

FAQ

What is TerraZyme? TerraZyme liquid stabilizer is specifically formulated to modify the engineering properties of soil and aggregate mixtures by catalyzing natural chemical reactions in the soil, converting poor materials into more water and load resistant forms to improve the structural properties of cohesive soils.

TerraZyme is a bioenzyme concentrate made from the fermentation of plant-based organic matter. The catalytic enzymes in TerraZyme are natural protein molecules that speed up chemical reactions. These catalysts accelerate changes in the road materials to form new chemical and physical structures. Many materials change their forms over long periods of time, but transformations that would have taken years to accomplish can be completed within very short periods when the appropriate catalytic enzymes are added under the right conditions.

Is TerraZyme safe? TerraZyme is non-toxic, harmless to humans, animals, marine life, and the environment. It is non-irritating, non-flammable, and non-corrosive. TerraZyme contains no combustible or corrosive materials, and can be safely used near open flame or in poorly ventilated areas. It contains no bacteria nor known allergens. TerraZyme has been tested safe by both independent and government scientific agencies.

Technically speaking? TerraZyme is perfectly soluble in water, dark in color and smells of molasses. Its specific weight is similar to that of water and the pH level is between 4.3 and 4.6. It has a characteristic odor. As TerraZyme is a concentrate gloves and masks are good general practice during handling. TerraZyme is best stored at a temperature below 55 C and above freezing.

What tests are required on the soils in order to see if TerraZyme is a good fit? Soil analysis classified according to AASHTO Soil Classification System (grain size distribution, Atterburg limits, moisture density relations, California Bearing Ratio, organic content) is all key information to project success. It is also helpful to know the lab's opinion on percent swell (shrinkage on drying). Most labs should be able to give instructions on the best way to take samples or will send a technician to do it themselves. Digital photos and descriptions of the problem sections in the road are very useful and will help NPI to give specific recommendations on product usage for specific projects.

When correctly applied to cohesive soils, beneficial changes happen: the liquid limit is reduced, the plasticity index diminishes, optimum moisture content (OMC) is reduced as maximum density increases, when the CBR test is applied after curing to TZ treated soil, an increase in the support capacity is observed and the expansion measured in this test is notably diminished, permeability is greatly reduced and the workability of the soil is improved.

If we plan to use asphalt anyway, why add an extra step and cost of adding TerraZyme in the road base? Very simply, the surface only lasts as long as its support structure. A stronger, stiffer base structure greatly reduces movement under traffic loading. Less movement means less surface cracking or rutting from load transfer into the subgrade, and reduced water infiltration and resulting freeze-thaw damage. This results in less cost in maintaining road surfaces in optimum condition over an extended life. Stabilizing the road base and sub base protects your expensive surface materials, insures that road project dollars are not wasted, and establishes a higher quality of infrastructure to support desired growth in developing areas.

Is there any negative effect when enzymes are mixed with any other organic material?

In general, organic material is not good for road structures. It prevents good compaction and opens pathways for water penetration into the road structure and underlying subgrade as it degrades. Additionally, most organic materials tend to swell with wetting and shrink with drying. This movement is disruptive to soil structures and the densities achieved during compaction, with the effect of increasing the porosity of the structure. As water infiltration is a damaging influence on soil structures in warm and cold climates, most road specifications limit allowable organic content to less than 2% or 3%.

Is TerraZyme ready to use? TerraZyme is a concentrate that requires dilution in water for proper application rates and to achieve uniform dispersion and mixing with the particles of soil being treated. The concentrate dosage varies from 1 liter for 25 cubic meters of soil to 1 liter for 33 cubic meters of soil, depending on the soil type and plastic characteristics. Project recommendations are made by NPI based on local soil analysis results.

Water requirements are determined separately from the concentrate dosage. Measurements are made in the field on the day of application to determine how much water is needed to bring the actual field soil (natural) moisture content up to the optimum moisture content (OMC) needed for maximum compaction. In cases where the soil material contains high amounts of fines or higher plasticity, the TerraZyme treated water to be added is kept 1 to 2 points below OMC level to account for the change in working characteristics caused by TerraZyme.

Application consists of adding the required amount of concentrate to enough water to bring the road section to within 1-2 points below OMC. An adequate rule of thumb for projects with no tested moisture levels is 1 liter of TerraZyme Concentrate added to each 1,000 liters of water with at least 1% liquid (measured by weight of soil) added to the treated material.

For example: 1 liter of TerraZyme Concentrate will treat about 30 cubic meters of soil. Most road treatments at 15-20 cm depth. So for a road that is 5 meters wide, and treated to a depth of 20 cm, each meter length is 1 cubic meter of soil and one liter should treat about 30 meters in length. If the soil weight is 1200 kgs per cubic meter, the minimum water required (1% by weight) will be 12 kgs (liters) per cubic meter of soil treated, so the 30 meter length would require a minimum of 360 liters of water and one liter of TerraZyme concentrate. If the water truck holds 1,000 liters of liquid, one tank full of water with 2.8 liters of TerraZyme can treat 83.3 meters length (by 5 meters wide by 20cm thick). A 5,000 liter truck would be filled with 13.9 liters of TerraZyme concentrate and 5,000 liters of water and would treat a 416 meter length of road that is 5 meters wide and 20cm thick. In drier climates, much more water than 1% may be needed to approach OMC for compaction.

Does TerraZyme serve the purpose of acting as a supplement on a conventional road meaning that there will be the cost of constructing a regular road relative of the course to the axle load it can take and TerraZyme acts as an additive to make it more durable. Or will TerraZyme enable the cost of a project to be greatly reduced by minimizing the need for soil amendments?

TerraZyme serves to increase the strength and compaction of treated roads. It also serves to alter the properties of the soil components of the road structure. These changes give the option of increasing the utility or capacity of the road structure to handle more or heavier traffic, or can be used as an alternative to more expensive upgrades that involve new or replacement layers with expensive materials, or the two approaches can be combined to upgrade a road to a needed level using a combination of TZ with a reduced quantity of new materials for lower costs and better performance. If milling equipment is used to rehabilitate an old asphalt road, both time and hauling costs are greatly reduced. In gravel road stabilization, there is a cost to including TZ, but the results are greatly improved and the durability of the road is increased for road materials that fall within specification. In summary it depends on the engineering approach taken as to the focus on cost or performance.

Is a TerraZyme road earthquake proof? TerraZyme is considered flexible system whenever adequate soil moisture is present. This means that if earthquake damage were to occur, water penetration at the crack lines would provide the opportunity for the crack area to reseal under conditions of moisture and traffic or regular compaction. The moisture needed for this is commonly available in most soils during the wetter parts of the year.

What kind of technical expertise should we have available on our project to increase chances of success? The application process is relatively simple and easily learned. It is important to have access to a civil engineer with a general knowledge of soil mechanics and road construction to fully utilize the benefits of TerraZyme under varied traffic and climate and material scenarios or to help convert standard road designs to a stabilized designs. Experienced equipment operators with fully functioning road equipment are the keys to efficient and successful applications. Your chances of a successful project rise dramatically with the level of experience of your engineer and operators.

What kind of equipment is required to apply TerraZyme? Equipment options range from standard ripper/grader road equipment through a range of milling/recycling machines and agricultural tractors and attachments. Some aspects of the process can be accomplished through manual labor with hand tools where employment opportunities are needed. The key to success in all of these scenarios is managing the compaction moisture and density and providing a smooth, crowned surface that will shed rain or snow water without ponding on the drive surface. A road team with standard road construction equipment can easily exceed an output of 3,000 square meters per day. In recycling and stabilizing RAP with an asphalt reclaimer, output can reach 50,000 square meters per day. Projects done with manual mixing and transport of materials will need to plan for much smaller sections or use local experience with the rate of work possible to plan an appropriate length for each day of work.

How is TerraZyme applied? Basic soil stabilization with TerraZyme is accomplished in four steps: loosen soil to be treated, humidify the loosened soil with the correct solution of TerraZyme and water, mix the treated soil uniformly, & compact and shape the treated road layer while it is within one or two points below OMC. Application instructions and training are available.

After compaction, what is the ratio of expansion? TerraZyme stabilization will reduce expansive characteristics of plastic soils, but the rate of reduction depends on both the dosage and the soil characteristics. Soils that are outside of the published specifications for TerraZyme should be reviewed with Nature Plus for recommendation on how to proceed.

Will extreme weather affect the road (hot or cold)? TerraZyme is only sensitive to weather during application and curing. Application should be done only when temperatures are at least 5-10 degrees above freezing to prevent ice from forming in equipment or in the road structure during the first two weeks of curing. Enzymes are only active when there is moisture in the soil and when temperatures are warm. Good curing requires the presence of some water and warm temperatures and the compacting forces of traffic over at least two weeks. If temperatures are low, curing is delayed. If temperatures are too high and soils dry quickly, curing will also be delayed by the lack of moisture in the soil.

What about axle load, maintenance and drainage issues in a road that TerraZyme has been used? With higher structural strength, a stabilized road has increased axle load capacity. This means that it can handle more traffic of the same load or can handle heavier axle loads with the same frequency. This improvement is generally measure by deflection of the cured road after 30 days following treatment. When traffic and structural strength are well matched, the maintenance requirements on the road are cut tremendously. Because drainage impacts the subgrade upon which road structures are supported, good drainage to keep surface moisture from entering the subgrade under the road remains an important engineering consideration for all roads. When road materials are stabilized in combination with adequate soil binder (clay materials within plasticity specifications) erosion is greatly reduced, but it is still an important practice to install culverts and drainage ditches as needed to keep water from running over the surface of the road or ponding along its margins to prevent moisture from working its way into the subgrade and causing a loss of subgrade support, which can lead to road failure.

What does a TerraZyme road look like right after it is finished? Will it feel like cement or soft soil? If it contains more than 20-30% clay, will the surface become slippery and lost traction? TerraZyme roads will resemble the materials placed on the surface. If the wear layer is soil or gravel, it will look like soil or gravel. If an emulsion or chip seal or asphalt is placed on the surface that will be the look of the road. An unsurfaced road of TerraZyme will have many of the characteristics of the untreated materials found in the road. Over time, the tendency of clay surfaces to become slick will greatly diminish, but where clay is present in larger quantities, a coarse sand or small stone layer, or an emulsion seal is usually preferred as a wear layer to prevent slippery conditions during prolonged wetness.

How long must the road cure before traffic can resume? If the road material contains enough sand and rock to compact well at OMC, traffic can resume immediately. For soils with higher clay content and excessive wetness, several hours of drying are preferred to prevent tires from marking and deforming the surface. A quick transit with equipment will show readiness for traffic by lack of movement in the treated layer and lack of tracking.

As time goes on will TerraZyme reduce or increase its bonding strength? Will the road come out with cracks or become fragile? TerraZyme stabilization works with the native soil and water in the road. As the road goes through cycles of being wet and then drying, the materials will become more and more stable and react less and less to wet conditions. On roads with clay content or higher plasticity, it is not uncommon to have extensive cracking occur during the first one or two drying cycles. Cracking will diminish to nothing within four or five wet / dry cycles. Roads that experience this cracking can often be watered with a truck two or three times during a week to create the next drying cycles and hasten stability. As materials go through the curing process and experience these wet and dry cycles, they become permanently more stable and road density and strength will increase.

How long will the roads last when TerraZyme is used? Road life is a function of traffic intensity (weight and frequency) and the strength of the underlying subgrade that supports the road structure. Every road is different, but if the road structure is well matched to the traffic loading, the design life will be reached before rehabilitation work is needed. Since soil materials are used in TerraZyme roads, we find that these stabilized roads generally double or triple their strength and yield a life that is also 2-3 times normal as a minimum. The changes to the soil are permanent, so as long as the traffic level on the road does not exceed the design life estimates, the road will remain in excellent condition. Single season dirt roads on palm oil plantations in Malaysia endure 5 or more years without need for rework after stabilization.

Can TerraZyme be used for dust control? TerraZyme stabilization will generally lock up 70-80 percent of the fines that create fugitive dust. In addition, when the gradation of the road is well managed during stabilization, the road will form a hard firm surface that shows very little dust generation over time. If the soil is not truly a clay bearing soil, silt materials will begin dust generation at the surface within the first few weeks of drying and traffic. Surface treatments of salt water, asphalt emulsion or TerraBond, or hot mix asphalt caps are all traditional methods of additional surface modification for 100% dust control where either silt or high plasticity clay is present.

Why not just use conventional soil additives like lime, cement and cement kiln dust to stabilize local roads? These additives (6-10% added to soil) can be effective in soil stabilization. Carry with them cost and environmental concerns in their use or manufacture. TerraZyme improves the mechanical qualities of the existing soil materials and can increase the overall quality of its structure and surface without the environmental concerns or full costs of hauling these or other soil/rock materials to the road site. These cost savings can be very high where sources of crushed rock or granular material are many kilometers from the project site.

In what road design applications can TerraZyme be effective? TerraZyme has been used worldwide in a variety of road applications: on unsurfaced rural/dirt roads, on roads that will receive a surface treatment, surface treatments on stabilized base materials (MgCl₂ for dust control, single and double chip surfaces or asphalt pavement), as a stabilizing additive to soil plus RAP (recycled asphalt pavement) during full-depth reclamation. TerraZyme can strengthen base layers and sub-base layers of highways covered with asphalt material & base layers of unsurfaced roads or soil roads.

How do you measure performance & success? Comparison of data from non-stabilized road sections with data from stabilized sections gives the best information on the improvements in the treated soil layers. The Army Corp of Engineers uses an Unsurfaced Road Index (URI) method to evaluate the surface conditions of gravel and soil roads. This methodology is illustrated in the World Bank Report on stabilizers compared in Paraguay. Measurements in the field with DCP (Dynamic Cone Penetrometer) or deflection equipment will also reveal strength increases from treatment if done after adequate curing (generally 30 days of good weather).

What are the factors that could cause a road to fail – how do we keep that from happening? Poor material selection, improper dosage, improper water content during compaction, poor mixing or uneven application, poor surface formation (no crown or camber or leaving holes) during final surface finishing and poor compaction can all contribute to various types of failure we have investigated. Generally, if published specifications are followed during site and material evaluation, and the correct application process and equipment is used, the only real concern is managing the mixing and moisture level of the treated layer through compaction. Weather can influence results if application is done during rain or extended wetness. Also, in some hotter/drier climates, it is needful to spread reflective sand or small stone, or spray water occasionally or apply a surface seal to retain water so that rapid drying does not occur and soil humidity levels continue to support curing for several weeks.

Is there Government Certification for TerraZyme? Yes, both laboratory and field testing has been documented in many countries and certifications issued. TerraZyme was selected as the soil stabilizer for use in World Bank projects in Paraguay, & USAID reconstruction in Honduras, national use in Philippines and Thailand, and in testing or recommended or approved within the Americas, India, China, etc.