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FINAL REPORT

ON

THERMALLY MODIFIED SAND

DEMONSTRATION PROJECT

PREPARED FOR

Mr. Elliott P. Levine, Inventions Coordinator
U.S. Department of Energy
Inventions and Innovation Division
Mail Stop EE-521
1000 Independence Avenue, SW
Washington, D.C. 20585

GE²T PROJECT No. 93093

September 23, 1994

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FINAL REPORT

ON

THERMALLY MODIFIED SAND

DEMONSTRATION PROJECT

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I BACKGROUND

The use of salt and salt/sand mixtures on icy roadway surfaces has dramatically increased during the past 30 years. Despite extensive documentation on salt related damage to the roadway improvements, vehicles and the environment, road maintenance departments have continued to rely on this practice as a means to maintain "June travel in January" road conditions - commonly referred to as the "bare pavement policy".

Road maintenance departments in northern climate areas have long recognized the safety benefits for public mobility on icy roadways from the use of sand. As an abrasive material, the sand improves the surface traction that results in more drivable and less hazardous road conditions during the winter months. In moderate temperature areas, down to 20°F, salt is used as an effective deicer. In colder areas where temperatures drop below 20°F, salt becomes ineffective and pure sand is normally used as an abrasive on icy roadways.

Stockpiles of pure sand stored during the winter months oftentimes freeze into large unworkable, monolithic piles. To maintain a free-flowing condition, it has been found to be necessary to add salt to the sand. The addition of salt in amounts ranging from 5 to 10 percent to that of sand, is usually sufficient to provide relatively free-flowing abrasive material that could be stored in stockpiles and applied to icy road surfaces with conventional sand spreading trucks. Another alternative for winter storage of pure sand to maintain a free-flowing condition is in humidity-controlled, heated buildings. As would be expected, this method has high capital and operating costs, and not cost effective for general highway maintenance use.

The invention demonstrated herein is a method of thermally modifying pure sand that will remain in a free-flowing state throughout the winter season without the need for the salt additive. The thermally modified sand provides an abrasive material that when applied to icy roads does not cause environmental and corrosive damage as done by the application of sand with salt. This alternative method for producing free-flowing sand, referred to as Thermally Modified Sand (TMS), was developed and patented by Mr. Dino Talavera of Wasilla, Alaska.

It is the simplicity of Mr. Dino Talavera's invention that makes the Thermally Modified Sand process extraordinary and novel. By employing a very simple process of freezing screened sand particles by forced air convection under subfreezing conditions, the invention creates a product that has significant value in terms of economic and environmental benefits. Since salt additive is not needed for maintaining a free-flowing sand condition, the invention substantially reduces material costs and eliminates environmental damage.

With the exception of the fan unit, the TMS process utilizes sand production equipment that is typically used in gravel production yards across the country. The process is entirely open to the natural elements of which it is dependent, i.e., the ambient temperature of the air. When the ambient air temperature falls below freezing, a fan is used to force subfreezing air through the sand particles as they fall from the conveyor belt into a stockpile. The forced air movement imparted from the fan freezes the moisture on the sand particles as it falls to the ground. When stockpiled, the frozen sand particles do not adhere to one another and remain in a free-flowing condition.

PHOTO 1 - Processing Equipment Used in This Demonstration Project
To Produce Thermally Modified Sand

On June 1, 1992, Mr. Talavera submitted a grant application (prepared by GE²T) to the U.S. Department of Energy (DOE). The application was submitted for a grant from DOE's Energy-Related Inventions Program (ERIP). The grant was approved by DOE's Inventions and Innovation Division on September 22, 1993. The grant recipient was Thermally Modified Sand, Incorporated, and Mr. Dino Talavera was designated as the Recipient Project Director. Mr. Elliott P. Levine represented DOE as the Inventions Coordinator on this grant.

II STATEMENT OF WORK

Project Aim

The project aim was to demonstrate the suitability of Thermally Modified Sand (TMS) for large scale use by the State of Alaska Department of Transportation & Public Facilities (ADOT&PF) for the treatment of icy state roadways. The DOE funded the production of a commercial quantity of TMS material sufficient in volume to conduct the large scale demonstration project.

Project Objective

The objective of the demonstration project was to have the ADOT&PF's Operation & Maintenance Section use Thermally Modified Sand for the treatment of icy state roadways. The demonstration project involved the production and use of approximately 2,600 cubic yards of TMS material.

The field test results were to be used to compare similar sections of icy roadways treated by ADOT&PF with conventional salted sand to the road test sections treated with TMS material. The demonstration project took place on state maintained roadways located in the south central area of Alaska, where typical air temperatures persist below freezing throughout most of the winter. The project study area is shown on the vicinity map in the Attachment Section of this report. The demonstration project also included the evaluation on the workability of a stockpile of TMS material that was left undisturbed throughout the 1993/94 winter season.

The work plan consisted of the following five (5) Tasks:

Task 1 - Production of Thermally Modified Sand (TMS)

Task 2 - Construction of Two (2) Stockpiles of TMS Material

Task 3 - Application of TMS Material to Icy Roadways Maintained by the State of Alaska

Task 4 - Evaluation of Undisturbed Long-Term Storage Stockpile of TMS Material

Task 5 - Preparation of Quarterly and Final Reports

III WORK PLAN TASKS

The following section presents a summary of the work performed on the completion of the five (5) work plan tasks.

TASK 1 - PRODUCTION OF THERMALLY MODIFIED SAND (TMS)

Under this task, Mr. Talavera mobilized his TMS processing equipment during the month of September 1993 to the ADOT&PF maintenance facility in Palmer, Alaska. On October 13, 1993, approximately 2,600 cubic yards of pure sand was delivered to the Palmer Maintenance Facility for the TMS demonstration project. The stockpile of pure sand designated for the TMS project was kept separate from ADOT&PF's 13,000 cubic yard sand stockpile that was mixed with salt. By mid-October 1993, Mr. Talavera began processing TMS material during the night-time hours when the air temperatures fell below freezing. By the end of January 1994 he had processed approximately 1,600 cubic yards of TMS material. The remaining 1,000 cubic yards of unprocessed sand was stockpiled for the remainder of the winter in the TMS material processing area.

PHOTO 2 - TMS Processing Equipment Setup at the ADOT & PF Palmer Maintenance Facility. Stockpiles of Pure Sand for the Demonstration Project are to the Left of the Processing Equipment.

The original work plan proposed the production of approximately 2,500 cubic yards of TMS material that was to be used in this demonstration project. However, the south central area of Alaska, where this demonstration project was conducted, experienced a relatively warm winter with record high temperatures summarized as follows:

The average winter temperature of 1993 was approximately 6°F higher than the historical average for the Anchorage area. Also, the month of January 1994 was the tenth warmest January on record for the Anchorage area where the average temperature was approximately 5°F higher than the historical average for January in the Anchorage area. A newspaper article on the unusual warm temperature titled *Anchorage Goes Tropical* was featured in the Anchorage Daily News on February 1, 1994 (a copy of the article is enclosed in the Attachment Section to this report).

Consequently, the warmer than usual air temperatures caused difficulties in the production and storage of the TMS material. Mr. Talavera was unable to effectively process all of the 2,500 cubic yards of sand.

A detailed description of the processing effort and the amount of TMS material produced by Mr. Talavera was described in the Second Quarter Technical Progress Report dated June 14, 1994, prepared by GE²T. It was observed, however, that the apparent ideal weather condition for processing TMS material occurred on January 11, 1994. The air temperature dropped to 9°F with a light wind condition. The rate of TMS production was estimated to be 1 cubic yard per minute.

TASK 2 - CONSTRUCTION OF TWO (2) STOCKPILES OF TMS MATERIAL

Technical Progress Report No. 2 described the stockpiling of approximately 300 cubic yards of TMS material that was set aside for the TMS long-term storage test pile.

PHOTO 3 - 300 Cubic Yard Stockpile of TMS Material That Was Used to Evaluate the Long-Term Storage of TMS.

The approximate locations of the staging area for the processing of TMS material and the various stockpiles of sand are shown on the Site Plan Map (FIGURE 3) provided in the Attachment Section to this report. The locations of the thermistor probes are shown in the long-term storage stockpile. Also, the long-term storage stockpile was located on the north site of the new maintenance garage and was therefore in the shadow of the garage building during most of the winter months.

Approximately 1,200 cubic yards of sand was processed into TMS material for use by ADOT&PF. The processed material was located in the maintenance yard for easy access during the winter months of January through March. The remaining unprocessed sand material was spread over the staging area at a depth of approximately 4-feet.

PHOTO 4 - Staging Area for the Processing of the TMS Material.
The Stockpiles were Separated Into Processed and Unprocessed Material.
Placards were Placed on Various Piles to Direct ADOT&PF on Their Use.

Because of concerns raised by Mr. Talavera about salt contamination during the later stages of the demonstration project, representative soil samples were collected by Mr. Peter Curtis of GE²T and analyzed for salt content. Provided in the Attachment Section is Lab Reference No. 394084 prepared by GE²T that summarized the test results for salt content in the soil samples. Six (6) soil samples were collected and the conductivity levels of the prepared sample were measured. The conductivity levels were used to roughly estimate the percent salt by weight. The percent of salt was very low with the highest level of 0.5% and the low level was less than 0.1%. These levels are low when compared to the prepared salt pile that was used by the ADOT&PF where the estimated salt content was on the order of 5 to 10% by weight.

TASK 3 - APPLICATION OF TMS MATERIAL TO ICY ROADWAYS MAINTAINED BY THE STATE OF ALASKA

Under this task, the processed TMS material was to be loaded into ADOT&PF's sand spreading trucks for application to road test sections located in the project study area. A detailed description of the sand spreading operation was provided in the First and Second Quarter Technical Progress Reports prepared by GE²T.

PHOTO 5 - A Small Test Pile of TMS Material is Being Scooped Up By a Loader.

PHOTO 6 - TMS Material Being Dumped By the Loader Into an ADOT&PF Sand Spreading Truck.

PHOTO 7 - TMS Material Being Discharged From the Sand Spreading Apparatus on the Sander Truck.

During this demonstration project several attempts were made to apply the TMS material onto the state maintained roads. Some of the loads were satisfactorily applied to the state highways. However, several loads were found not to have free-flowing characteristics. In these cases the TMS material "cemented" in the truck's sand bin, and did not evenly discharge from the sand spreader unit.

The first application of TMS material occurred on October 26, 1993, and was reported to have been a successful application. Several of the trips with the sanding equipment were photographed and video-taped by Mr. Talavera and GE²T personnel. Photographs were also taken to document the icy road conditions and affect of the TMS sand compared to road sections applied with salted sand.

PHOTO 8 (left) - TMS Material Applied to a Slightly Icy Road Surface.

PHOTO 9 (right) - TMS Material Applied to Ice Packed Road on March 17, 1994. Note the Large Clumps of Cemented TMS Material.

It appeared that the unusually warm air temperatures may have been a factor in causing the TMS material to "cement" in the vibrating bin of the sanding truck. Based on GE²T's microscopic examination of the soil grains in the long-term storage TMS stockpile, it appeared that the individual TMS grains were coated with a film of frozen water. Whereas, the thawed and re-frozen TMS sand grains had distinct ice crystals that cemented to one another. It is possible that a slight melting effect on the frozen TMS particles at a critical temperature may have contributed to the cementation behavior of the TMS as it was being delivered to the road test sections in the vibrating bins. These were assumptions made by Mr. Robert E. Gilfilian, P.E., based on limited field observations, and require further testing to determine the cause of cementation.

PHOTO 11 (above) - Cemented TMS Material in the Base of the Truck's Sand Bin on the Conveyor Device.

PHOTO 10 (left) - Mr. Talavera on Top of Sanding Truck Attempting to Free the Cemented TMS Material. Mr. Chris Kepler of ADOT&PF is Observing the Discharge End of the Spreader Device.

TASK 4 - EVALUATION OF UNDISTURBED LONG-TERM STORAGE STOCKPILE OF TMS MATERIAL

Under this task, a 300 cubic yard stockpile of TMS material was produced by Mr. Talavera in October 1993 and set aside for long-term monitoring purposes. The condition of the stockpile was checked by personnel from GE²T on a one to two week basis throughout the winter season. The stockpile was left undisturbed and not used for road application purposes.

Two (2) arrays of thermistor probes were installed in the 300 cubic yard long-term storage stockpile that was located on the north side of the maintenance building shown in FIGURE 3. The thermistors were calibrated prior to use with two (2) fixed temperature reference points. An array of thermistors was installed on the south and north sides of the stockpiles at depths of 12, 24 and 36-inches below the surface. A calibrated thermistor probe was used to measure the air temperature, approximately 12-inches above the surface of the stockpile.

PHOTO 12 - Temperature Measurements being Recorded in the Long-Term Storage TMS Stockpile.

PHOTO 13 - Probing the Long-Term Storage TMS Stockpile to Determine the Free-Flowing Characteristics of the TMS Material.

A summary of the stockpile temperature measurements, free-flowing sand characteristics and weather conditions are given in the Table (2 pages) provided in the Attachment Section. Graphs of the temperatures measured in the south and north side thermistor arrays in the long-term storage stockpile are presented below.

LONG-TERM TEST STOCKPILE

Southside Temperatures

LONG-TERM TEST STOCKPILE

Northside Temperature

Overall, the temperature profiles indicated no unusual behavior throughout the duration of this demonstration project. All of the temperatures in the stockpile were below the freezing point until the spring breakup. As would be expected, colder temperatures were recorded in the deeper sections of the stockpile. Also, the soil temperatures on the north side of the stockpile were typically two to three degrees centigrade colder than the south facing side of the stockpile.

It is interesting to note that the warm spell that occurred at the end of January and the beginning of February 1994 raised the soil temperature in the stockpile but did cause the temperature to go above the freezing point. During this time, however, the surface soil on the stockpile had thawed and subsequently re-froze.

On February 28, 1994, Mr. Gilfilian collected representative samples from the long-term storage stockpile. He examined the TMS material under a microscope in the field. A description of his findings were reported in a memorandum that was included in Technical Progress Report No. 2. The findings of the microscopic examination noted the following differences in the appearance of ice in soil samples collected at the 6-inch depth (consisting of re-frozen TMS) and a free-flowing sand sample collected at the depth of 20-inches below the surface of the stockpile:

- * The re-frozen TMS from the 6-inch depth contained numerous distinct ice crystals that appeared to be the size of the fine to medium sand particles. There also appeared to be film of frozen water on the individual sand particles. This was determined by placing a warm point of a pen on the soil particles that caused moisture to appear on the soil particles.
- * The sample of the free-flowing TMS collected at the 20-inch depth did not contain any visible ice crystals. Similar to the above observations of the sample from the 6-inch depth, there appeared to be film of ice on the individual sand particles.

The sample from the 6-inch depth consisted of TMS that experienced several freeze-thaw cycles. The above observations were used in the assumption on the cementation of the TMS material in the vibrating truck bin explained under TASK 3

TASK 5 - REPORT PREPARATION

This task consisted of the preparation of two (2) quarterly technical progress reports and this final report on the TMS Demonstration Project. Since the completion of the second quarter reporting period, a memorandum prepared by Mr. Peter Curtis of GE²T on April 4, 1994, described the field inspection of the TMS stockpiles with Mr. Talavera. Also, on March 24, 1994, Mr. Chris Kepler, P.E., sent a letter to GE²T that summarized the ADOT&PF observations on the use of the TMS material during this demonstration project. A copy of these correspondences are provided in the Attachment Section.

IV CONCLUSIONS AND RECOMMENDATIONS

The unusually warm air temperatures that were experienced during the winter season of 1993-1994 in the Southcentral area of Alaska were believed to be a significant factor that hampered the implementation of the TMS demonstration project. The warm temperatures delayed the production of TMS material. Also, the warmer temperatures may have caused the cementation of TMS in the vibrating sanding truck bins as the result of transfer of energy (heat from frictional forces) that caused frozen soil grains to cement or bind to one another. The apparent cementation reduced the free-flowing characteristics of the TMS material.

During times of colder temperature, particularly at the beginning of the demonstration project, the TMS material had satisfactory characteristics for the treatment of icy roadways. Based on the observations made during this demonstration project, it appeared the use of TMS material for the treatment of icy roadways in Northern regions of Alaska that experience colder ambient temperatures would be suitable for the use of TMS material in lieu of salt and sand mixtures. Further study for this application of TMS material appears to be warranted.

ATTACHMENTS

MAP OF PROJECT STUDY AREA

TMS - FIELD REPORTING

LAB RESULTS

CORRESPONDENCE AND MEMOS

FIGURE 1 - FINAL REPORT - THERMALLY MODIFIED SAND

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2605 Denali St., Suite 203, Anchorage, Alaska 99503-2749

SCALE: N.T.S.

DATE: 9/22/94

GEI PROJECT NO. 93093

THERMALLY MODIFIED SAND

Mail-Su Office: 1800 E. Parks Highway, Suite D-100, Wasilla, Alaska 99554
Anchorage Office: 255 E. Pinewood Ln., Suite 102, Anchorage, Alaska 99503

SCALE: 1" = 100'

FIGURE 3 - SITE PLAN OF TMS STAGING AREA
ADOT&PF PALMER MAINTENANCE FACILITY - LOT H-2B, PALMER INDUSTRIAL PARK, PALMER, AK

GILFILIAN ENGINEERING &
ENVIRONMENTAL TESTING, INC.

2605 Denali St., Suite 203, Anchorage, Alaska 99503-2749

SCALE: 1" = 100'

DATE: 9/22/94

GEI PROJECT NO. 93093

Motorists deal with a wet road and glaring sun on the Minnesota Bypass on Monday. Unseasonably warm weather, which has melted snow and ice, has made for sloppy driving all over the city.

Anchorage goes tropical

Jet stream delivers spring-like temperatures to city

By SHEILA TOOMEY 2/1/94
Daily News reporter

Somewhere in the Pacific, north of the equator, a whole lot of warm air is surely missing.

Suspicion has focused on the jet stream, reported to be meandering farther north than usual this year, raising temperatures in southcentral Alaska, melting ice, exposing early potholes and infecting an unwary populace with spring fever just when it expected to be fighting cabin fever.

A 48-degree high on Saturday set a record for the day in Anchorage, the National Weather Service said.

On Friday, the temperature in Honolulu set a record low for the day, plummeting to 56 degrees.

Coincidence, or cosmic convergence?

"It's all your fault," said Glen Trapp of the weather service in Hawaii, looking for someone to blame even though things were back to normal by Monday, meaning 78 degrees and "balmy."

Trapp was kidding. Although weather systems in different

■ **SOCKED IN:** A rare heavy fog blankets southeast Alaska for the fourth day. B-1

■ **FLOODS:** Overflowing rivers take toll in four states. A-3

parts of the globe are related, it's not a one-on-one, we-win, you-lose relationship, the experts say.

In simplest terms, we are warm because "a band of southerly winds is blowing north," said meteorologist Bob Clay of the weather service in Anchorage.

This "ridge" covers the entire West Coast, said Kelly Redmond, regional climatologist with the Western Regional Climate Center in Reno. "Everybody's been above average." And the system is persistent, delivering warmer than normal days with only a few exceptions since mid-December.

Thanks to the jet stream and its ridge, high temperatures in January in Anchorage averaged 5 degrees above normal, while lows were 8 degrees above normal, Clay said.

The jet stream is air that

blows up from the South Pacific, part of Mother Nature's eternal, unsuccessful effort to equalize temperatures around the globe.

"That's the whole function of weather," Redmond said. "Moving warm air north, moving cold air south."

This year, the jet stream is following a more northerly route than normal, he said. Weather people aren't sure why. And it's doubling back on itself, reacting to a infinite number of variables, making predictions very iffy.

Think of it "like a river," Redmond said, "a braided Alaska stream, loopy, that just meanders all over the place."

What we really want to know is whether the spring-like temperatures delivered by this river of warm air will last until the sun and the Earth position themselves for real spring.

They could, they might, but probably won't, seems to be the answer.

Redmond said he wouldn't be surprised if the warmth persisted. But, it usually doesn't

Please see Back Page, **WARM**

A warm January in Anchorage ...

The 10th warmest January on record (Average high temperatures)

... after a very warm winter in 1993

Source: National Weather Service • RON ENGSTROM / Anchorage Daily News

WARM: Anchorage goes tropical

Continued from Page A-1

last that long.

"The best we can do is look out 10 days," Clay said. That forecast says warm weather will continue into next week with some chance

of rain or snow at the end of this week.

"We're going to pay," warned Jack Klingbeil of the state Department of Transportation. His people had just filled in "a car taker" on O'Malley Road, a very large pothole that nor-

mally would not have begun attacking vehicles until sometime in March.

Klingbeil has been watching Alaska winters for 41 years and likens 1994 to 1972. "We were able to crack-seal in February," he said. But over the long term,

all gifts of warm weather are balanced by attacks of cold weather, he warned.

"If it holds through February," Clay said, "there's a good chance of no more bitter cold." But, he noted, "Weather is so unpredictable."

**TMS - FIELD REPORT
GE²T 93093**

Sheet 1 of 2

DATE	12/17/93	12/23/93	12/29/93	01/05/94	01/12/94	01/19/94	01/28/94	02/04/94	02/11/94
AIR TEMPERATURE	-9°C Cloudy no winds	2.6°C Cloudy wind - 15 mph from NW	5.9°C	-5.8°C Cloudy wind - 25 mph	-5.2°C Cloudy light wind	-7.0°C Cloudy no wind	5.4°C Cloudy light wind	2.8°C Cloudy light wind	-13.2°C Clear no wind
TEMPERATURE °C									
Probe 1 - Location: South side 3' below surface	-1.9	-1.1	-0.7	-1.3	-4.0	-3.0	-1.9	-1.0	-0.7
Probe 2 - Location: South side 2' below surface	-1.6	-1.3	-0.9	-3.1	-7.3	-4.5	-2.3	-1.0	-0.9
Probe 3 - Location: South side 1' below surface	-1.5	-1.2	-1.0	-5.7	-9.0	-5.8	-2.0	-0.8	-4.2
Probe 4 - Location: North side 3' below surface							-0.6	-1.3	-1.0
Probe 5 - Location: North side 2' below surface							-0.3	-1.2	-1.5
Probe 6 - Location: North side 1' below surface							0.0	-0.7	-5.2
Observations: - Free Flowing - FF - Frost Depth - FD - Snow Cover - SD - North side - N - South side - S - Not Measured - NM	FF 4" FD 0 SD	1/3 up S. Side FF 3" FD 2" SD	FF: N - 0" S - 1" SC: E - 0" W - 0"	FF: NM FD: NM SC: N - 0 S - 2"	FF: NM FD: N - 36" S - 36" SC: N - 2" S - 1 1/2"	FF: NM FD: N - 32" S - 31" SC: N - 2" S - 1 1/2"	FF: NM FD: NM SC: No Snow	FF: South side to 15" FD: NM SD: No Snow	FF: None FD: NM SD: No Snow

**TMS - FIELD REPORT
GE²T 93093**

Sheet 2 of 2

DATE	02/18/94	02/25/94	03/04/94	03/11/94	03/18/94	03/25/94	04/01/94	04/14/94	
AIR TEMPERATURE	-8.5°C Clear wind - 25 mnh	-14.5°C Clear light wind	-14.0°C Snow light wind	-1.7°C Partly Cloudy light wind	-7.0°C Clear No wind	7.7°C (45°F) Partly Cloudy Windy	10.3°C (50°F) Partly Cloudy - 15 mph wind	10.1°C No Wind Sunny	
TEMPERATURE °C									
Probe 1 - Location: South side 3' below surface	-4.0	-5.9	-4.5	-2.7	-1.3	-1.9	-0.9	-0.9	
Probe 2 - Location: South side 2' below surface	-7.0	-8.5	-5.5	-2.5	-1.2	-2.2	-03.7	-0.4	
Probe 3 - Location: South side 1' below surface	-10.9	-11.2	-5.0	-1.7	-1.1	-1.5	0.0	0.5	
Probe 4 - Location: North side 3' below surface	-5.6	-8.4	-5.3	-3.7	-2.0	-3.5	-1.4	-1.0	
Probe 5 - Location: North side 2' below surface	-9.8	-12.3	-7.5	-3.4	-2.2	-3.4	-1.1	-0.9	
Probe 6 - Location: North side 1' below surface	-13.3	-14.6	-7.7	-2.7	-4.0	-2.1	-0.3	0.0	
Observations: - Free Flowing - FF - Frost Depth - FD - Snow Cover - SC - North side - N - South side - S - Not Measured - NM * Stockpile thawed due to high temperatures	FF: NM FD: NM SD: No Snow	FF: N - 0 S - 0 FD: N - 19" S - NM SC: No Snow	FF: NM FD: NM SC: 6 - 12" new snow	FF: N - 0 S - 0 FD: N - NM S - 6" SC: N - 0 S - 6"	FF: N - 7" S - 2" FD: N - 7" S - 2" SC: N - 1" S - 3-6"	FF: N - S - FD: N - 2* S - 2* SC: No Snow	FF: N - 19" E - 30" S - 33" W - 17"	Only Occ. frost in Pile at 7"	

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MEMORANDUM

TO: TMS Demonstration Project
GE²T Project No. 93093

FROM: C. Peter Curtis

DATE: April 4, 1994

SUBJECT: TMS Soil Samples - Free Flow

Arrived at project site on April 4, 1994, at 1:10 P.M. Collected temperatures from the "pilot" stockpile and pulled temperature probes. The southside probe was completely in the thaw zone, and the probe was easily removed.

The northside probe was frozen into the stockpile 2' to 3' in depth. Frost had to be chipped away to obtain the probe.

Dino Talevera was on-site and asked me to collect 6 grab samples from various locations around the processing area. Two samples were collected from the stockpiles, and 4 samples were collected from the staging area. When I drove to the staging process area, the van became stuck in saturated sand. Dino Talevera had dug four test pits 3' to 4' deep through the sand to be processed last winter in and around the staging area.

Dino Talevera dug a test pit 5' from the south edge of the test "pilot" stockpile which was thawed from 32" to 36" and "freeze dry" below this depth. The TMS material became free-flowing with some effort by using a shovel. The temperature at "freeze dry" is -0.9° C.

Dino Talevera requested the salt content be measured on the 6 grab samples collected from the processing area before he reshapes the several stockpiles. Dino Talevera left the site at 1:45 P.M.

Peter Curtis took pictures and then left the site at 2:15 P.M.

GILFILIAN ENGINEERING & ENVIRONMENTAL TESTING, INC.

Professional Environmental Consultants

Main Office: 255 E. Fireweed Lane, Suite 102, Anchorage, Alaska 99503-2025
(907) 277-2021 • FAX (907) 274-8683

Mat-Su Office: 1800 E. Parks Highway, Suite D-100, Wasilla, Alaska 99654
(907) 376-3005 • FAX (907) 373-3686

LAB REFERENCE NO. 394084

CLIENT: Dino Talevera

GE²T PROJECT: 93093

LEGAL/PROJECT NAME: TMS Sand

PRIVATE: PUBLIC (LIST STATE ID NO.):

DATE RECEIVED: 4/4/94 TIME RECEIVED:

DATE SAMPLED: 4/4/94 TIME SAMPLED: SAMPLED BY Peter Curtis

Sample No.	Description	Dry Soil Weight (gram)	Conductivity (mS/cm)	% Salt by Weight
1	Between TMS and Stockpile	15.11	0.049	0.2%
2	TMS Stockpile	15.17	0.069	0.2%
3	4' Below Surface Face of TMS	15.27	0.147	0.5%
4	2' BGS South Face of TMS	14.69	0.040	0.1%
5	3' BGS Between TMS & Stockpile to East	17.30	0.008	<0.1%
6	South Face of Stockpile Sand Ready to be Processed	15.62	0.004	<0.1%

NOTE: These levels indicate probable natural salt content.

BGS - Below Ground Surface

This analysis was performed by: Gilfilian Engineering & Environmental Testing

If you have any questions concerning the above results, please call me at 376-3005.

Cheryl Fultz, Water Lab Manager

4/11/94
Date

STATE OF ALASKA

DEPARTMENT OF TRANSPORTATION AND PUBLIC FACILITIES

CENTRAL REGION — DIVISION OF MAINTENANCE & OPERATIONS

WALTER J. HICKEL, GOVERNOR

3/28/94

4111 AVIATION AVENUE
P.O. BOX 196900
ANCHORAGE, ALASKA 99519-6900
(FAX 243-1512)

March 24, 1994

Robert Gilfillian, P.E.
Gilfillian Engineering & Environmental Testing, Inc.
255 E. Fireweed Lane, Suite 102
Anchorage, Ak 99503

Re: TMS Sand Project

Dear Bob:

Peter Curtis from your Wasilla office called me this morning and we discussed the future of the TMS Sand project.

In our opinion, the project should be terminated. The weather is too warm to make TMS sand and with the failure of the last truck test last week, it seems appropriate to stop.

Dino, or someone, needs to come up with a way to haul and distribute the sand that will work. Having the sand continually "freezing up" in the box is not acceptable. Also, in a true operational situation, no one could afford or rely on all the effort Dino put into processing the sand piles.

We don't believe that the sand was successful on the Palmer Fishhook test section. Unfortunately, that part of the test did not go very long, so good, solid conclusions are probably premature. However, we did observe that the snow pack and/or ice did not melt off except in the sun, and that was only because it was still early in the winter and it was relatively warm. The sand did provide some traction, but it took more loads of sand to accomplish the same benefit as the salted sand.

We did see one possible use for the sand. Early in the winter, before the sand would freeze, it could be used on gravel side roads where we don't want the snow pack to melt. This period of time would be short, however, and we would have to begin using dry chips as we normally do when the temperature dropped.

Robert Gilfillian, P.E.

-2-

March 24, 1994

It is regretful that the project was not more successful - mostly for Dino's sake. He worked hard and went through a lot of mental and physical anguish. He deserves an "A" for effort.

If you wish to discuss this, please call. It has been a real pleasure working with all of you.

Sincerely,

A handwritten signature in cursive script, appearing to read "K. Chris Kepler".

K. Chris Kepler, P.E.
MatSu District Superintendent

cc: Boyd Brownfield, P.E., M&O Director, Central Region

KCK/srf