

**Use of Verglimit Deicing Product on  
El Dorado County Highway 50  
PM 38.6 to 39.7**

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**California Pavement Preservation Center  
203 Langdon Hall  
California State University  
Chico, California 98929-0930  
(530) 898-6032**



<b>PROJECT SUMMARY PAGE</b>	<b>Technical Report: CP2-2008-103TB</b>
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<b>Author:</b> M. Stroup-Gardiner	
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<b>Prepared by:</b> M. Stroup-Gardiner California Pavement Preservation Center 203 Landgon California State University, Chico Chico, California 95930	<b>Date:</b> March 23, 2008
<b>Abstract:</b> <p>A proprietary deicing material, Verglimit, which is formulated to be added to the hot mix asphalt at the plant was placed on Highway 50, PM 38.6 to 39.7 in the fall of 2007. This additive is marketed as providing continual deicing of the roadway surface by releasing gradually releasing a blend of sodium chloride and sodium hydroxide as traffic wear breaks the encapsulating material.</p> <p>While the concept of the product is desirable, several difficulties were encountered during the mix design, placement, and maintenance of the test section. Difficulties were encountered with obtaining an optimum asphalt content using the Superpave volumetric mix design method. Extra safety measures were needed to protect hot mix asphalt plant workers from contact with the caustic Verglimit dust. Plant operators reported visible rusting of machinery within 24 hours of using this product. Caltrans needed to frequently monitor the test section to keep the section surface dry. After several months, the section was showing signs of raveling.</p>	
<b>Keywords:</b> Deicing, Verglimit	

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## **DISCLAIMER**

**The contents of this report reflect the views of the authors who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the State of California or the Federal Highway Administration**

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## INTRODUCTION

Verglimit, a proprietary product, is marketed as reducing the man power and materials needed for preventing the formation of ice on roadways in winter. The Verglimit material is a mixture of sodium chloride and sodium hydroxide encapsulated in linseed oil which is added to the end of the hot mix asphalt (HMA) production. Once it is in place, traffic wear continually releases the deicing compound on the pavement surface, which is intended to provide an ice-free driving surface.

District 3 placed a 1-mile section of a thin overlay (1-inch) with Verglimit on El Dorado (ED) County 50 from posted mile (PM) 38.6 to 39.7 in the fall of 2007; the entire project was from PM 32 to 39.7. The performance of this section was monitored over the winter. This Technical Brief documents this Verglimit section of roadway. Information included in this Brief includes:

- Materials information
- Mix design test results
- Construction notes
- Performance

## MATERIALS

### HMA Components

The binder used on this project was a PG 64-16 and the aggregate gradation was a ½ inch Type “A” maximum coarse asphalt concrete. The aggregate properties reported for the mix design are shown in Table 1.

**Table 1. Aggregate properties.**

Aggregate Properties	Mix		Coarse Fraction	Fine Fraction
	As – Used	Specification Limits		
Sieve Size	Gradation, Cumulative Percent Passing, %			
19.0 mm	100	100		
12.5 mm	96	95 – 100		
9.5 mm	83	75 – 90		
4.75 mm	60	52 – 62		
2.35 mm	38	35 – 45		
1.18 mm	27	---		
0.60 mm	18	16 – 26		
0.30 mm	13	---		
0.15 mm	9	---		
0.075 mm	6	3 – 7		
Kerosene Equivalent	$K_m = 1.2$		$K_c = 1.1$	$K_f = 1.2$
Specific Gravity			2.73	2.78
LA Abrasion				
100 Revolutions	4%	10% Max.		
500 Revolutions	18%	45% Max.		
Crushed Particles	99%		99%	100%
Sand Equivalent		50% Minimum		72%

Shaded cells indicate no data available

## Verglimit Product

The Verglimit product, according to the Material Safety Data Sheet (MSDS), is a mixture of calcium chloride, calcium hydroxide and sodium hydroxide with “harmless additives”. Other literature found through a web search indicates this component is a linseed oil (Turgeon, 1989). Manufacturer information provides guidance such as:

- Specific gravity of the product is 1.8
- Verglimit to asphalt cement ratio not to exceed 1.7:1
- Verglimit needs to be added cold as the last component of the mix (i.e., after asphalt cement is mixed with aggregates)
- Marshall mix design method is recommended
- Mix needs to be stored hot for 10 to 15 minutes prior to compaction
- Once compacted, the samples need to be stored in a dessicator with drying agent to avoid absorption of water by the mix
- Marshall stability needs to be determined without subjecting the samples to a water bath conditioning step
- Mix design air voids are recommended as follows: 1.5 to 2% for low traffic, 2.0 to 3.0% for high traffic.
- Mix 25 lb. bags without opening (\* no information given about using Super Sacks)
- Mixing temperature must not exceed 358°F (\* Manufacturer document indicates “179°C (338°F)” however, the conversion from 179°C is 358°F. Therefore it is unclear what maximum temperature is to be used.)
- The uncompacted HMA-Verglimit surface must not experience rain; the surface needs to be rolled without water
- In-place air voids need to be between 3% and 4%.
- Air temperature during paving should not be lower than 10°C (50°F).
- Full sawn joints are required
- Any porous surface areas need to be sealed the same day as construction with a “suitable emulsion” to keep water from penetrating the surface.
- The HMA-Verglimit overlay should not be any thinner than 2.5 times the size of the coarsest aggregate in the mix.
- Pre-coated screenings can be used to improve friction; these are to be applied during the last roller pass. Loose particles need to be removed prior to opening to traffic.
- Rolling operations will crush Verglimit product in the upper portion of the overlay. This activates the product and will result in a wet looking surface.
- Rollers should not use water, although light wiping with an oil product can be used to keep the material from sticking to the tires.
- Strongly recommends not opening HMA-Verglimit overlay to traffic until the morning following construction
- The new surface will have to be washed prior to opening to traffic. Washing will have to continue for the next several days with a “large surplus of water”.

- Two passes are recommended for washing: 1) the first pass should use a low water application (1/4 gal/yd<sup>2</sup>), and 2) a second pass with a water quantity of 1 gal/yd<sup>2</sup> within 15 to 30 minutes of the first pass.
- Temporary speed limit reduction and “Pavement Slippery when Wet” signs are recommended until the pavement no longer looks wet.
- Washings, twice a day (before local rush hours) should be used.
- Striping may peel off new HMA-Verglimit surface.
- Manufacturer notes “...Verglimit surfaces do not need any maintenance...”

### Mix Design

The Verglimit vendor called for a rich mix design, defined as 0.1 to 0.3% above optimum binder content (OBC), in-place air voids of between 3% and 4%, a gap graded aggregate gradation and 5.5% by total weight of the Verglimit product. A portion of the minus 4.75 mm (No. 4) aggregate fraction equal to the mass of the Verglimit product added. Table 2 shows the mix design results. Based on the Verglimit manufacturer’s recommendation of 4% voids, an optimum binder content was selected as 5.8%.

**Table 2. Hveem stability mix design using Verglimit and PG 64-16.**

Hveem Mix Design Information	Asphalt Content, %			
	5.0	5.5	6.0	6.5
HMA Specific Gravity	2.35	2.36	2.38	2.39
Surface Flushing	None	Slight	Slight to Moderate	Heavy
Hveem Stability	47	41	37	NA
Air Voids, %	6.0	5.0	3.6	2.6

### PRECONSTRUCTION

The District 3 project was advertised February 26, 2007 (03-2M6104). The engineers’ estimate for the projects was \$1.5 million. The bid opening date was March 28, 2007; the contract was awarded to Don Garcia Excavating and Paving for \$1,698,000. This contract included a section to evaluate a proprietary deicing material, Verglimit using Verglimit from PM 38.6 to 39.7.

### CONSTRUCTION

The Verglimit product can only be added in an HMA batch plant and was supplied to the plant in Super Sacks. Opening the Super Sacks generated significant safety problems because of the airborne caustic dust. Difficulties with weight proportioning of HMA mix components were immediately evident due to the continual weight gain of the Verglimit as it absorbed moisture from the air. The contractor needed to stop production so that the plant could be modified to contain the Verglimit dust. The Verglimit dust was so corrosive it pitted and rusted any bare metal within 24 hours of contact.

Construction records indicated the mix was very tender. It moved easily under the rollers with little densification. Rolling was suspended until the mat cooled to below 270°F. Chips were spread at a rate of 2 lb/yd<sup>2</sup> and rolled into the Verglimit mat at a temperature of between 190 and 200°F. The entire project was placed using a “Method Specification” for placement and compaction, so no information for in-place density is available.

The initial surface appeared slick and tracked onto adjacent sections of the roadway. In one case, the HMA-Verglimit product tracked onto a concrete bridge deck, making the deck so slippery that it had to be sandblasted to restore friction.

The water run-off was tested to insure that best management practices (BMP) were followed.

## POST CONSTRUCTION

As per the Verglimit supplier, the section was washed and sanded after construction. The continually wet nature of the roadway required the agency to water, sand, and sweep almost daily for more than 6 weeks after construction. Initial use of the Verglimit supplier directions for sanding failed to improve the wet surface. The agency found it needed to modify the sweeping portion of the process so that a rotary broom was used to scrub the sand into the HMA-Verglimit surface.

Even with the daily sanding of the project, the section appeared to be wet all of the time. Tracking of the adjacent surfaces, up to a half-mile after the end of the Verglimit section, also continued to be a problem. The continually wet nature of the surface resulted in the corrosive material being sprayed on bare metal surfaces of vehicles, causing pitting within 24 hours of traveling this section of roadway. After the first snow event, the section raveled (Figure 1) and continued to be wet in appearance. This section of roadway is continuing to ravel and should be milled off and replaced during the next construction season.



Figure 1. HMA-Verglimit surface after first snow.

## DISCUSSION

A review of the construction documents, Verglimit manufacturer information, and interviews of key District 3 staff indicates the following:

1. It seems the only background the Verglimit manufacturer has on mix design methods for HMA with Verglimit is for the Marshall mix design. No information was available for guidance for using this product in a Hveem or gyratory mix design method. Since Caltrans uses the Hveem mix design, it was very difficult to determine an optimum binder content for HMA-Verglimit mixes.
2. Only limited guidance was provided on how to safely handle the Verglimit Super Sack product. The caustic nature of the dust resulted in significant plant and

- construction damage. Worker safety issues were also a concern because of potential inhalation of, and eye and skin exposure to, the caustic dust.
3. The tender nature of the mix made it difficult to obtain compaction. This is likely due to moisture being absorbed from the air by the Verglimit.
  4. It is highly unusual for contractor or agency staff to daily monitor a section of roadway. The continual need to wash, scrub and sand the surface required an unusually high level of man-hours to ensure the safety of the driving public.
  5. The HMA-Verglimit mix costs about 3 times the amount of the conventional HMA. This cost does not include the continual traffic control, materials, and work needed to keep the section safe for the driving public.
  6. According to the literature, there have been several projects nationwide that have exhibited similar problems and poor performance.
  7. If any influence on de-icing benefits were noted in the literature, it was limited to minimal benefits obtained when there was only a light snow fall; no benefits were noted when heavy snow falls were experienced.
  8. Verglimit did not provide the benefits as claimed.
  9. Verglimit did not perform satisfactorily.
  10. Little guidance was provided by the manufacturer on using the Hveem mix design method.

## **RECOMMENDATIONS**

Recommendations based on the findings from this project are:

- Do not use Verglimit on any future projects in California.
- Cold-plane the HMA-Verglimit overlay and replace it with a standard HMA overlay at the end of the winter season.
  - Because of the caustic nature of the additive, the milled HMA should not be recycled as reclaimed asphalt pavement (RAP); this material needs to be scrapped.

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