UNITED NATIONS
United Nations Stabilization Mission
in Haiti

MINUSTAH

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Mission Des Nations Unies Pour
La Stabilisation en Haiti

TO WHOM IT MAY CONCERN

This is to certify that from 25 to 27 J une, 2012, MINUSTAH Military Engineers carried out a pilot project u sing the AGGREBIND © product for surface stabilizat ion . The test was done on a stretch of d i rt road (100 meters long by six meters wide) on Tabarre 52, Port au-Pri111ce, Haiti. Mr. Robert Friedman, President and representative of AGGREBIND ©, was present to supervise and guide the test by MIN USTA H.

The test was successfu lly completed by the Brazilian Engineering Company (BRAENGCOY), one of MIN USTA H's six military engineering companies. The Mission Projects Cell (MPC) and Military Engineering Branch (U8) managed the coordination with AGGREBIND <D to plan and implement the test.

The ti me-frame of i mplementation and the initial results were quite satisfactory. We look forward to monitoring the stretch of road completed to observe the long-term results as the road experiences its usual traffic flow.

Port-au-Prince, Haiti
29 June 2012

Malek KABBANI
Chief Mission Projects Cell
MINUSTAH

Malek Kabbani
Chief, Mission Project Cell

UN MINUSTAH HAITI

Tabarre 52 Test Road at the National Police Unit Before

Tabarre Road Test Report to
MINUSTAH HAITI

Side One, the inner side, was opened within two hours of completion.
Side Two, the outer side, was opened after six hours of completion.

AggreBind is a cross-linking styrene acrylic polymer that gets progressively stronger and more resilent with the passage of time. The maximize time for full compression stength is 28 days. The process of curing is by the evaporation of the moisture and the chemical action of the cross linking. Roads are opened within two hours, as a matter of necessity, with no affect to the curing. When situations permit, it is good to allow more time before opening the road.

It is not necessary to bring in prepared materials, as AggreBind is designed to work with insitu (on site) materials within parameters. I was not advised in advance that we were to use materials other than what was on site.

The slight orange-peel effect on Side Two was the result of an extremely quick evaporation rate and over compacting. It was agreed with Cpt Bandeira that the smaller compacter used on Side One was better suited for the job.

On Side One the distribution of the AggreBind:Water mixture was completely disbursed in five separate passes, then disc hoe mixed in, vibro compacted and top sealed. On Side Two we disc hoe mixed after each release of the AggreBind:Water mixture and then disc hoe mixed in, vibro compacted and top sealed. The sequence of 5 releases and 5 mixes is better than a full disbursment followed by mixing. The scars or patches caused by the grader were filled in with a slurry mix of the soil and AggreBind.

These patches set very quickly. The patched areas were barely discernible from the rest of the road.

One of the patched areas

See the attached protocol for patching.
AggreBind will bind to asphalt roads and cement roads.

Smoothness of the road surface:

- Side Two is smoother than Side One.
- Side One was opened in 2 hours and the stone piles along the shoulder fell onto the new surface.
- Side Two was closed for 6 hours after completion. The side piles were sand and soil that only created dust.
- AggreBind is a cross-linked styrene acrylic polymer that begins to set immediately. While two hours is absolutely OK with cleaned shoulder (no debris falling in), when possible, overnight is better.

There is an area that bothers me. It is in the middle of the road and across from the driveway entrance to the National Police. Slurry mix was placed in there. It is possible that this patched section was opened up too soon. (The crew needed to leave at 12:30PM. They did not want to leave cones on the road feeling the cones would be stolen. I did not insist that they post someone on the spot for two hours more.) The remedy is to make another AggreBind slurry (soil/sand & AggreBind) and place it in the area. I would continue to observe that small area to confirm that the surface was damaged by the grader and that there is no moving water underneath the road. (This is where the water pipe leaked and was replaced.)

I compliment the crew on their work. While this was a test it was also a learning process for the men. Doing a road is much easier than doing a 100 meter test with a limited amount of material.

AggreBind is a purveyor of a unique polymer for road stabilization and block manufacturing.

Prepared by June 28, 2012
Robert D. Friedman
Partner - AggreBind

Recommendations for future work

Soil, rocks and stones migrated into the road from passing trucks (wider than cars) and kicked
these loose stones into the road. The shoulders should have been cleaned of debris. (This was not seen at night when Side One was being finished.)

When prepared materials are going to be used, excavate the full road before processing. Close one side, excavate, then open and do the same on the second side.

This will prevent the spillage of the excavated materials on to the finished side.
Grading of Side Two tore up sections of Side One, along the middle.

The spillage into the road from the shoulders caused markings and disturbance to the freshly rolled and coated surface of the road. These “scars” can be avoided in the future with a clean work site from shoulder-to-shoulder.

Further, AggreBind in white (dries clear) can be used on the shoulders to spray the loose material.

- This would eliminate the ambient dust and dirt from rolling onto the roads.
- Would make the road safer and healthier for both motorists and pedestrians.
- It would also reduce vehicle maintenance costs.

If the road sides were sloped (pitched outward) it would reduce or eliminate the surface water on the road after heavy rainstorms.

Piles left on the sides caused unnecessary work. These were finally removed at the end of the project. This piles should have been removed at the beginning so that there would have been clean working areas.

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BRAZILIAN ENGINEERING COMPANY

ENGINEERING FINAL REPORT – IWO NR 358/U-8 Ops

Data	18 June 2012
Mission	AggreBind Test
Document	IWO NR 358/U-8 Ops
Location	Tabarre 52 Street (next to Charlie Camp)
Coordinates	N18º 33' 21.25" N, W72º 15' 13.58"
Start	25 June 12
End	27 June 12
Deployed troops	17 troops
Used equipment	01 Loader, 01 Skid steer, 01 roller, 01 grader, 01 light tractor, 01 Plough trailer and 01 Air compressor
Used vehicles	01 Water truck, 02 Dump truck, 01 Truck tractor, 01 low bed and 01 ¾ ton Marrua Jeep
Used material	Sand and AggreBind.
Main activities	Leveling and Compacting
Considerations	According to letter "e", number 2

1. SITUATION

- MINUSTAH was requested to carry out a paving work in order to test the application and resistance of AggreBind, according to IWO 358/U-8 Ops, 18 June 12.

- It is important to highlight that BRAENGCOY was only in charge of paving the street chosen with the product to be tested.

2. EXECUTED WORKS

a. Planning to carry out the works:

In order to allow the flow of vehicles on the road, and in accordance with the representative of the product manufacturing company, BRAENGCOY carried out paving works on the west road lane on 25 June 12. The next day, the team carried out paving works on the opposite lane. The paved stretch is 100 meters long and 06 meters wide. All is as the reconnaissance determined by IWO 342 U8/Ops.

b. PHASE 01: Paving the west road lane:

The lane stretch was set (100 meters long and 03 meters wide) by using sticks every 20 meters, and it was also set a cut level of 15 cm from the natural ground. The cut and the consequently disposal of material are due to the recommendation of the manufacturer to exclude stones whose diameter is over 2.0 cm (these particles are abundant at the site chosen to test the product) from the mixture. Either the cut and disposal of material, or the application of (gravel) sand had been defined by the recce determined by IWO 342 U8/Ops.

After scarifying the soil with the grader, and the consequently disposal of about 75 m 3 of material, the water truck poured water on the soil, and by using the roller, the ground was compacted. After compacting the soil, the ground was leveled by using the grader. Next, a mixture of water and AggreBind to the proportion of 1:8 (AggreBind: water) was applied. It is

Next, a mixture of water and AggreBind to the proportion of 1:8 (AggreBind: water) was applied. It is important to highlight that the proportion used differed from that established by the manual and also determined during the recce (1:3).

The change was a recommendation given by Mr. Robert D. Friedman, the product manufacturer representative.

After finishing the application of the total quantity of the mixture on the road, the mixture (substance-soil) was homogenized by the plough trailer. Once more, the material was compacted by using a roller.

Finally, a sealing mixture was applied to the proportion of 1:3 (AggreBind: water).

The work ended at approximately 09:30 pm. It is important to highlight that during the scarification, a tooth of the scarifier (grader) broke due to the abundant presence of hard rocks and hand Stones at the site. Also, as an adversity and still during scarification, it is important to mention that a water pipe which supplies the HNP facility was broken. All the necessary repairs were done by BRAENGCOY troops and thus they retard the accomplishment of the schedule set for the day.

c. PHASE 02: Paving towards the east side:

The procedure was analogous to the one carried out the day before. The exceptions are listed below:

- Cleaning of the road sides in order to avoid wind and traffic transportations of particles, as requested by Mr. Robert Friedman;
- Application of the mixture to the proportion of 1:7 (AggreBind: water), as requested by Mr. Robert Friedman;
- Homogenization of the mixture and sand simultaneously to the application (in every application of the mixture by the Dump truck, the plough trailer was used as requested by Mr. Robert Friedman);
- Compacting soil with Tandem roller.

d. PHASE 3: Road cleaning for the Chief of MPC verification

On Wednesday, 27 Jun 12, we used the air compressor to clean the road from side to side, from the beginning to the end, so that the Chief of the MPC could check the results. Mr. Malek went to the worksite in the morning, at around 9:00 a.m.

e. Considerations:

Breaking the water pipe which is under the road caused an excessive humidification of the material deposited. Even under a blazing sun, it is possible to state that the excess of water was responsible for the imperfections on the road. Moreover, the intense traffic of vehicles coming and going out of a residence occupied by the HNP also made it difficult the adequate execution of works. It is still important to mention that the intense traffic of trucks full of ramblair, in some occasions, left material on the road and drivers disrespected BRAENGCOY traffic signs as well.

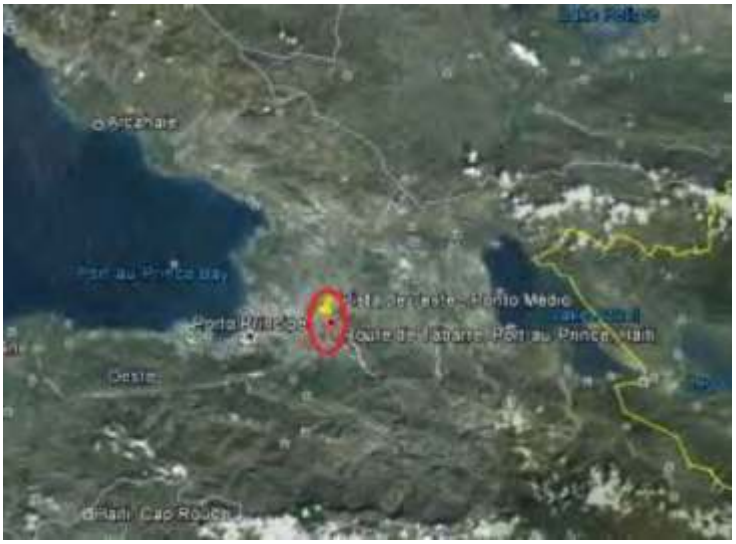
In order to best support the decision, it is recommended that the performance of the paved area be analyzed as time goes by, mainly in relation to the following aspects: resistance to intense traffic and to weather conditions (esp. downpours).

Table 1 summarizes the several procedures adopted and their possible consequences.

PROCEDURE	PHASE1	PHASE 2	POTENTIAL CONSEQUENCE
Cleaning road side areas	Not carried out.	to a great extent of the road	Partially avoids the incidence of particles on the applied mixture, making it easier to visualize results
Mixture proportion AggreBind: Water	1:8	1:7	Lower the proportion of water, better the connections between particles. There was no change on the proportion of the sealing layer (1:3).
Homogenization of the mixture and sand.	After applying all the mixture	Simultaneously with application of the mixture	It was observed that the simultaneous application makes it possible to apparently achieve better results.
Compacting	Roller	Tandem Roller	Compacting by the use of a Tandem roller caused road cracking. This was corrected by applying the sealing layer.
Time to apply the mixture and the sealing layer	At the end of the afternoon and at night	In the middle of the afternoon	The application of the product in the afternoon favors its cure.

3. PHOTOS

a) Location:



Picture 01: General location of the mission

Picture 02: location of the mission

b) Phase 01:

Picture 03: Initial situation and scarification.

Picture 04: Grader broken tooth

Picture 05: Cut and removal of 15 cm of natural soil.

Picture 06: Repair of broken pipe.

Picture 07: Sand application

Picture 08: Ground leveling.

Picture 09: Application of the mixture - Aggrebind: water.

Picture 10: Homogenization.

b) Phase 02:

Picture 11: Compacting

Picture 12: Cleaning the road sides.

Picture 13: Application of the sealing layer

c) Phase 03:

Picture 14: Cleaning the paved area for verification

Picture 15: The imperfection on the road was caused by the excess of water in front of the HNP.

ADRIANO DE PAULA FONTAINHAS BANDEIRA – CPT
Engineer Officer
Brazilian Engineering Company

----- Commentary by Ricardo Sheldon/MINUSTAH/UNFIELDMISSIONS on 15/02/2013 -----

LOCATION OF THE ROUT AND THE HNP/BLTS BUILDING
N 18.33.21 W 72.15.13,9 Tabarre 52

Rout and maingate of the HNP/BLTS

North to South

Excerpted:
Questions from Robert Friedman/AggreBind to the UN Field Missions Haiti in black
Replies from Ricardo Sheldon/MINUSTAH UN Field Mission in green

- We had been informed that the road was removed.
- The road was not removed - It's been completely overtaken by the dust - The Aggrebind layer might be 10 to 15 cm. underneath the actual rolling surface.
- During or before the installation there was a broken water pipe in front of the building. This is pg #18, pic #6 of Cpt Banderas's report.
- That issue of the water leakage was sorted out by that time - The water seen on the picture is due to the rain - The fact that there is an impermeable surface underneath the rolling surface contributes for the water not getting infiltrated through the soil.
- All the water that you see is most probably coming from this pipe.
- See the item above