

I. Construction Innovation Forum • NOVA Award Nomination

9424

Instructions

Step 1 Enter a Descriptive Name for the Process/Method/Technique you are nominating on line A of this page.

Step 2 Complete this page.

"I. Construction Innovation Forum • NOVA Award Nomination"

- Be sure to provide original signatures in Section B and E on this page. Your nomination cannot be reviewed without them.
- If you need additional space for names and addresses you may attach additional pages for names and address information. You may attach extra pages only for sheet I.

Step 3 "II - Innovation Description" — attach one (one only) 8-1/2" X 11" page that gives a succinct written description of the innovation. Put the name of the innovation at top of page. Tell us what you think is innovative about this. You should include:

- What the innovation is
- Why it is innovative
- What it changed or replaced
- Where and when it originated, has been used, and is expected to be used in the future
- If the nomination is for an innovative project, specifically identify its innovations.

Please type, with 1" margins, 10 characters per inch, 6 lines per inch.

Step 4 "III - Innovation Illustration" — attach one (one only) 8 1/2" X 11" page that contains one or more photographs, drawings, tables, graphs, clauses, etc., that visually describe the innovation. Do not submit more than one page of visuals. The jurors will see only one sheet for review. Put the name of the innovation at top of page.

Other You must submit 12 (twelve) sets of sheets I, II and III (a total of 36 pages)

Nominations are due September 15 mailed or delivered to:

The Construction Innovation Forum, 1000 Campus Drive, Suite 100, Ann Arbor, MI, USA 48104-6792, Phone: 313-995-1855, Fax: 313-995-5002

A. Name of Innovation: Soil Doctor Soil Stabilizer

B. Person(s) and /or Organization(s) Primarily Responsible for the Innovation (Those to whom NOVA Award should be presented.)

Name: W. Tom Witherspoon

Title: President

Affiliation: Soil Doctor, Inc.

Address: 1030 E. Beltline Road
Richardson, Texas 75081

Phone: (214) 867-3064

Signature: [Signature]

(Signature(s) indicate acceptance of the nomination and consent to have CIF research and make presentations on the innovation for the purpose of jurying and publicizing awards.)

C. Other Primary Sources of Information on the Innovation: (in addition to the persons nominated above.)

Name: Bob Lewis

Title: Marketing Director, Soil Doctor, Inc.

Affiliation: _____

Address: 1030 E. Beltline Road
Richardson, Texas 75081

Phone: (214) 867-3064

Name: Bob Ryan

Title: President, P.D.S.

Affiliation: Owner

Address: P.O. Box 507
El Dorado, Arkansas 71731-0507

Phone: (800) 243-7455

D. Independent Reference(s) familiar with the use of the Innovation

Name: Larry Schneider

Title: President - Schneider & Justice, Inc.

Affiliation: Client

Address: 426 Oakhill Drive
Denton, Texas 76201

Phone: (817) 382-0338

Name: Steve Dial, P.E.

Title: Hunt & Joiner, Consulting Engineers

Affiliation: Designing Engineers Who Spec's Chemical

Address: 4300 N. Central Expressway
Dallas, Texas 75206

Phone: (214) 823-4197

E. Person(s) making nomination:

Name: W. Tom Witherspoon

Title: President

Affiliation: Owner of Soil Doctor, Inc.

Address: 1030 E. Beltline Road
Richardson, Texas 75081

Phone: (214) 867-3064

Signature: [Signature]

(Signature(s) indicate familiarity with the the innovation and signify that information contained in the nomination is correct to the best of one's knowledge.)

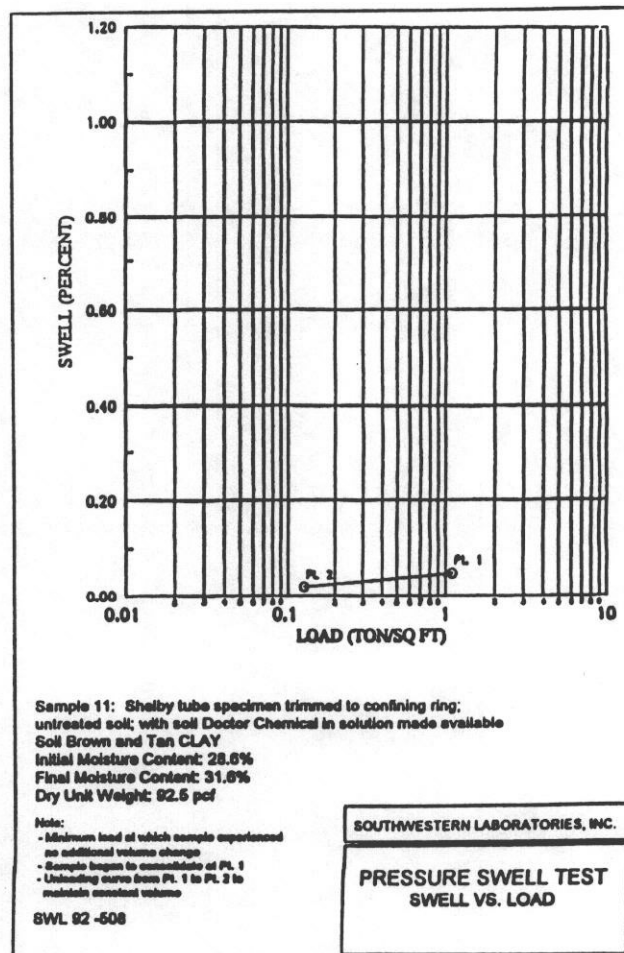
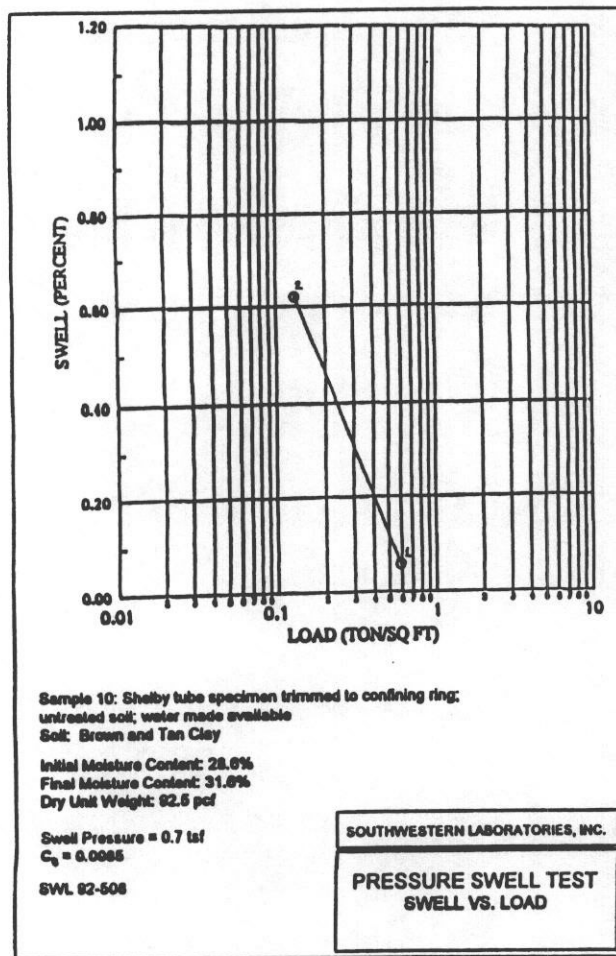
SOIL DOCTOR SOIL STABILIZER

What the innovation is: A more clear definition is attached in "III", but, it is basically an ion exchange to eliminate expansive clays from swelling. Why is it innovative and what it changed or replaced: Prior to this ionic exchange, the only approved stabilizer was lime. Since lime does not penetrate the clays and is more of a cementer, it does not adequately stabilize the expansive clays. This system is approximately the same cost as lime, but, makes a more stabilizing effect on the expansive strata. This chemical, which is potassium based, makes the clays release water and they have a greater affinity for the chemical than water. Therefore, swelling is eliminated.

Where it originated: See item "III".

Where it is expected to be used in the future: Soil Doctor is presently bidding race tracks, houses, building and new construction sites. Bids have also been made on streets and roadways to different municipalities. Soil Doctor is presently spec'd by the primary engineers in Texas and other states. Home Owners Warranty and National Home Insurance (90% of all foundation insurance coverage in the U.S.A.) are presently giving exclusive contracts to Soil Doctor.

Specific Innovations: In addition to the proprietary chemical innovation, Tom Witherspoon has filed for patents on the injection procedure. He has also developed innovative methods for lowering slab on grade foundations where heaving has occurred. The attached graph indicates laboratory tests as to how the innovative chemical works.



Background

Expansive soils are soils that shrink or swell under changing moisture conditions. This condition is even more evident in arid or semi arid areas where the climate has severe seasonal variations.

Expansion of soils causes more damage to structures than any other natural disaster, including earthquakes and floods. Losses to man-made structures are estimated to cause seven (7) billion dollars annually.

This costly behavior of expansive soils is attributable to the type and amount of clay minerals in the soil. The most common expansive clays are montmorillonite, chlorite, vermiculite and mixed layer type. These clays have an electric deficiency that is balanced by cations. This deficiency is most commonly balanced by water molecules which expand the lattice of the clay crystal structure. Since clay is structured as molecular sheets, this ion exchange supplied by water causes a separation in the lattice sheets and subsequent expansion of clay by water volume. The lower the initial moisture, the higher the percentage of swell.

Soil Stabilization

Soil stabilization can be described as any procedure or technique applied to the soil which minimizes or eliminates its swelling potential by improving its condition or changing its properties. These methods include prewetting of soils, replacing the expansive soils, adding a surcharge equal to the swelling pressure, altering soils density by compaction, isolating moisture from the soil and altering the properties of the soil by ion exchange with chemical additives.

Chemical Stabilization By Ion Exchange

Chemical stabilization by ion exchange involves introducing cations which satisfy the soil charge imbalance thus reducing or eliminating its need for water. This is the action by Soil Doctor chemical.

Soil Doctor chemical operates on this concept. The Soil Doctor chemical supplies cations to active clays to reduce its affinity for water. Since the stronger Soil Doctor cations neutralize the active clays charge imbalance, water is either expelled or blocked.

Cation Exchange Capacity (CEC) tests verify the occurrence of an exchange reaction as indicated by an increase in the concentration of cations obtained by treatment of expansive clays with Soil Doctor. These targeted cations remain within the limits of the Cation Exchange Capacity value of the soil, which indicates the soil is reactive and capable of absorbing or exchanging cations from the introduced solution.

Pressure swell tests performed by Southwestern Laboratories on Shelby tube samples from a very active area in Irving, Texas, depict the effect of ion exchange treatment by Soil Doctor chemical (reference the attached swell pressure graphs). Although the soil was retrieved during a wet time of year, well above the optimal moisture content (an approximate optimal moisture of 22%), saturation with water did produce a significant amount of swelling. The Soil Doctor saturated sample, however, not only had a small amount of initial swelling, but actually started repelling water and consolidated under the test pressure. This reversal of swell pressure indicates the ion exchange took place and chemical stabilization was achieved.

Field testing by this writer, over the past four years, indicates a permanence is achieved when this ion exchange takes place. Injection under one building at the Estrada Oaks Apartments in Irving was done in 1989. Despite a potential vertical rise of an approximate 10", this building segment has not moved since the injection. Because the building was heaving very rapidly at the time of the injection, results were obvious. Since the other buildings were not injected, their continued movement is proof of the effectiveness of Soil Doctor treatment.

Additional testing has been done on several houses with heaving problems. These houses were piersed, lowered and then injected with Soil Doctor stabilizer to stop the constant heaving problems. This application for repair of existing conditions has proven effective and will continue to be a source of remedial action.

One of the most effective applications of chemical injection was achieved on a house in Denton, Texas. The rear/center of the house has indicated severe heaving damage with slab cracking in excess of 1/4" and door alignment problems which caused egress/ingress problems for the home owner and a liability problem for the builder. Soil Doctor pulled the carpet back, drilled holes 2' on center in an approximate 10'x10' area and injected Soil Doctor chemical under the slab to a depth of 7'; this all being done in a relatively dry time of the year. During the next 60 days, nothing was obvious in the floor elevation and door alignments. The next 30 days, however, settlement of the floor was visible and doors started to open and close properly. Since the injection was made in a relatively dry time of the year and the consolidation of clays was measured in a very wet period, Soil Doctor chemical action was the only factor which could be attributed to this success. The attached testimonial from the home builder documents this achievement which has saved him thousands of dollars and his good reputation.

Although the repair application of Soil Doctor chemical has been proven, new construction application is even more exciting. Pretreatment of a selected site can lessen the chances of future heaving problems caused by decreased moisture transpiration as a result of the slab serving as a horizontal barrier for moisture movement. It can also defuse subsurface moisture concentration problems. The benefits are unlimited: runways, highways, building slab-on-grades, swimming pools, etc.

AWARD MANAGER'S SUMMARY
Nomination 9424

SOIL DOCTOR SOIL STABILIZER

The Innovation

The Soil Doctor Soil Stabilizer is a proprietary chemical stabilization technique to treat expansive soils, which are usually clay. The method involves the injection of a potassium based chemical into the soil to supply cations to the clay and neutralize the clay's imbalance in electrical charge.

Expansive soils are soils that shrink or swell with changing moisture conditions. The electrical charge on the soil particles of these soils is ion deficient and is naturally neutralized by the cations of water. This affinity for water causes the soil matrix to swell when water is present and shrink when it is not. Chemicals can be used to satisfy the soil's needs and at the same time exclude the water that causes the volumetric change. Such a chemical is that of Soil Doctor. As long as the chemical is available, the soil is stabilized, that is, it neither swells nor shrinks.

The Soil Doctor method consists of drilling one and a half inch diameter holes in the soil to depths of five, seven, or more feet, usually on a 2 x 2 foot grid. The Soil Doctor chemical under a pressure of about 250 psi is then injected through these holes for about two days. This injection time may vary depending on the job conditions. The maximum depth of injection is difficult to define because Soil Doctor, Inc. is still developing the method.

Much of the effect from a Soil Doctor application is noticed immediately after the two day pressurized application. However it may take 30 to 90 days after injection to completely stabilize some clays.

The Soil Doctor application is most effective when applied to saturated clay. If the clay is dry, much more Soil Doctor liquid is needed for treatment.

The cost of Soil Doctor stabilization is about \$2 to \$3 per square foot, as compared to lime stabilization which is about \$0.50 to \$0.60 per square foot. Soil Doctor, Inc. guarantees each stabilization treatment for five years.

Background of Innovation

The Soil Doctor idea started about five years ago. Mr. Tom Witherspoon is the only inventor and developer of the method.

Mr. Witherspoon had tried several methods for soil stabilization using the injection principle and it took some time to develop the equipment and procedures.

In addition to the proprietary chemical innovation, Mr. Witherspoon has filed for patents on the injection procedure. For instance, he has filed for a patent for a grout injection procedure for use in different types of soil.

The permanence of the Soil Doctor treatment is being observed. After four and a half years it appears to be still effective. Soil Doctor, Inc. gives a five year warranty to the customer. They will give another Soil Doctor treatment for 20% of the cost around the perimeter of the building. Good drainage is encouraged for the treated areas.

Application

Soil Doctor was first tried in Irving, Texas, on a two-story apartment building covering an area of 30' x 140'. The upheaval was about 3 inches, but Soil Doctor fixed the problem.

There are many applications for Soil Doctor such as low rise apartment buildings, houses, pavements, etc. It is not applicable to tall buildings because they require different types of foundations. Soil Doctor, Inc. is presently bidding projects for race tracks, houses, buildings, and new construction sites. Bids have also been made on streets and roadways in different municipalities.

Soil Doctor is presently being specified by principal engineers in Texas and other states. Home Owner's Warranty and National Home Insurance companies are giving contracts to Soil Doctor. These companies provide about 90% of all foundation insurance coverage in the USA.

Soil Doctor, Inc. believes that the future looks good and expect a continued expansion of their business.

Notes on Nominated Persons

Mr. W. Tom Witherspoon

Mr. Tom Witherspoon is the President of Soil Doctor, Inc., a company that specializes in the stabilization of expansive soils. Their methods are used as pre treatment when new construction is planned and as remedial treatment for homes, apartments, commercial buildings and streets.

Opinions of Outside Persons

Mr. Steve Dial, P.E.

Mr. Steve Dial is a user of the Soil Doctor system. He is a friend of Tom Witherspoon and this was the main reason that he used Soil Doctor and not some other competitor. He has used Soil Doctor on three house projects during the past two years.

Mr. Dial says that Tom Witherspoon was the originator of Soil Doctor. He thinks that another person from the company, Bob Lewis, was helping a lot in the development of field applications.

Mr. Dial also says that the Soil Doctor chemical is potassium chloride plus a surfactant. He says that the competition, Hayward Baker and PRO CHEM, can probably stabilize clay as well as Soil Doctor, but he only paid \$1.50 to \$2.00 per square foot which is cheaper than the competitor's price.

Mr. Dial had problems on one of his projects. The soil beneath a house had been stabilized using the Soil Doctor. A water leak developed in a pipe under the house and washed out the treatment. They had to fix the pipe and make new injections. So, Mr. Dial is concerned about the durability and longevity of Soil Doctor.

Professor Donald H. Gray

Professor Donald H. Gray is a professor of Geotechnical Engineering at the University of Michigan. He is an expert in soil embankment stability and has experience in soil stability problems in the western United States.

Professor Gray says that the application of a soil stabilizer using a grid of holes and pipes under pressure is not new. Applications have been made similar to the Soil Doctor technique using lime slurry. Lime treatment, however, does not give a nice uniform product and may not be as effective as chemical treatments.

Mr. Bob Lewis

Mr. Bob Lewis is the Marketing Director for Soil Doctor, Inc. He has a technical background. He began work with the company about a year ago and worked on the equipment. He added pipe and obstacle detectors that are used when making injection holes in the soil. Mr. Lewis adapted commercially available equipment and parts for use in the process. He was also instrumental in establishing the standard 2 x 2 foot grid system for the injection locations.

Mr. Lewis says that Soil Doctor has competitors. PRO CHEM Co. in Fort Worth, Texas, uses sulfuric acid to stabilize clay. He thinks that they may have been in business longer than Soil Doctor. They compete costwise very well. The Soil Doctor treatment may be more durable and has a better guarantee than PRO CHEM. Another competitor is Hayward Baker Co., also in Texas. They give a good warranty too, but they charge more.

Mr. Lewis says that one of the things that happened when Soil Doctor entered the market was that the price per square foot for soil stabilization dropped from 6 to 8 dollars to 2 to 3 dollars per square foot.

Mr. Larry Schneider

Mr. Larry Schneider is the President of Schneider & Justice, Inc. of Denton, Texas. His company are builders and developers.

Mr. Schneider said that the Soil Doctor process was used on one house of theirs that was having trouble because of soil heaving. The total stabilization process took 90 days, but the soil heaving was corrected. He found the Soil Doctor people very good to work with. Their performance warranty was for 3 to 5 years.

Prof. Richard D. Woods

Professor Richard D. Woods is Professor of Geotechnical Engineering at the University of Michigan. He is an internationally know soils consultant and has encountered a number of instances where grouting of soils was specified.

Professor Woods has worked with Hayward Baker Company in Texas on various consulting projects. He thinks that they are capable of treating swelling soils under houses. He goes on to say that the use of cationic soil treatments is not a new idea. The work of competitor PRO CHEM Co. may be comparable to Soil Doctor.

Professor Woods thinks that the 250 psi pressure used in injecting the Soil Doctor chemical is very high. Also, the 2 x 2 foot spacing of the injection holes is on the short side, but it still takes time and pressure to move an injected chemical more than one foot to achieve treatment.

Professor Woods provided the following written comment:

"The process employed for soil improvement by the Soil Doctor Soil Stabilizer is a well recognized principle of ion exchange by which an otherwise expansive clay is rendered non-expansive by changing the cation bound to the clay mineral. The intent is to render the clay hydrophobic. The

innovation may be in the form of the "potassium based" solution which is injected into the soil to promote ion exchange, and in the manner in which the solution is injected into the soil. The closeness of injection probes (two foot centers) would help speed up the process of ion exchange by making the solution more readily available to the clay.

"The other major approach to preventing swelling in these clays is through cementation. Either Portland cement or lime is often mixed with the soil thus forming a soil-cement. The drawback in this process is that the cementing agent must be physically mixed with the soil to achieve the desired result. The cation exchange method avoids the necessity of mixing the soil but depends on penetration of the soil by the active solution. Because clays are of low permeability, the close spacing of injection tubes described in this process would minimize the low permeability problem."

Award Managers' Comments

The Soil Doctor Soil Stabilizer appears to be an adaptation of well known soil stabilization methods. The Soil Doctor chemical composition is not disclosed, but it is thought to be potassium based. The spacing of injection holes and the injection process does not appear to be unusual.

There are some statements made under the heading "Why is it innovative and what changed or replaced:" on the second page of the original submission that do not seem to be entirely valid.

SELECTED INTERVIEW SUMMARIES

Phone Interviewer: Tons
Date: 11/29/93

#9424
No. 1

Name: Mr. W. Tom Witherspoon
Title: President
Affiliation: Soil Doctor
1030 E. Beltline Road
Richardson, TX 75081

1. Mr. Witherspoon says that the most innovative parts are the Soil Doctor chemical and the application method. Typically, one and a half inch holes are drilled to five, seven, or more feet in depth. Then the Soil Doctor chemical is applied under about 250 psi pressure for about two days. (This may vary depending on the job conditions.) The hole spacing is usually a 2 x 2 foot grid. Saturated clay is the best for application. If the clay is dry, much more Soil Doctor liquid is needed for treatment.

2. About two years ago another company was trying to inject acid. (Witherspoon's method is about five years old.) The acid method did not work.

3. Witherspoon has also tried other methods (besides Soil Doctor) for soil stabilization. For instance, he has filed for a patent for a grout injection for different types of soil.

4. The Soil Doctor idea started about five years ago. Witherspoon is the only inventor. No other person is involved in the innovation. He will send us the patent texts and some literature.

5. The Soil Doctor was first tried in Irving, Texas, on a two-story apartment building covering an area of 30' x 140'. The upheaval was about 3 inches. Soil Doctor fixed the problem.

6. It took some time to develop the equipment and procedures. Some skeptical people call the Soil Doctor chemical a "Snake Oil".

7. The maximum depth to which they can inject is difficult to define because the method is still developing. Much of the Soil Doctor effect is felt after the 2-day pressurized application. It may take 30-90 days to completely stabilize some clays.

8. The permanence of this treatment is being observed. So far, after four and a half years it appears to be permanent. The company gives a five year warranty to the customer. They will give another Soil Doctor treatment for 20% of the cost around the perimeter of the building. Good drainage is encouraged for the treated areas.

9. There are many applications for Soil Doctor: apartment buildings (low), houses, pavements, etc. Tall buildings have different foundations.

10. The future looks good, with a continued expansion of the business.

11. Witherspoon will send us his patent copies. He will also give us short literature pieces.

Phone Interviewer: Tons
Date: 11/29/93

#9424
No. 2

Name: Mr. Bob Lewis
Title: Marketing Director
Affiliation: Soil Doctor, Inc.
1030 E. Beltline Road
Richardson, TX 75081

1. Mr. Lewis says that the method uses a new, effective chemical additive applied at high pressure and at reasonable cost. The cost of lime stabilization is about 50-60 cents per square foot. Soil Doctor costs about 2-3 dollars per square foot. They guarantee it for five years. He thinks that the treatment should last at least 10 years, depending upon the situation.
2. Soil Doctor has competitors. PRO CHEM Co. in Fort Worth, Texas, uses sulphuric acid to stabilize clay. It has been in business maybe longer than Soil Doctor. Lewis did not "put down" PRO CHEM. They compete costwise very well. Soil Doctor treatment may be more durable and they give a better guarantee as compared to PRO CHEM. Another competitor is Hayward Baker Co., also in Texas. They give a good warranty, but they charge more.
3. Mr. Lewis says that one of the things that happened when Soil Doctor entered the market was that the price per square foot dropped from 6-8 dollars to 2-3 dollars.
4. Lewis is the Marketing Director for Soil Doctor, but he has a good technical background. He came to the company about a year ago and did some work on the equipment. He added pipe and obstacle detectors that are used when making injection holes in the soil. Basically, there is no specially designed new equipment in the Soil Doctor process. Commercially available equipment and parts were taken and modified for the specific tasks. Lewis was also instrumental in establishing a standard 2 x 2 foot grid systems approach for the injections.

NOTE:

The work appears to be slanted toward houses. They have treated about 30-40 houses so far.

Phone Interviewer: Tons
Date: 11/30/93

#9424
No. 3

Name: Mr. Larry Schneider
Title: President
Affiliation: Schneider & Justice, Inc.
426 Oakhill Drive
Denton, TX 76201

1. Mr. Schneider cannot tell what is the most innovative aspect of the Soil Doctor. He met Tom Witherspoon and became convinced that the process should give good results.
2. The Soil Doctor was used on one house which was heaving. The total process took 90 days, but the heaving was corrected.
3. Mr. Schneider does not have any numerical data to give us. He says that the Soil Doctor people are very good to work with. The performance warranty given was 3-5 years.
4. Mr. Schneider has heard about PRO CHEM soil stabilizers in Fort Worth, Texas. He never compared them with Soil Doctor. He does not remember the costs for the Soil Doctor treatment

Phone Interviewer: Tons
Date: 11/30/93

#9424
No. 4

Name: Prof. Richard Woods
Title: Associate Chairman
Affiliation: Department of Civil and
Environmental Engineering
University of Michigan
Ann Arbor, Mi 48109-2125

1. Professor Woods thinks that the 250 psi pressure used in injecting the Soil Doctor chemical is very high. It should lift up the whole house.
2. The 2 x 2 feet spacing for the injection holes is on the short side, but it still takes time and pressure to move the injected chemical more than one foot to achieve treatment.
3. Professor Woods has worked with Hayward Baker in Texas on various consulting projects. He thinks that Baker is capable of treating swelling soils under houses.
4. The use of cationic soil treatments is not a new idea. The work of competitors PRO CHEM may be comparable to Soil Doctor.
5. Dick will write his own paragraph for us.

Phone Interviewer: Tons
Date: 12/03/93

#9424
No. 5

Name: Mr. Steve Dial, P.E.
Title: Consultant
Affiliation: Hunt & Joiner
Consulting Engineers
4300 N. Central Expressway
Dallas, Tx 75206

1. Steve Dial is a user. He has had experience with Soil Doctor on three different projects. He says that the Soil Doctor chemical is potassium chloride plus a surfactant. He says that the competition, Hayward Baker and PRO CHEM probably can do clay stabilization as well as Soil Doctor, but he paid \$1.50 to \$2.00 per square foot which is cheaper than the competitor's price.
2. Mr. Witherspoon was the originator of the Soil Doctor. He thinks that another person from the company called Bob Lewis was helping a lot in the field application developments.
3. Steve Dial is a friend of Tom Witherspoon. This is one of the main reasons why Dial used Soil Doctor and not some other competitor. Mr. Dial has used Soil Doctor on three projects (houses) during the past two years.
4. Mr. Dial had problems on one of the projects. They had stabilized a house using the Soil Doctor. A water leak developed in a pipe under the house and "washed" out the treatment. They had to fix the pipe and make new injections. So, Dial is concerned about the durability and longevity of the Soil Doctor.
5. The future looks good for Soil Doctor (and others). The cost is reasonable and people have learned about the availability of chemical treatments.
6. Steve Dial did not know that Tom Witherspoon was going to apply for the NOVA award. He said if we want to try another reference, we could call Garry Williams, Southwest Labs, 214-631-2700. Williams is a geotechnical engineer and he may have done some initial testing for Witherspoon.

Phone Interviewer: Tons
Date: 12/02/93

#9424
No. 6

Name: Donald H. Gray
Title: Professor
Affiliation: Department of Civil and
Environmental Engineering
University of Michigan
Ann Arbor, MI 48109-2125

1. Professor Gray says that the soil stabilizer application using a grid of holes and pipes under pressure is not new. Applications have been made similar to the Soil Doctor technique using lime slurry. Lime treatment, however, does not give a nice uniform product and may not be as effective as chemical treatments.

CONTACTS MADE

Contacts Made

Name: Mr. Steve Dial, P.E.
Title: Consultant
Affiliation: Hunt & Joiner
Consulting Engineers
4300 N. Central Expressway
Dallas, TX 75206

Name: Donald H. Gray
Title: Professor
Affiliation: Department of Civil and
Environmental Engineering
University of Michigan
Ann Arbor, MI 48109-2125

Name: Mr. Bob Lewis
Title: Marketing Director
Affiliation: Soil Doctor, Inc.
1030 E. Beltline Road
Richardson, TX 75081

Name: Mr. Larry Schneider
Title: President
Affiliation: Schneider & Justice, Inc.
426 Oakhill Drive
Denton, TX 76201

Name: Mr. W. Tom Witherspoon
Title: President
Affiliation: Soil Doctor, Inc.
1030 E. Beltline Road
Richardson, TX 75081

Name: Prof. Richard D. Woods
Title: Associate Chairman
Affiliation: Department of Civil and
Environmental Engineering
University of Michigan
Ann Arbor, MI 48109-2125

PRIMARY EXHIBITS

TIMMONS & KELLY

ATTORNEYS AT LAW

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PATENT & TRADEMARK
MATTERS

CABLE PATMARK DALLAS
FAX 214/220-0060

OF COUNSEL
DANIEL RUBIN, P.C.

April 9, 1993

MR W TOM WITHERSPOON
537 E POLK ST
RICHARDSON TX 75081

Re: U.S. Patent Application
"Method and Wand for Injecting a Liquid into the Ground"
Our File: P-9195

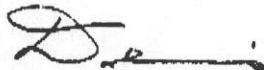
Dear Tom:

Enclosed is a copy of your patent application, and the related formal documents, as filed. We mailed the application to the U.S. Patent and Trademark Office on April 1, 1993.

We will notify you as soon as we receive the official filing receipt from the Patent Office. The filing receipt will indicate the filing date and the serial number of the application.

If you have any questions, please let us know.

Very truly yours,



H. Dennis Kelly

HDK/sm
Enclosures

SOIL DOCTOR'S TREATMENT AND TESTING SPECIFICATION

Soil Samples (Pre-Treatment)

Sampling depth will be the same as treatment depth with a minimum of three (3) shelly tube tests per boring. Frequency shall be one boring per 1500 square feet. Undisturbed soil samples will be extracted at 3 ft., 5 ft., and 7 ft. using a 3" shelly tube. The samples will be wrapped in foil and sealed in clear plastic bags and clearly marked with exact location of bore and sample depth. Sampling to be done by trained Soil Doctor Personnel.

Pre-Treatment Soils Analysis

All pre-treatment analysis shall be performed by an independent geotechnical laboratory. A minimum of three (3) One-Dimensional swell tests shall be conducted in a manner similar to that of ASTM-D3788-80.

Test results shall be reported for a swell of 48 hours duration under a single surcharge load simulating actual loading due to the building and clay overburden.

Treatment

High pressure injection of Soil Doctor, Inc. stabilizer chemical shall be performed by trained personnel using Soil Doctor equipment. Injection to be on 3 ft. centers, to a depth of seven feet, at a pressure of 3,000 PSIG. Treating process will be performed by Soil Doctor, Inc. or equal. Contact Bob Lewis 644-8695.

Post-Treatment Analysis

Soil samples shall be removed for treatment verification 72 hours after treatment. The samples shall be taken in the same manner as described for pre-treatment, and shall be taken from borings in close proximity (6-8 inches) to pre-treat borings. All post treatment analysis shall be performed by the geotech engineer testing pre-treatment samples; using identical methods.

Verification

Pre and post treatment boring logs and shrink-swell characteristics shall be submitted to Engineer of Record within 3 working days after receipt by Soil Doctor.

SOIL DOCTOR INJECTION PROCEDURE

Purpose

Soil Doctor chemical stabilizer has been designed to chemically alter the ionic attraction of clay soils to water. This chemical makes an ion exchange with interstitial clay particles and retards the clay sheet separation as a result of water clay molecular formations. It also remains soluble in water and only leaves in the form of precipitate after evaporation.

Procedure

It is intended that the active clays be injected to a depth commensurate with seasonal moisture changes. If, however, reactive water is probably at deeper depths, this procedure can be extended to include these zones.

Perimeter- Injection at the perimeter shall be implemented by using a high pressure wand to force the chemical into impermeable clays. While the normal depth is 9', soil tests may necessitate deeper injection. Standard injection spacing is 3' on center at a distance of 6" from the perimeter of the house. Pressure at the nozzle shall be not less than 1,800 psi and shall be injected at a 4 point laterally and downward with the use of a 40° nozzle. I.D. of the wand shall be not less than 1/4" and the penetration rate of the nozzle shall be less than 1 foot per 10 seconds.

Interior- Holes shall be drilled in the concrete floor, 1/2" in diameter through the slab to allow for injection. These holes shall be 3' on center over the entire area of the facility. Injection shall then be made by using a high pressure wand to force the chemical into impermeable clays. While the normal depth is 9', soil tests may necessitate deeper injection. Pressure at the nozzle shall be not less than 1,800 psi and shall be injected at a 4 point laterally and downward with the use of a 40° nozzle. I.D. of the wand shall be not less than 1/4" and the penetration rate of the nozzle shall be less than 1 foot per 10 seconds. If required, packing shall be set at the floor level to ensure no returns during the injection process. Care shall be taken to locate and avoid plumbing during this process. Should rupture of these lines occur, this process shall be discontinued until same can be repaired.

SECONDARY EXHIBITS

S & W FOUNDATION



Owned & operated by
W. Tom Witherspoon
B.S.C.E. Southern Methodist Univ.
M.S.M.A.S. -- U. T. at Dallas
Registered Professional Engineer
Registered Professional Land Surveyor
Licensed Irrigator
Amer. Soc. of Civil Engineers
Amer. Soc. of Petroleum Engineers
Amer. Soc. of Petroleum Geologists
One current patent pending
Over twenty years experience in
construction, drilling and engineering
Author and speaker

No other foundation repair contractor can come close to the technical expertise and equipment capability of S & W Foundation. While S & W has been the expert in remote pier drilling and grout injection; we have also become experts in epoxy injection, structural repairs and drainage corrections. All of these areas are done strictly in house. This allows us to provide a complete service for your every need.

Our field superintendents combine experience with technical knowledge to provide the best onsite capability possible.

SCHNEIDER & JUSTICE, INC.
BUILDERS/DEVELOPERS
426 Oakhill Drive
Denton, Texas 76201
817-387-9870

January 12, 1993

Soil Doctor, Inc.
1030 E. Beltline Road
Richardson, Texas 75081

Re: Chemical Injection

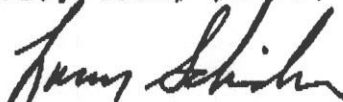
Gentlemen:

You injected your chemical treatment through the slab at 2213 Oak Park Drive in Denton, Texas in an attempt to stabilize the upheaval and consolidate the bearing clays. I must say that I was elated with the results. Not only did the upheaval stabilize, but it appears to have settled the slab and put the doors in good operation. Cracks in the slab, which previously were in excess of 1/4", now are approaching 1/16" and the back door operates correctly.

Although you were very conservative in your sales presentation, the results are more than acceptable. Since I was facing a lawsuit of a large magnitude, this stabilization technique should save me thousands in remedial repair costs and maintain my good reputation.

Thanks again for your assistance in this matter and feel free to have any of your potential customers call me for a personal confirmation of this product.

Very truly yours,


Larry Schneider, Pres.

LS/ms

FOUNDATION MAINTENANCE PROGRAM

Soils in the North Texas area generally consist of a high concentration of water-sensitive clays which imparts to them qualities of excessive expansion when wet and shrinkage when dry. This cyclic motion of the soil in turn causes differential movement of and undue stress to the structural elements of buildings resulting in cracked and unlevel floors, cracks in masonry and drywall and tight doors and windows. Key to the minimization of these problems are proper drainage away from the structure and a consistent watering program. Maintenance of a more constant soil moisture content adjacent to the structure's foundation by implementation of the following guidelines will minimize soil movement resulting in less stress and longer service life of the structure.

DRAINAGE

Soil slopes of approximately one inch per foot away from the perimeter beam of the structure should be maintained for a distance of three to four feet. Soil should be predominantly clay to facilitate the shedding of water. Sand or other porous materials should not be used. Soil levels against the concrete perimeter beam should be approximately two inches below the brick ledge of a slab type foundation and should be about half way up on the beam of a pier and beam foundation.

Swales are normally incorporated into soil grading between structures to carry water into drainage channels or storm sewers. These features should never be altered by the addition of fill material or blocked by construction of landscaping beds, structures, etc.

Gutters and downspouts are helpful in improving drainage away from a structure and reducing erosion adjacent to the perimeter beam. Downspouts should have extensions and splash blocks and should discharge onto the ground at least two feet away from the structure.

Flower bed curbs or walls near the foundation may cause water entrapment and entry into the structure. Beds should be filled with porous soils and the surface should be maintained two inches below the slab to prevent water entry to the structure. Drains or weep-holes should be installed in flower beds near ground level to assist in the drainage of water.

WATERING

Water can be removed from soil adjacent to and under the foundation by roots of trees or shrubs and by evaporation. Whenever cracking of the soil occurs or soil shrinks away from the foundation, the moisture level is too low. Care should be exercised when planting trees and shrubs. A good rule-of-thumb is to locate plants such that at maturity the foliage does not cross the vertical plane of the foundation.

Water should be added in a deliberate and systematic manner using an automatic sprinkler system or by installation of soaker hoses placed eighteen inches from the foundation and at a depth of six to ten inches. Water should be applied very slowly for at least one hour or until runoff is observed. A suggested watering frequency is four or five times weekly during the dry seasons and less during the remainder of the year.