

"...to build the infrastructure of the country, Avijeet Agencies maintains a vision of effective and superior construction, emphasizing on quality, integrity and service to clients."



**AVIJEET AGENCIES**

PRIVATE LIMITED

*making ways for better days...*

TerraZyme - A replacement for metaling & Soling

## **Information Package**

A Cost effective method of Road Construction



**AVIJEET AGENCIES PRIVATE LIMITED**

235(155) Sydenhams Road, 2nd Floor,  
Opp.Nehru Indoor Stadium, Chennai - 600 003

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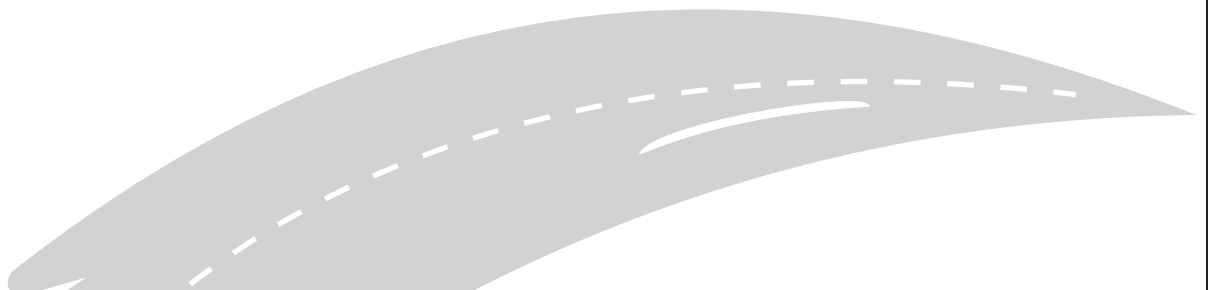
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E-mail : [info@avijeetagencies.com](mailto:info@avijeetagencies.com)



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## **TerraZyme a bio-enzymatic soil stabiliser.**

*A replacement for metalling and soling for construction of roads, yards and parking lots*

We would like to introduce ourselves as a Civil Engineering Company involved in the construction of roads using an innovative technology called TerraZyme, a bio enzymatic soil stabilizer.

TerraZyme, manufactured by Nature Plus Inc U.S is an excellent replacement for metalling and solling. TerraZyme is a liquid extract from sugar molasses that improves the engineering qualities of the soil like CBR values and density and decreases the OMC, plasticity index of soil.

The main feature of TerraZyme is the remarkable cost saving aspect. TerraZyme saves cost from 15% to 40% in comparison to the conventional system of road construction. Maintenance cost is dramatically reduced up to about 75%.

Understanding the construction activities that your firm would be involved in developing the respective retail outlets, we would like to mention that TerraZyme would be an ideal solution for Quality roads with a tremendous Cost saving feature.

### **TerraZyme is also used for construction of:**

- Highways
- Rural Roads
- Parking lots
- Townships Road, internal roads.
- Secondary Roads
- Airport Runways
- Road shoulders
- Recreation Paths

We would like to mention about our project for the National Highways (**NH66**) at Tindivanam that has proven the road strength after heavy monsoons in unpaved conditions.

TerraZyme has also been tested by the Central Road Research Institute (C.R.R.I) - New Delhi, Anna University- Chennai & College of Engineering - Trivandrum with successful results.

For further information, please feel free to contact :

### **Mr. Apoorva Modi**

235(155) Sydenhams Road, 2nd Floor,  
Opp.Nehru Indoor Stadium, Chennai - 600 003  
Ph : 42175333, 26480115  
Fax : 91 - 44- 42175444  
E-mail : info@avijeetagencies.com

INTRODUCTION





## **TerraZyme, a bio enzymatic soil stabilizer**

TerraZyme is a natural, non-toxic liquid, formulated using vegetable extracts. Apart from being a concept accepted the world over as a sound and resourceful road building practice which completely replaces the conventional granular base and the granular sub base, it emphasizes on strength, performance and higher resistance towards deformation.

## **Cost Saving feature of TerraZyme**

The cost economics of implementing TerraZyme in road building is yet another appealing characteristic of this technology. The overall cost reduction would be about 15 to 40 % of the total cost of construction. The maintenance cost compared to the conventional system would be reduced from 50 % to 75%. Given that there is an achievement in superior strength parameters at the base level of the TerraZyme road, further reduction in the bitumen layer is possible which would provide an over all saving in surfacing costs.

## **TerraZyme is also used for constructing:**

- Highways
- Rural Roads
- Townships Road
- Secondary Roads
- Airport Runways
- Road shoulders
- Recreation Paths
- Parking lots

## **The Main features of TerraZyme are highlighted below:**

- The soils treated with TerraZyme renders improved density values by reducing the void ratios to a large extent which results in an overall improvement in the California Bearing Ratio about 800 %.
- It facilitates higher soil compaction densities, and increases soil strength and stability for lasting roads.
- TerraZyme replaces Soling and WBM of conventional road structure.
- TerraZyme also reduces the crust thickness of asphalt layers.
- TerraZyme also proves to increase the road quality and decreases the maintenance cost.

## **Types of Soil and TerraZyme Effects :**

TerraZyme can be used various soil types ranging from black cotton soils to hard murrum soils. TerraZyme works with all types of soil which has a minimum 10% of clay particles. TerraZyme improves CBR values of soils having values as low as two. Treatment of soils having higher CBR values with TerraZyme ( soils like laterite, murrum, etc.), are cheaper to improve. After treatment soils can achieve CBR values equivalent or more as compared to conventional base course that is the water bound macadam. TerraZyme is usually used in treating soils having Plasticity index in the range of 6 - 25. Soils after being treated with TerraZyme behaves like a semi rigid pavement structure and has reduced permeability.

## **TerraZyme and Roads abroad:**

We would also like to mention that the manufacturing process of TerraZyme is **ISO-9002 certified** and the product has also gained wide acceptance across the globe as detailed below. Nature Plus product, TerraZyme Soil Stabilizer, was selected by **USAID** as the principal product for stabilizing the roads being reconstructed in Honduras due to the extensive damage from Hurricane Mitch under Project **RECAP/USAID-FHIS 004**.



- Nature Plus product, TerraZyme Soil Stabilizer, is a approved product for the **World Bank/MOPC** road rehabilitation project in Paraguay, **BIRF 3685-PA**.
- Nature Plus product, TerraZyme Soil Stabilizer, has been tested by **department of transportation**, under severe climatic conditions in Commonwealth of Pennsylvania for a period of 8 years (1992-2000) and has been granted provisional approval for its use in the **Commonwealth of Pennsylvania**.
- Nature Plus product, TerraZyme Soil Stabilizer, has also been tested extensively in field conditions in countries like **Brazil, Malaysia, Thailand, Mexico, Honduras, Mexico, Columbia and Uganda** with successful results.

#### **World Bank and TerraZyme:**

The World Bank supported the Highway projects in Paraguay which included a Pilot Program of Earth-Road Stabilization en route for testing innovative low cost technologies that could be applied under various conditions to improve low volume unpaved road performance and reduce the maintenance requirements. The approval of the World Bank and the incorporation of TerraZyme in their projects is in itself a distinction.

#### **Laboratory and Field Research:**

TerraZyme has been tested and has been proved successful by the following prestigious institutions:

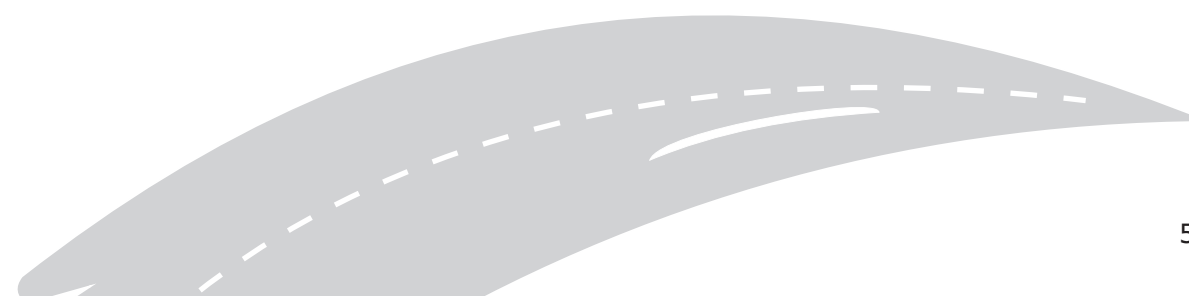
- |   |   |              |
|---|---|--------------|
| ü | Central Road Research Institute (CRRI)                      | - Delhi      |
| ü | Anna University   | - Chennai    |
| ü | Bangalore University "Dr. A. Veeraraghavan"                 | - Bangalore  |
| ü | College of Engineering ,Trivandrum "Dr. Kuncheria P. Isaac" | - Trivandrum |
| ü | Shanmuga College of Engineering                             | - Tanjore    |

#### **Various successful & prestigious projects executed by us for the following clients:**

- ü Shapoorji Pallonji
- ü Dalal Mott MacDonald
- ü NH 66 N.H. Department (T.N.)
- ü NH 4A N.H. Department ( Goa )
- ü P.W.D. , Maharashtra
- ü Mantri Developers
- ü Brigade Group
- ü Wipro Limited
- ü Semac Consultants
- ü Tata Power Corporation Ltd.
- ü Nasik Municipality
- ü Orchid Healthcare & Pharmaceuticals
- ü Anabond (P) Ltd

TerraZyme roads have been used as loading base, parking areas and yard areas in various projects around the country. To substantiate the fact and findings of performance of TerraZyme are the performance certificates enclosed.

For a copy of the reports or for any additional information about TerraZyme, kindly mail us at [info@avijeetagencies.com](mailto:info@avijeetagencies.com) so that the necessary reports may be dispatched.





# WORKING MECHANISMS OF TERRAZYME

# WORKING MECHANISMS

TerraZyme is a surfactant (an ionic surface active agent) which changes the hydrophilic nature of clay and lime materials to hydrophobic. Its application not only assists in the expulsion of water from soils, but also aids the lubrication of soil particles and increases the compatibility of many soils. The reaction of TerraZyme on these materials is particularly effective because of the ion-exchange capacity of clay minerals the property that clay minerals have of absorbing certain ions such as the TerraZyme molecule, thereby changing its physical properties. Of special importance is that TerraZyme changes the plastic characteristics of these materials due to a reduction in its water absorbing capacity. Unlike most other soil stabilizers, the effect of TerraZyme on these materials is permanent.

TerraZyme was developed to assist engineers with the removal of adsorbed water in materials in order to achieve maximum density with less mechanical effort and to prevent the absorption of water, that results in permanently stabilized construction materials. Most materials are made up of stacks of silica and alumina sheets. The arrangement of these result in different clay minerals such as Kaolinite, Smectite, Illite, etc. A simplified explanation is that these clay minerals have a predominately positive electrical or an ionic charge. This causes clay minerals to have a strong attraction for any cations present. Cations, or negative molecules, are therefore attracted to the positive clay minerals like iron filings to a magnet. In close proximity to the clay molecule or particle, the electrostatic forces are larger and thereby the ions are held very firmly. Nominal temperatures will not remove them. This layer of water is known as the electrostatic diffused double layer. This water is known as the adsorbed water. Moving further away from the clay particle, the water molecules are no longer in an attracted or orientated state, and this water is known as random water and it is also called absorbed water. Certain materials, like Smectite, have spaces between the plates or layers that can adsorb water, causing them to expand. These are known as expansive or swelling materials and are the cause of many failures in foundations or road works. The solution therefore is to obviously expel or prevent the adsorption of water. If some powerful positive molecules can be supplied, the negative charge of the clay minerals can be satisfied and balanced out. At the same time, any weaker cations such as water can be disassociated and replaced, and/or occupation of the vacant ionic sites on the surface of the clay can take place. Large cations, such as sodium or water, cannot easily fit into these sites and is disassociated or replaced. Small cations, on the other hand, fit firmly into these vacated sites and cannot be removed. We therefore have the situation that the clay's negative charge is in balance and positive ions cannot be removed, thereby rendering the clay inert to water. **The soil mass is now a permanently stable, Water Repellent Road Surface similar to rigid pavement.**

TerraZyme a cations-reactive synthetic compound that forms a protective coating, on oily clay layers on the surfaces of soil and clay particles. It reduces ion mobility and ion exchange and simultaneously makes the material hydrophobic by eliminating the absorption of water. The result is a soil material that is much less sensitive to moisture, more workable and it can be compacted to a better particle-interlock state by equipment and traffic forces. Better particle interlock means higher internal friction and improved bearing capacity. It also means greater density and less penetration of water. The active reagent is permanently bonded to the material particles and should any excess reagent be present, additional water will facilitate deeper penetration into the soil horizon until the entire reagent has been adsorbed. TerraZyme *Will Maintain Normal Traffic in Wet Weather.*



# APPLICATION PROCESS

**Loosen soil with a Grader or Pulverizer.**



**Mix treated soil to uniformity.**



**Humidify soil using TerraZyme mixed with water**



**Compact treated road surface near optimum humidity.**





## COST AND DESIGN COMPARISON FOR PROJECTS WITH DIFFERENT TOPPING.

### General Comparison

#### Conventional Design

Cross - Section	Thickness	Rate/m3	Amount/m2
Solling	230mm	600.00	Rs. 138.00
WBM Grade II	75mm	1000.00	Rs. 75.00
WBM Grade III	75mm	1200.00	Rs. 90.00
<b>Total</b>			<b>Rs.303.00</b>

#### TerraZyme Design

Cross - Section	Thickness	Rate/m3	Amount/m2
250mm in two layers of 125mm each. The top 125mm has 20% by volume 40mm down metal			Rs.240.00*
<b>Total</b>			<b>Rs.240.00</b>

**SAVINGS** : Rs.63.00 per Sq.mt  
: 21.0%

Note :

- The strength of TerraZyme treated road base is similar to a semi rigid pavement with high CBR values, thereby giving the ability to reduce the thickness of asphalt layers.
- \*The rates are based on prevailing rates for supply of metal and soil at Chennai





Kerala - Alwaye Residential Road



Schwing Stetter Inplant Road



Nasik - Municipality Road



PWD, Maharashtra - Panvel Village Road



Pondicherry - MGMC Campus Road



National Highway 66, 42/8 Tindivanam 1



Pondicherry - Sedurapet Inplant Road



Sriperambudur - Orchid Pharmaceuticals

GALLERY



**TO WHOM EVER IT CONCERNS**

This is to certify that M/s.Avijeeet Agencies (P) Ltd., Chennai have successfully completed road construction project using TerraZyme at the site of our project "Mantri Tranquil" at 7/9/13, Gubbalala Village, Off Kanakapura Road, Bangalore - 560 062.

TerraZyme technology has replaced soling and WBM of conventional road construction methodology. The cost of construction of the road using TerraZyme is cheaper by 25% and speed of execution using this product is 3 times faster as compared to conventional methods.

The road is in use for the last 6 month and is catering to normal traffic. It was also observed during this period that the roads constructed using TerraZyme suffered no damages like potholes, ruts or depressions, even though no asphalt topping was provided, during the heavy spells of rainfall.

We here by state that the roads built by M/s.Avijeeet Agencies (P) Ltd., are in excellent conditions and do not show any signs of fatigue.

We here by conclude that the construction of the roads in our project by M/s.Avijeeet Agencies (P) Ltd., with the product TerraZyme was successful.

We wish them success in all their future endeavors.

  
Chandrashekar. K  
(G.M.Projects)



## COMPLETION CERTIFICATE

**ISSUED TO** : M/s. Avijeet Agencies (P) Ltd., Chennai,  
#155, sydenhams Road,  
IInd Floor, (Opp.Nehru indoor stadium)  
Chennai: 600003

**Towards** : Construction of parking lot in our project at electronic city,  
using the product TerraZyme, manufactured by  
Nature Plus Inc, USA.

**Project** : Wipro Limited  
EC-4 Project  
Sy # 70 (P) & 84 (P), Electronic  
Hosur Road, Bangalore 560010.

This is to certify that **M/s. Avijeet Agencies (P) Ltd., Chennai**, have completed Construction of parking lot in our project at electronic city, using the product TerraZyme, manufactured by Nature Plus Inc, USA, as per above to our complete satisfaction as on June 30, 2005

With best regards,

For **WIPRO TECHNOLOGIES LIMITED**

**Krishna Murthy LP**  
Senior Manager – Infrastructure

### Wipro Technologies

*Innovative Solutions. Quality Leadership*

111, Anna Salai, Gaiety, Chennai - 600 032, India. Tel : 91-44-2230 1530 Fax : 91-44-2230 1532 / 2230 1397 [www.wipro.com](http://www.wipro.com)  
Regd. Office: Wipro Limited, Dooda Kanneli, Sarjapur Road, Bangalore - 560 035. INDIA Tel : 91-80-28440011, Fax : 91-80-28440054



**Datal Mott MacDonald**  
1/99-11, Mount Pleasant Road,  
Chennai - 600 036 India.  
Tel : + 91-44-234 0571, 234 0511.  
Fax : +91-44-234 0474.  
Email : Chennai@data.mottac.in/india.com

Date : 23.10.02

## TO WHOM ITS MAY CONCERN

M/s Avjeet Agencies (P) Ltd. Located at # 42 (44), Rithedon road, Purasawalkam, Chennai - 600 007, have been laid road with TERRAZYME application of 50 mtrs stretch for trial purpose for our client Orchid Health Care at Irangallukottai, Sripurumbudur. Avjeet Agencies (P) Ltd has taken the trial road Using Terrazyme which is a bio enzymatic soil stabilizer.

The strength and performance of the road have been evaluated by us and OHC. Also the road was assessed by the soil mechanics department of various labs within Chennai. Further to that final approval have been given, to lay the road based on Anna University test result report which is an independent institution based in Chennai and their findings reveals that the road has achieved a CBR OF 85% at the top layer and relative compaction of 100%. The construction cost of the Terrazyme road is lower than the estimated conventional design. M/s. Avjeet agencies have taken on board to lay the internal roads of OHC Formulation unit with in the premises with in course of time.

After various investigation & lab test in the trial road laid by M/S. Avjeet our client Orchid Health Care has granted the approval for the use of Terrazyme technology in the construction of roads in their project in light of the above.

We hope that M/S. Avjeet agencies will perform in laying the entire road with in the premises with the same result of the trial road, Laying with Terrazyme application as per the test conducted at site as well as at lab.

Thanking you

For Datal Mott MacDonald.

  
U.S. Mukherjee,  
Construction Manager

# REFERRALS



## NATIONAL HIGHWAYS

From

Thiru K. Thangarasu, M.E., MIE,  
Superintending Engineer,  
National Highways,  
H.R.S. Campus, Guindy,  
Chennai-600 025.

To

M/s AVIJEET AGENCIES (P) LTD.  
CHENNAI-600 007.

Dated : 07-02-2003.

Gentleman,


I like to inform that M/s Avijeet Agencies (P) Limited have tried the bio-enzymatic soil stabilizer Terrazyme, in the formation of the diversion road for the work of "Reconstruction of the minor bridge at Km 42/8 of NH-66".

The work was done as an experimental basis. After the formation of the earthen embankment the sub-base and base were treated with Terrazyme. No asphalt layer was laid.

Since no W.B.M. and P.C. layers were done, the cost of the diversion road was very much reduced (nearly 50%).

The diversion road withstood for 8 months during the construction of the bridge. Even during rainy days, with heavy traffic, there was no damage to the diversion road. No deformation, no slush forming or any ill effects were found.

It is concluded that the use of Terazyme is found to be satisfactory.

  
7/2/2003  
Superintending Engineer,  
NH:Chennai-25.

# REFERRALS



Phones 6832173, 6832325, 6832376  
(FAX) 6832427, 6313376, 6913266

केन्द्रीय सड़क अनुसंधान संस्थान

(वैज्ञानिक एवं औद्योगिक अनुसंधान परिषद्)

Fax 91 11 6845943  
E.Mail cri@simetd.emet.in

## CENTRAL ROAD RESEARCH INSTITUTE

(COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH)

Delhi-Mathura Road, P.O. CRRI, New Delhi - 110 020 (INDIA)

ISO/FPD/02/2A(0)/757

Dated 10-10-2001


Apporva Modi  
Avijeet agencies Pvt. Ltd.  
42, Ritherdon Road  
Purasawalkam, Chennai  
600007, India

Dear Mr. Modi,

We would like to thank you and your consultants, for the efforts you have made to introduce to us the bio-enzymatic soil stabilizer "Terrazyme", manufactured by Nature Plus, Inc. As mentioned in our previous letter, CRRI is ~~most~~ interested in new technologies, which can lower the life-cycle cost of roads.

The results of the preliminary laboratory test we conducted correlate with the information from the various test reports you provided. We observed that positive behavioural changes occur in some soil types after stabilisation with the product. However these require a detailed study before any positive conclusions are drawn, and we would like to observe the behaviour of roads stabilised with TerraZyme under normal traffic conditions. We invite you to join us for the further discussion on the possibilities of utilisation of your product in the construction of rural and urban roads.

Thanking you

  
Dr. Sunil Bose

Head, Flexible Pavements Division

REFERRALS



## **GANESAN BUILDERS LIMITED**

72-A, C.P. Ramaswamy Road, Chennai - 600 018.  
Phone : 4995172, 4970985, Fax : 91-44-4996225  
E-mail : geebeel@viasmd01.vsnl.net.in

January 2, 2002

### **To Whomsoever It May Concern**

This is to certify that Avijeet Agencies (P) Ltd. Located at # 42, Ritherdon Road, Pursalwakkam, Chennai - 600 007 has done the soil stabilization work at our construction site for M/s. **Schwing Stetter India (P) Ltd.** Sriperambattur., for an area of 1848 Sqm. in the natural soil with gravel mixed layer of 300mm thick (150mm in the natural clay soil one layer and another layer of 150mm gravel bought from outside) mixed with TerraZyme soil stabilization chemicals making the surface hard enough to lay the concrete topping without any soling or WBM treatment during Sep '2001.

The road was topped with RCC concrete pavement and has already experienced one monsoon and there is no surface deterioration and is performing upto expectations. The road is catering to a traffic Density with 20 Ready Mixed Concrete Trucks of axle load 20 to 30 tonnes in addition to 4 wheeler and 2 wheeler traffic.

We wish them success in all their future endeavors using bioenzymatic soil stabilizer TerraZyme.

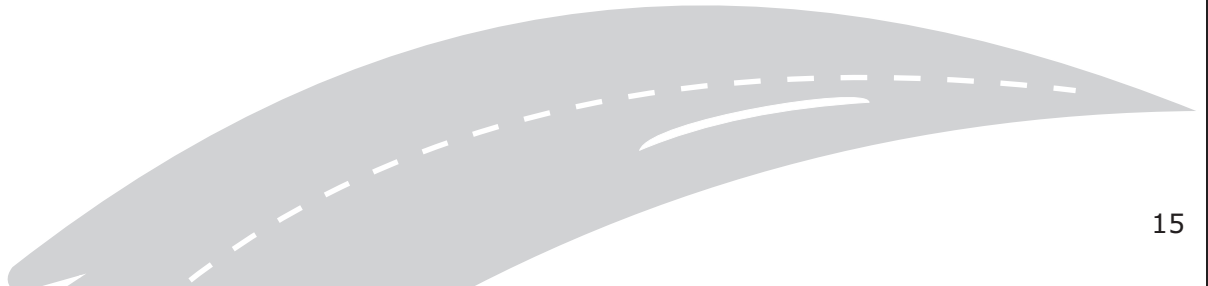
Thanking you,

Yours truly,  
for **Ganesan Builders Limited.**

**M. Karthikeyan**  
Project Coordinator.

---

Regd. Office : 53, Dr. Ranga Road, Mylapore, Chennai - 600 004.





## TECHNICALIYA CONSULTANTS PRIVATE LIMITED

C.O.D No.5, NEW No.8 & 10, ANNAI NAGAMMAI STREET, MANDAVELI, CHENNAI - 600 02E  
PHONE : 4933278, 4933287, 4933408, 4953303 FAX : 91-44-4937341 E-mail : technicaliya@vsnl.com

16<sup>th</sup> October 2002

### TOWHOMSOEVER IT MAY CONCERN

MAHATMA GANDHI MEDICAL COLLEGE HOSPITAL AND RESEARCH  
INSTITUTE AT PILLAYARKUPPAM, PONDICHERRY

#### Road work using TerraZyme

M/s. Avijeet Agencies (P) Ltd. located at # 42 (44), Ritherdon Road, Purasaiwalkam, Chennai - 600 007 had laid the internal roads at the above project site using TerraZyme which is bio enzymatic soil stabilizer.

The road laid at the above campus has been subjected to heavy vehicular movements including the construction traffic, for over a period of six months, and has suffered no deformations, potholes, dust formation or any other kind of softening even though the road has not been surfaced with bitumen. Even with heavy spells of rain the road has not given way to slush, rutting or other ill effects.

The construction cost of the TerraZyme road was found to be lower than the estimated conventional road specifications using soling, Water Bound Macadam, black topping etc.

The roads were laid with a professional approach in the execution of this project. We recommend TerraZyme as an alternative to conventional road designs.

For TECHNICALIYA CONSULTANTS PVT. LTD.,

  
DIRECTOR



**TOYOGAN CORPORATION**

Gammon House, Veer Savarkar Marg, Prabhadevi, Mumbai - 400 025. (India)  
Tel. : 461 4071 Fax : 460 7399 E-mail : sgsl@vsnl.com

August 2, 2001

Mr. Apoorva Modi.  
Avijeet Agencies Private Ltd.  
65 (73), Devraja Mudali Street,  
1<sup>st</sup> floor,  
Chennai-600 003.

Dear Mr. Apoorva,

I would like to confirm that the work done by you at Waghivali Village, Survey No V. R. No 9 km 0/300 to 3/800 Taluka Panvel; District Raigad measuring a distance of 4 km length and 3.75 meters width, is performing well.

Should you require any further queries please do not hesitate to contact me.

Thanking you.

Yours faithfully,

Dinesh N. Joshi.  
Partner.

REFERRALS