

Attachment 4
Dust Stop Trial Summary



DUST STOP MUNICIPAL BLEND APPLICATION PROTOCOL

MIX-IN APPLICATION

In some cases, we recommend that Dust Stop Municipal Blend (DSMB) be mixed into the soil. The mix-in application is recommended particularly in situations where:

- 1) The road is composed of a highly compactable / low permeability clay based soil,
- 2) The road will have to endure heavy traffic such as a mine haul roads,
- 3) Any situation where longer lasting results are desired.

DSMB comes in a concentrated liquid form and is easily applied. The advantages to mixing in DSMB are as follows:

- 1) Longer lasting results
- 2) No recirculation requirements in the water truck used for the application
- 3) Can be mixed into hydrophobic materials that are difficult to treat with a topical application.

Equipment Required:

- 1) Grader (or any soil mixing /scarifying equipment)
- 2) Water truck
- 3) Rubber Wheeled Compactor / Loaded Haul Truck

Application Procedures

For the purposes of this application protocol, we will be using the application rate of 4 L / m² of DSMB water mixture. However, in the field, typical mixing ratios and application rates can vary depending on soil type and traffic amounts / type (weight). For this project we will use a dilution rate of 10 % DSMB.

- 1) The first step is to calculate the area that will be covered by the DSMB application. To do so you will need to measure the length and the width of the road. Multiply the length by the width of the road to find out the total area that will be treated.
- 2) For example, if your road is 6 m wide by 1,000 m (1 km) in length, the total treatment area will be 6,000 m².
- 3) Using the example above we can now calculate how much DSMB is required. For an application of 6,000 m², use the typical application rates described above to calculate the amount of product required. The amount of product required is the entire surface area to be treated divided by the typical application rate (4 liters DSMB emulsion/m²) of the product. Therefore 24,000 liters for 6,000 m² means that we will need 2,400 liters of DSMB.

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- 4) When doing mix in applications, it is recommended to scarify / rip the soil to a depth of 4" (10 cm) – 6" (15 cm). To do this, a grader should be used with the ripper attachment. Rip / scarify the entire road surface to the above depth and place all the loosened material evenly over the surface of the road. When dealing with hydrophobic soils it can be necessary to construct retaining windrows and apply the product to the middle of the road. This will prevent loss of product during application.
- 5) Efforts should be made to remove larger aggregate during the ripping / grading process; rocks larger than a fist should be removed.
- 6) DSMB comes in 1,000 liter totes. Each tote comes equipped with a 2" spout at the bottom of the container. Simply attach a 2" quick coupling joint (banjo quick disconnect or similar) to a pump if available or if the product is to be gravity fed into the truck a short section of hose will aid in getting the product in the tank. Ensure that the cap on the tote is loosened / removed to vent the tote.
- 7) Once the soil has been ripped / scarified, and the water truck has been filled with the correct amount of water and DSMB you are ready to apply the solution.
- 8) Apply product as evenly as possible over the desired treatment area. At this stage, apply 3/4 of the product contained in the water truck. The rest will be applied at a later stage (after compaction). 3/4 is just a guide, the correct amount of water / DS mixture should be the volume required to obtain OMC (optimum moisture content) in the loosened soil. The remainder of the product will be applied after. Please see the guideline below for how to measure OMC in a soil.
- 9) After the product has been distributed on the road, begin mixing in windrows, back and forth with the grader. Careful attention should be made by the grader operator to make sure while mixing the windrow, he does not cut any deeper into the road with his blade.
- 10) Once the soil has been thoroughly mixed, and the moisture content is consistent in the windrow, the soil should be spread back out over the surface of the road / re-shaped. A 2% crown is recommended to assist with water drainage after the road is complete.
- 11) Compaction with a rubber wheeled compactor or loaded haul truck can begin. Compaction effort should be distributed evenly over the surface, ensuring to stagger the wheel paths to ensure complete coverage.
- 12) After the compaction is complete, apply the remaining 1/4 of the water and DSMB mix to the surface of the shaped and compacted road. This will enable any surface material to be bound to the material below and will result in a strengthened, dust free road.
- 13) The road is ready to be opened to traffic as soon as it dries. The amount of time it takes to dry can vary depending on the soil / material the product is applied to and the climatic conditions of the day. A general rule of thumb is, the longer you can wait to re-open the road, the better.

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14) Ensure that the water truck is rinsed with water after the completion of the project or at the end of the work day. Utilize the residual product in the rinse water on berms, or areas that border the treated area to help minimize fugitive dust from contaminating the treated area.

The application rate discussed above has been a popular rate in the past. However the application rate that will be applicable for you can be highly dependent on your soil type. **Please contact your local representative for suggestions on what rate would be best applicable for your requirements.*

*** The amount of water used in any particular application will vary depending on the soil conditions. The above are merely suggestions that should be very close to your actual requirements***

The above protocol is supplied by Cypher Environmental Ltd. to be used as a guideline only. The information contained in this protocol has been compiled as a result of the methods used during past successful DSMB applications. Successful application methods and techniques are not limited to the guidelines listed above and the actual method used during the application of the product should be determined on a per project basis by the foreman in charge of the application. DSMB should only be used in compliance with all provincial/state and local regulations.

Results may vary when applied to different soil types and variances in the application methods and amounts may be required to suit these variances accordingly.

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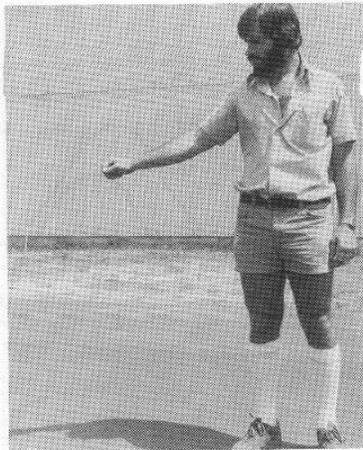
SOIL MOISTURE FIELD TEST: OPTIMUM MOISTURE (OMC) TEST

This piece was put together to determine the moisture content of clay based soils in the construction of roads.



(a)

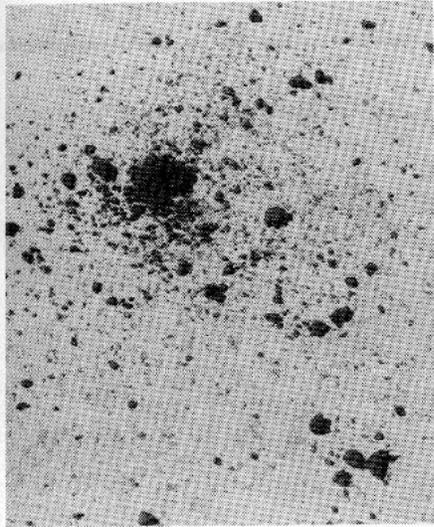
Take note of the size of the sample grabbed, the size could be half just as long as it forms like this on squeezing tight. This will become second nature after a few trial runs. When doing this test, as much gravel should be removed from the hand-full of soil as possible, or it will skew the results of the test.



(b)

Hold the soil about a meter off the ground to do the test. The soil is then released (not thrown to the ground) and dropped on to a hard surface. The sample breaks in many small pieces.

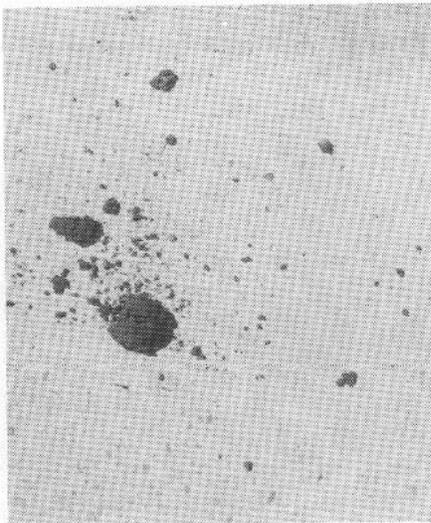
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(c)

Too Dry

This sample breaks into many small pieces and is under OMC. If compaction takes place at this moisture content you will not reach maximum dry density of the soil and the results will suffer.



(d)

OMC

The sample breaks into just a few small pieces. This is the desired result and if the soil is in this condition, compaction can take place.

Should the soil stay in one piece it is over OMC, if it stays in one piece and flattens on the ground it is dangerously over OMC.

All of these conditions can be rectified on the day by simply adding moisture in the dry sample and blade mixing the wet until sufficient moisture has been dehydrated from the soils. These are very simple tests that can be relied on once grasped fully and assessed correctly.

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DSMB Work instruction for application- Baffinland Iron Mines

DSMB dust suppression product is a concentrated liquid and requires to be mixed with water at different amounts for specific applications. For our roads, 3 specific application rates have been identified. * Application rates based on average 11 meter width road*

Application Rates for Mixing

- 1- 1st initial application- 5000 liters/25,000 liters' water (5 totes/ 1 full 740 load)- 1 Kilometer application
- 2- 2nd sealer coat- 2000 liters/28,000 liter's water (2 totes/1 full 740 load)- 2 kilometers top spray coat- Applied 24 hours after 1st application
- 3- Routine Maintenance- 1000 liters/ 29,000 liters' water (1 tote/1 full 740 load)- 2 Kilometers top spray coat- Applied every 2 weeks

Steps for Mixing load and loading truck.

- 1- Set up totes at mixing station to allow to drain into the mix tank- remove top lid and open spout on bottom of tote to allow to drain
- 2- Fill mixing station tank with water from the bottom fill point, ensure not to over fill tank and to allow space for all tote materials to be blended in, if required, turn water off at 50% capacity and allow totes to completely drain.
- 3- When totes are empty- rinse as best as possible with water and drain into mixing station. Close drain spout and replace caps- Empty totes should be placed back into the c-can it came from for tidy housekeeping and organized back haul.
- 4- Fill mixing station to capacity with water and turn on recirculation pump at the same time for better mixing.
- 5- Once tank is full, allow material to recirculate for 5-10 minutes and then load into the 740 water truck.
- 6- When tank is empty, top up water truck to full capacity with additional water

Application to road surface- 1st initial application

- 1- For initial application to the road, assess the length of road first by supervisor and mark out start and finish points.
If using fresh gravel for length of road, place material with grader and fully cover the road way
If fresh gravel is only being used for spot repairs such as potholes and rough sections, place in needed areas and spread with grader
- 2- Have grader pull all available material onto the road from shoulders and remove windrows on either side, shape the road to a center crown as much as is possible, and remove larger rock and cast off the road. The full kilometer of application area should be all graded before applying DSMB product
- 3- Utilizing the 740 water truck and modified spray bar of pressurized spray application to the road surface, align the truck at the start point and ensure that if working into a fresh area that a couple meters' overlap is done at the transition from treated to untreated area.
- 4- Starting to the outside of the road, the water truck will apply the DSMB in the following pattern, 8 full passes should be obtained with the load, but may vary depending on the road widths

**** AWT truck in 3rd gear operating at 1800 rpm (9 miles per hour) for application****

- 1st pass- outside edge of road- full length of planned application (1 km)
 - 2nd pass – opposite outside edge of road- full length of application (1 km)
 - 3rd pass- overlap 1st pass and work closer to center of road full length (1 km)
 - 4th pass- overlap 2nd and 3rd passes full length of application (1 km)
 - Repeat full application sequence until tank is empty, ensuring road is well saturated
- 5- Rework entire stretch of roadway with grader to fully mix material back and forth and final shaping of the road surface.
 - 6- For best results- use grader packer attachment or tire pack with rock truck for compaction
 - 7- Allow product to settle in for 12-24 hours before applying seal coat application

****Repeat process for each kilometer of road way application****

Application of Seal Coat – 2nd layer application

- 1- For 2nd application- seal coating- allow initial application 12-24 hours of set time before seal coating
- 2- Load water truck with applicable load mix of DSMB
- 3- For best results, use the gravity spray bar, or high mounted spray pots for wider road surface coverage of seal coat topping spray.
- 4- For best results use a packer/ grader packer or rubber tired rock truck for compaction

Application of Routine Maintenance layer

- 1- For general maintenance application- suggested every 2 weeks in warm dry weather, apply DSMB to the road surface in similar fashion as the 2nd application seal coat

Long range visual-TREATED- Minimal dust off OHT (24 hours after treatment)



Long range Visual- UNTREATED- Visual dust off OHT at KM100 dip northbound



PHOTO 3 and 4 – Long Range Visual of Treatment Area Post-Trial

Fresh gravel laid out



Pressurized application of DSMB



Product applied – full coverage



PHOTO 5, 6 and 7 – Photos Taken During August 2019 Dust Stop Trial