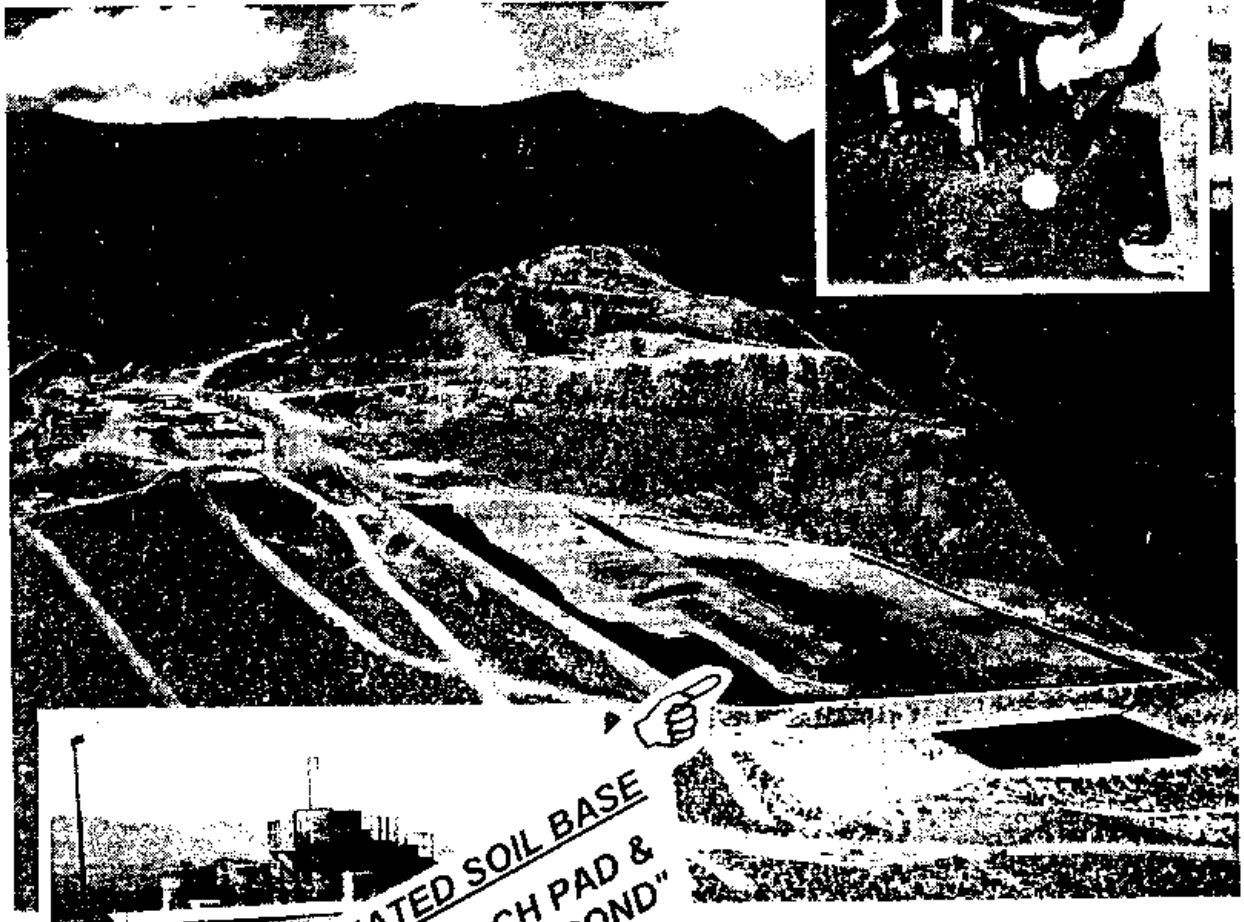
John F. Jordan
President

California
MINING JOURNAL
MINING AROUND THE WORLD!
The West's Leading Domestic Mining Publication
Volume 56, Number 7 MARCH 1987 $1.60/Canada $2.50

Vanderbilt's Morning Star Mine

San Bernardino, California

Story Page 4



PERMA-ZYME TREATED SOIL BASE
11 ACRE HEAP LEACH PAD &
2 MILLION GALLON "PREG POND"

Upper right: Gold and silver dore being poured.

Lower left: Carbon absorption, desorption and electrowinning plant.

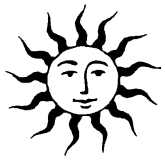
DOT&PF M&O NEWSLETTER

Volume 3

Fall, 1994

PERMA-ZYME - A NEW APPROACH TO ROAD STABILIZATION

By Boyd J. Brownfield, P.E.
Director, Central Region M & 0
Anchorage, Alaska



Picture this! It's spring, the subbase goo (pronounced "elephant dung") is boiling and oozing up through your gravel roads. They are all but impassable. The phone is ringing off the hook with some of the state's finest critics having relatively unkind things to say about your roads, your employees, your wife, kids and ancestors and there's absolutely nothing that can be done about it. Sound familiar? - Like the spring of '94?

ENTER - a new product called **PERMA-ZYME.** This stuff is supposed to stabilize some of the worst roads. It solidifies the very materials that you and I have been taught never to leave in a road bed; that elephant dung we traditionally find oozing out of our roads each spring making forward motion of any motor vehicle all but impossible.

Earlier this year I was asked by my boss, John Horn, to look into this product to see if it had any application in Alaska. That we did and found some pretty impressive results.

PERMA-ZYME is a liquid product which, when mixed with certain types of earth materials, alters the properties of these materials to produce a solid, almost rock-hard material. It actually fuses them together to creates a very dense and permanent base which resists water penetration, weathering and wear. AND, the process is no more difficult than watering,

ing/regrading and compacting the road bed as we now do to our non-paved roads each summer. There is, of course, one important exception. Under the present mode, the fruit of our labors generally lasts about two weeks, unless, of course, it rains, then we can count in terms of days. PERMA-ZYME on the other hand, if applied correctly, lasts for years.

Sister States and County Road Commissions have had some of their roads last up to 7-8 years at which time they ended up paving or chip sealing right over the existing road bed. I personally researched this product and talked at some length with DOT and County Road Officials from Pennsylvania, Idaho and Nevada. Without exception, they all rave about this product and have used it from four to about ten years.

Does all this sound too good to be true?? WELL, it is and it isn't.

Let's take the "It is too good to be true" first. PERMAZYME isn't the answer to every unstable road bed. It will not work on all kinds of soils in every instance. A road bed composed of purely silt, sand and gravel with no organic material, clay or cohesive materials characteristics will not react with this product. If your soil does not have any ability, when wetted, to stick together, it probably will not work with PERMA-ZYME. In fact, as a quick test, take a handful of your soil, wet it to an estimated optimum water content and try to make a ball out of it. If it sluff s off and falls apart, forget PERMA-ZYME. **It's too good to be true.**

Now let's take the latter. Since there are several points to be made in favor of PERMA-ZYME, I will number them.

much like a snow ball - and you get compaction and cohesiveness, chances are the soil will respond to PERMA-ZYME. PERMA-ZYME works best in soils having 18% to 30% **passing the #200** sieve. THAT'S

RIGHT, 30% passing the #200 - that's the soil you and I were taught to dread and get rid of at all costs; the soil that principally causes the ugly breakups we (and the rest of the world) have each spring. It will work with less passing this sieve; these percents render optimum results. Now for a "kicker." If your soil falls into the "Too-Good-To-Be-True" category, go find some elephant dung and mix it. Proof! - it changes categories.

(2) **ROAD BUILDING:** PERMA-ZYME is easy to apply and requires no special equipment or application procedures. It can be mixed with a recycle machine right on the job site when sufficient "cohesive" fines are present or combined with appropriate imported fines when not present. The process requires a road grader for mixing, spreading and crowning, a water truck to dispense the mixture and a roller (wobbly wheel, vibrating steel drum, sheepsfoot, etc.) to compact the new surface.

A typical operation would include:

Blading the existing bed to a depth of 4-5 inches and windrow loose material. Unless the road lacks sufficient material or is of the wrong consistency, there is no need to bring more in. Remember, the soil must be of the "elephant dung" quality.

Adding PERMA-ZYME to a tanker of water. The PERMA-ZYME comes in 5 gallon drums. It takes three drums to treat one mile of road, 25 feet wide, *6* inches deep.

Spray both the bladed surface and windrow to obtain optimum moisture content. Blend the PERMA-ZYME mixture well into the soil with a blade or pulverizer. While it is not necessary, it is desirable to leave the mixture in a windrow along the side of the road overnight. This allows the PERMA-ZYME to be thoroughly blended.

Spread the windrows over the roadbed and blade the road to a final crown. Compact with a sheepsfoot, pneumatic or other type compactor during the process. If the mixture gets too dry on a hot day during the process, apply a light mist of PERMA-ZYME/water (ratio of .1 to 1,000) over the road. If a vibrator roller is used, use the vibrator only for the first and second pass. After that, turn it off so that fracturing will not occur. And there you have it. The road is ready for action using simple straightforward common road building procedures.

(3) ENVIRONMENTAL IMPACTS: You can drink (although there are better products on the market to quench one's thirst). You can feed it to your kids, animals, fish or vegetation and it will harm no one. It's biodegradable.

Now all this may sound too good to be true, but it ISN'T. It is true!

We in the Central Region have already used it on several roads throughout our region. So far the roads treated are extremely hard and stable. Even those stretches on which we didn't do a particularly good job of application. We are also applying it to a local gravel air strip. The real test, of course, will come next spring. I am both hopeful and confident and will pass on results in the appropriate future newsletter.

Should it prove successful, it will not only free precious manpower for other needed maintenance but I believe it will revolutionize the way we deal with the gravel roads as well as road beds for our major highways, slope stabilization and a host of other applications. If it doesn't work - well - I'M *LEAVING DODGE!*

Feel free to call me at *(907) 266-1735* if you have any questions.

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Jerome Highway District tests successful enzyme product for road base stabilization

Jerome County has a large influx of dairies the past 15 years. This has thrown an extra burden on our county road system due to the increase in traffic. Our old price coat asphalt roads just would not support this traffic load. We spent all our time patching holes and breaks. We tried other types of asphalt surfaces, double chip seal coats and two inch mats, but were still having problems with base failure.

In the fall of 1982, we tried PERMA-ZYME Enzyme (supplied by Idaho Enzyme, Inc., Jerome) on a 1/2 mile test section of gravel road for dust control. This test was not entirely successful for controlling 100% of the dust and we were not very satisfied. We did notice the road stayed quite stable and smooth, except for a short section by the "Stop" sign which had some rutting left from the application process.

In the spring of 1983, while blading gravel roads, one of our grader men pulled onto the rutted section of the 1/2 mile test section, dropped his blade and got sparks and smoke. He got out and found the road base so hard and dry he could not cut it with the blade. It was so hard I could not drive a crowbar into the surface. Right then we realized we had something far more important than dust control; base stabilization. We left this 1/2 mile section in gravel to observe it, and treated another three miles and put a double chip seal asphalt coat on top of the PERMAZYME base. This road is still free of any breaks, potholes, cracks or frost damage eight years later.

In the spring of 1985, one section of this road was under water for a period of 21 days with traffic running through it. **The treated base did not soften or fail, and today, six** years after the flooding, no damage is apparent. We were so pleased with the performance of the treated base, we have put it down on 40 miles of new asphalt surfaced roads, using mostly the more economically double chip seal surface and several miles of two inch cold mat surface. We have had virtually no patch or repair work on any of these roads, except some minor frost damage in the hard winter of 1988. We had some sections of our newest constructed roads lift in the sub-zero weather due to the submoisture from pivot sprinklers spraying the roadway and flooded barrow pits the fall before, but even then most of these sections went back down intact without usual breakup. After leaving our original 1/2 mile test section in gravel for three years, without any grader maintenance, we added some PERMA-ZYME to our water truck, sprayed this enzyme mixture to soften the surface and tight bladed it, compacted it and applied a double chip seal asphalt surface. Even then we left a 200 foot section unpaved until this last fall. After eight years, this treated section was still so hard and smooth we couldn't cut it with a blade. We covered it with a double chip seal coat when we continued to oil the rest of the mile section. As you drive over this mile road, you can't tell any difference in the old or new section, except by appearance of surface oil color.

Every year we try to add five or six miles of new asphalt road in our district. We take an old gravel road, blade up the barrow pits, shape and crown it, and treat three inches of this existing material with PERMAZYME. Then in the fall of the year, or at our convenience, we haul another three inches of crushed, dirty gravel, (dirty **meaning at least 15 to 20% passing a 200 screen), smooth it out and leave it untreated for the traffic to** drive on, usually **over the winter months.** We have waited as long as two years, before placing the asphalt, but our usual procedure is to follow up the next summer by adding water and PERMA-ZYME to the top three inch lift, mixing and compacting and covering it with the double chip seal. Either emulsion or cut back asphalt works, but in our county I always used .5 gallon of MC 800 per square yard with 3/4 inch of 3/4 minus clean gravel. This was followed with .4 gallon of MC 3000 per square yard and 1/2 inch of 112 inch chips. We drag a non-rotating broom over the surface between layers to smooth the 3/4 gravel before shooting the MC 3000. This removes any roughness caused by the chip spreader, trucks and roller.

We use PERMA-ZYME to stabilize road shoulders, if we plan an overlay on existing narrow asphalt roads. We have a lot of 20 foot wide asphalt roads in need of repair. We treat four foot of shoulder on each side of the oil with PERMA-ZYME, compact it, and then overlay the existing 20 foot roadway with reclaimed asphalt two inches deep and 24 feet wide. The stabilized shoulder not only holds up the new asphalt shoulder, but stops moisture from migrating under the existing roadway.

The PERMA-ZYME treatment is very economical. It is also very easy to use; the only extra labor or effort required is to pour or pump it into your water truck. It is totally non-toxic, requires no protective gear for the men, is environmentally safe, and will not damage or corrode equipment.

If you have any questions about our program, you can call me at Jerome, (208) 324-8303, or the new Jerome County Road Supervisor, LeRoy Lewis, at (208) 324-4601.

-Clarence Miller
Jerome Highway District Supervisor
(retired)

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Idaho Technology Transfer Center
Box 7129 - Boise, Idaho 83707-1129

WAGONWHEEL EXPRESS
Volume II, Issue 2 Spring 1991