EVALUATION OF CALCIUM MAGNESIUM ACETATE DEICER IN SCOTT COUNTY

Progress Report for Iowa Highway Research Board Project HR-253

March 1987

Highway Division
Iowa Department of Transportation

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By

Max Sheeler
515-239-1237
Office of Materials
Highway Division
Iowa Department of Transportation
Ames, Iowa 50010

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INTRODUCTION

A presentation by Bjorgsten Laboratories of Madison, Wisconsin in September 1980 introduced the Iowa Department of Transportation to calcium magnesium acetate (CMA) as an alternative deicing agent. Research on the CMA deicer began shortly thereafter. A CMA coated sand was produced (10 ton) and field evaluated in Iowa during the winter of 1981-82. About 60 ton of CMA deicer was produced at a ready-mix concrete facility in a ready-mix truck during the winter of 1982-83. This material was field tested on a three-mile section of US 30 near Ames.

During March 1985, another 50 tons was produced in a continuous pugmill process. The resulting product was too dusty for use and a method for agglomeration is being investigated so the material can be used. The raw materials left over from the continuous process trial were used to produce the CMA deicer used in this field evaluation.

The objective of this study was to further evaluate the deicing capabilities of CMA/sand deicer. A testing site different from that previously used was chosen in order to vary use conditions and obtain a second opinion on performance from different field personnel.

MATERIAL

The deicer was produced by W. G. Block Company at their Muscatine facility during October 1986. Production was by mixing acetic acid, hydrated lime and concrete sand in a ready-mix truck to produce a deicer consisting of three parts sand and one part CMA. The process used is described in detail in a September 1984 Project HR-253 report.

Seventy-three tons of CMA/sand deicer were produced. It was stored in a salt shed at the Iowa DOT maintenance garage on Ia. 130 near I-80 at Davenport.

FIELD EVALUATION PROCEDURES

The location for the field trial was on eastbound I-280 from I-80 to the Mississippi river bridge, which is about nine miles. This roadway carries 7000 ADT with about 50% trucks.

The nominal spreading rate for the CMA deicer was about 300 lbs. per lane mile. Regular 1 to 1 mix of sand and rock salt was applied at the same rate to the westbound lanes for performance comparison.

Use of the CMA deicer was limited to deicing of pavement and did not include frost runs for bridge decks. Observations of performance, weather conditions, effects on spreading equipment, etc. were made by maintenance field personnel.

FIELD PERFORMANCE

Due to the mild winter, only two storms required CMA usage to a degree where comparisons could be made. The first occasion involved snow and an average temperature of 27 deg. F. and the second involved rain, sleet, snow, and ice at an average temperature of 31 deg. F. A copy of the detailed report from

the field appears in the appendix. Observations and conclusions made by field personnel may be summarized as follows:

1. For both storms, excessive time was required to fully remove the snow and ice from the CMA deicer lane. The CMA deicer did not produce a residual brine, like rock salt, that assists in final deicing of the roadway.
2. Clean up of the CMA equipment was much more difficult and time consuming than with rock salt equipment. The CMA deicer caked badly in corners and crevices.
3. The CMA deicer was not effective in the storm involving freezing rain and sleet. Blading was required for complete deicing and not needed for the rock salt lane.
4. In general, it was evident in both storms that the CMA deicer performance was not as dependable or predictable as that of rock salt deicer.

DISCUSSION OF RESULTS

It was reported that the eastbound lane using CMA deicer required about 2 hours longer to reach near normal pavement conditions than did the westbound lane using rock salt deicer. Traffic volume during one storm was reported to be less than normal. The slowness of CMA deicfer to perform in the absence of traffic has been observed in other trials and is considered to be a significant objectionable feature of CMA deicer.

For both storms, the rate of application for CMA deicer was increased by 20 to 25% for applications following the initial runs. The increased rate had no discernable effect except to keep the CMA melting ice in the short term. It was reported that the CMA usage for the storm involving freezing rain was almost twice that of the rock salt deicer.

The reported performance of the CMA deicer in this trial was similar to that observed in previous trials. While CMA deicer can be effective under some traffic and weather conditions, it must be recognized that it is a slower performer than rock salt.

RECOMMENDATIONS

1. Use the remaining CMA deicer at Davenport in the same trial location at the first opportunity.
2. Direct future funds and efforts to the production of cheaper acetic acid rather than CMA production and field trials.

ACKNOWLEDGEMENT

Appreciation is extended to Resident Maintenance Engineer, Kevin M. Mahoney and his forces for their cooperation in providing on-site evaluations of the CMA deicer.

APPENDIX

Field Evaluation Reports

Scott County
I280 EBL

METEOROLOGICAL DATA FOR CMA SPREADING

	Temp.	Wind Chill	Dew Point	Precipitation Type	Precipitation Amount	Precipitation Rate	Cloud Condition	Prior Road Conditions	Comments
Jan 9-10 1987	29° Ave	10°-11° Ave	27° Ave	Snow	4.5"	.4" per hr.	Cldy	Dry	Snow began 12 PM Fri Jan 9 ended @ midnight. Some flurries after. 5-6 mph ENE Wind followed by 10-15 mph N wind.
Jan 28 1987	31° Ave	26°-28° Ave	31° Ave	Rain, sleet, snow (Ice)	0.16 (Precip)	0.016 ph	Cldy	Dry	Storm began 03:00 hrs 1-29-8 ended 13:00 hrs. Wind ESE. After storm wind NE.

CMA USEAGE
I280 EBL
Period January 9-10, 1987

1. **Storm information - see chart:**

- **# of trucks spreading:**

  1 - MD Truck

- **operation:**

  Tailgate spreader. Load covered with tarp. Driving lane treated then passing lane initially followed by another pass on driving lane, between 1:00 PM and 7:00 PM on the 9th. Same number of passes in WBL with 50/50.

- **initial application rate**
  - **CMA:**

    ±300 lbs/lane mile

  - **Traditional:**

    ±300 lbs/lane mile

2. **Condition of both roadways?**

   No visible difference between EB & WB lanes during storm. Both melting, but then later freezing due to sifting.

3. Length of time needed to bring both roadways to a relatively safe condition? Different?

Yes. EBL took ± 2 hours longer to reach near normal pavement conditions than the WBL. Near normal pavement in maintenance area for A-B roads achieved @ 11:00 AM January 10th (Saturday). Clean up accomplished with 50/50 mix both lanes.

4. Relative condition of the roadway the day following?

See #3.

5. Traffic difference?

No difference by direction. Traffic volume less than normal due to storm and day of week.

6. Effect of CMA on equipment short term?

Packed in corners of dump body very tight. Took longer than usual to clean up. (Box very well waxed beforehand). Some additional cleaning time required on spreader, but not extreme.

7. Effect of CMA on equipment long term?

Not measureable at this time.

8. Comparative ease of spreading CMA vs traditional material?

No difference noted this storm.

9. Decisions regarding proper deicing operations?

All deicing operations supsended approximately 7:00 PM on the 9th due to fluctuating snow rate and increase in winds and change in wind direction causing unwarranted icing conditions. Plowing only until final clean up began around dawn on the 10th when deicing resumed.

a. Storm (use)? (ie 1st, 2nd, etc.)

1st storm. ± 8 Tons used of CMA.

b. Remedial action, if any?

Yes

i. Increase rate of CMA

Increased rate ± 20% on second application.

- effect

Thawing then ice both with CMA and traditional. No discernible effect with increase in application rate.

ii. Change to traditional methods.

Changed to 50/50 for clean up due to shortage of crew, all on overtime, and considerable more ice on EBL.

- effect.

Clean up accomplished as expected except per #3.

iii. Suspension of deicing chemicals.

See #9.

10. General comments?

- Due to need to dead head back on WBL, the WBL receives more plowing. This cannot be avoided.

- During storm compartive amounts of CMA and 50/50 mix applied to each lane.

- No residual assistance from brine on EBL for clean up. EBL had considerably more ice and packed snow as opposed to the WBL.

- Due to conflicts with other snow routes CMA will only be applied between US6 interchange and Illinois on the EBL for future storms. Too much overlap between I80 & US6.

- 50/50 tracking onto EBL from ramps has an effect on CMA.

CMA USAGE
I280 EBL
Period January 29, 1987

1. **Storm information - see chart:**

   - **# of trucks spreading:**

     1 - MD Truck

   - **operation:**

     Tailgate spreader, tarped load. Treatment began 4:00 A.M. - three passes made between 4:00 A.M. and 10:30 A.M. Same number passes WB lanes with 50/50.

   - **initial application rate**
     - **CMA:**

       ±300 lbs/lane mile

     - **Traditional:**

       ±300 lbs/lane mile

2. **Condition of both roadways?**

   Border line temperatures caused much freezing and thawing. EB lane with CMA deteriorated sooner and thawed slower. CMA seemed to have better abrasive quality.

3. Length of time needed to bring both roadways to a relatively safe condition? Different?

Yes. EBL took ± 2 hours longer - had to use under body blade for final clean up. Not needed WB. Near normal pavement in maintenance area for A-B roads achieved at 10:30 A.M.

4. Relative condition of the roadway the day following?

Dry.

5. Traffic difference?

None.

6. Effect of CMA on equipment short term?

Well waxed box needed hammer and chisel to clean corners, also mechanical parts on spreader very difficult. Overall cleaning much more difficult than last storm.

7. Effect of CMA on equipment long term?

Could be a problem in long term, see #6.

8. Comparative ease of spreading CMA vs traditional material?

First load seemed to be chunking, following two loads reasonable.

9. Decisions regarding proper deicing operations?

Majority of deicing stopped 9:30 A.M. to 10:30 A.M. 50/50 brine kept melting in progress for the sporadic remainder of storm. CMA had no lasting effect, but temperature was high enough that under body blade cleaned slab.

a. Storm (use)? (ie 1st, 2nd, etc.)

2nd storm. ± 12 Tons used of CMA.

b. Remedial action, if any?

Yes

i. Increase rate of CMA

Increased rate ± 25% on second and third applications.

- effect

Did keep CMA melting ice in the short term, however; when temperature fluctuated freeze/thaw, 50/50 remained effective and CMA did not.

ii. Change to traditional methods.

Needed final removal of ice/slush with under body blade. 50/50 did not.

- effect.

See #3.

iii. Suspension of deicing chemicals.

See #9.

10. General comments?

This storm was very different from last CMA usage storm. Pavement had ice, slush, and wet several times as temperatures and wind speed varied.

CMA had no residual effect.

CMA usage almost twice that of 50/50 and not as effective.

Equipment very difficult to clean up, hammer and chisel used.