

Final Report  
for  
**Verglimit at Hole-in-the-Wall Slide Section**  
Experimental Feature Evaluation

FHWA Experiment Features Project OR 87-01

by  
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## Foreword

This report represents the work of a number of individuals over a 2-year period, each adding to the information. These individuals are:

Joe Schlieski - Project Manager

Vernon Williams - Section Foreman - Richland

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## DISCLAIMER

The contents of this report reflect the views of the author who is responsible for the facts and accuracy of the data presented herein. The contents of this report do not necessarily reflect the views or policies of the Oregon Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

**VERGLIMIT  
AT  
HOLE-IN-THE-WALL-SLIDE**

INTRODUCTION

The issue of icy roads and bridges is a problem that the highway department and motorists must deal with each winter. Many measures are implemented to reduce the risk to drivers, but these corrective actions normally occur only after ice has already formed on highways and bridge decks. A Verglimit overlay may be a solution to this problem.

Verglimit is the brand name for an anti-icing, multi-component defroster that can be added to an asphalt concrete wearing surface during construction. It is composed mainly of encapsulated calcium chloride crystals, which are released and activated in small quantities by traffic induced abrasion. Verglimit is produced in Germany and has been used primarily in Europe. In view of favorable reports from Europe and New York State, it was decided to evaluate Verglimit in Oregon.

In 1983, experimental Verglimit overlays were placed on two Oregon bridges known to have icing problems. The performance of the test overlays, constructed on the Salmon River Bridge in Clackamas County and the Quartz Creek Bridge in Clatsop County, was very disappointing. While the Verglimit appeared to be effective in melting snow and reducing the formation of ice on the decks, the material failed and had to be replaced. This failure was attributed to job specifications which did not include all of the Verglimit supplier's recommendations and poor construction practices. Construction problems included excessive liquid asphalt content and low compaction. These two projects did not allow for an accurate appraisal of Verglimit, so a new site was selected for testing the deicing chemical.

Because of the previous problems, the primary objective of this evaluation was to determine if a durable pavement could be placed with Verglimit in the asphalt concrete. The secondary objective was to determine if Verglimit was effective in de-icing the pavement and how long it would last. The final objective was to observe guard rail and sight posts to determine if there was increased corrosion from the de-icer.

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SITE DESCRIPTION

The Verglimit additive was used on a site constructed on the "Hole in the Wall Slide" Section, Baker - Copperfield Highway, Baker County, Oregon. The chemical was added on a test section of roadway from Engineering station 124+00 to 133+00 (mile point 30.323 to 30.493).

This section of highway had an average daily traffic count of 610 vehicles in 1983. While the literature furnished by the Verglimit organization recommends a 5000 AADT or higher traffic count to be effective, their technical representative still recommended installation at this site. This was after he was informed of the lower traffic count.

The evaluation site is in a dry-freeze area with a annual temperature range of -20° to 100° and an annual rainfall of 15 - 20 inches. The altitude is approximately 2400 ft.

COST INFORMATION

The bid prices were as follows:

	Quantity	Unit	Unit Cost	Total Cost
Item # 21 AC Mixture	385.80	Ton	\$ 35.00	\$ 13,503
Item # 22 Liquid Asphalt	25.59	Ton	\$ 230.00	\$ 5,885.70
Item # 24 Verglimit	21.78	Ton	\$1,320.00	\$ <u>28,749.60</u>
				\$ 48,138.30

Or: In-place cost of \$124.78 per ton of verglimit mix as compared to \$ 43 per ton for conventional mix.

The contract included a bid item for Verglimit. The contractor's bid was only for the FOB jobsite cost of the Verglimit additive. Additional handling or production costs for mixing and placing the material were not included. While the exact amount of these extra costs are not known, it is evident that the actual in-place cost would be much higher than indicated above.

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CONSTRUCTION

PREPARATION

The Verglimit crystals will be damaged if mixed with the aggregate for over 15 seconds, and ineffective if not thoroughly coated with liquid asphalt. The maximum recommended temperature is 338° F.

Verglimit representatives did not consider the contractor's drum dryer mixing equipment capable of meeting all of their requirements. Information supplied by Verglimit showed several methods of modifying the drum dryer to add Verglimit in the mix without damaging the coating or the crystals.

These methods were not economically feasible with the contractor's plant. As evidence of this, the contractor elected to back-haul the aggregates for the Verglimit 35 miles to his batch plant in Baker.

Using methods found in the literature received from Verglimit, a 7.5% Verglimit content was calculated. This was due to the low traffic count. Further discussion with the manufacturer's representatives yielded a recommended mix with 6.5% liquid asphalt and 3% air voids. The mix design was developed by the Highway Division in conformance with the manufacturer's recommendations.

The Verglimit was stored in a warehouse at Blue Mountain Asphalt Co. in Baker, Oregon. The unopened pallets showed no signs of damage even though it had been stored for over a year. The bags that were not on pallets had sustained some damage. The pallets included a heavy cardboard wrapper which should be kept in place as long as possible.

The base lift of asphaltic concrete had been laid the previous day and was clean and dry. The base lift compaction was 90% to 92% (by nuclear gauge), which is at the low end of the specification.

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CONSTRUCTION (Cont.)

MIXING

The production of the mixture was done with a Barber-Green batch plant that met with the manufacturer's approval. The pyrometer that measured the rock temperature was not working properly at the start and some 50 tons of mix were rejected due to low temperature.

During the problem with the temperature, it was noted that below 270°F., the liquid asphalt did not coat the Verglimit crystals. At approx. 280° F. the asphalt appeared to adhere in small drops, possibly centered around fine aggregate particles. At 290° F. the asphalt began to form a film on the Verglimit crystals. Due to the length of haul and the 280° F. laydown temperature specified, the mix temperature at the plant was set at 310° F.

Workers wearing filter masks dumped the Verglimit, by hand, into a custom designed hopper on the side of the weigh bin. The addition of the Verglimit was controlled by a gate that would dump the weighed material into the pug-mill.

July 24, 1987 - East bound - 175 tons

During the first day Verglimit was mixed, the mix was fine and rich with excess passing the 1/2", 1/4", #10, #40, and #200 sieves. The asphalt content was between 7.5% and 8.3%. This was not in conformance with the mix design.

July 27, 1987 - West bound - 209 tons

The second day that Verglimit was mixed, the mix was coarse and lean with 46% passing the 1/4" screen and a 6.1% asphalt content. Once again, the mix did not conform to the design.

TRANSPORT

The mix was hauled to the job site in 12 yard dump trucks with "pup" trailers. Standard tarps covered the mix for the 35 mile trip to the work site. The mix temperature at delivery to the job site varied from 280° to 300° F. with the lower value measured on a non-typical load which was in the truck for 1 hour 45 minutes.

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CONSTRUCTION (Cont.)

PLACEMENT

The mixture was placed with a Blaw-Knox tracked paver in a 17' wide panel. The transition from regular to Verglimit mixes was done by running the paver almost dry of regular mix before dumping the Verglimit mix. This agrees with the manufacturer's recommendations. The Verglimit mix, while looking relatively normal at the plant, appeared to be dry and fine both in the truck and after laydown. Mat temperatures ranged from 275° to 295° F..

The air temperature at the time of placement was 85° to 90° F. with no wind or moisture. Generally, these would be considered as ideal weather conditions for any kind of asphalt paving.

A plant problem delayed placement of the material on the east bound lane by 1 hour 30 minutes. This was at the northeasterly end of the test section and covered approximately 250 feet. During this pause, the paver was moved forward just enough to keep the mix from setting. This also allowed the mix to cool and probably made adequate compaction impossible.

COMPACTION

Compaction was achieved by using the following:

- A. A rubber-tired breakdown roller 4 down and back passes;
- B. A vibratory drum roller using 3 vibratory, and 1 static pass.

The drum rollers used little or no moisture to avoid activating the Verglimit. This rolling pattern, while at somewhat at odds with the manufacturer's recommendation not to use vibratory rollers, was the same as for the regular mix. The Contractor had contacted other users of the mix and was told that this pattern would work as long as care was exercised to avoid breaking the Verglimit crystals. There was no evidence of crystal fracture during the process.

The above method yielded first day compactions of 96.0% and second day compactions of 93.5%. At the time, the rolling pattern was yielding barely passing compaction results on the conventional mix.

As a note, when too much water is used in rolling, the surface shows white spots probably due to the water first dissolving the smaller Verglimit particles and then evaporating, thus leaving a white calcium chloride residue.

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CONSTRUCTION (Cont.)

FINISHING

Finish rolling was done with static drum rollers. As the first panel was going to be left over the weekend before the matching panel was laid, the edges were sealed with tack coat 6" on either side to prevent moisture from entering the mix at the edge.

The recommended sand coat for added skid resistance was not applied. The Friction numbers, measured with the locked-wheel friction tester averaged 60 which is good for new asphalt pavements.

The flushing to eliminate excess Verglimit on the surface was to be delayed until the matching panel was laid. This was possible because it would be 3 to 6 weeks before traffic would be allowed on the panels.

PROBLEMS

Although the Verglimit representatives did indicate that drum-dryers could be used, the information supplied showed significant physical modifications would be required. These modifications entailed the introduction of Verglimit into the drum-dryer at, or near, the midpoint.

- A. Most of the Drum-dryer plants currently used in Oregon do not have this feature. These modifications appear to be expensive and would impact the final cost of the product.
- B. Bituminous Design Unit has some concerns as to whether the Verglimit can be successfully integrated with the aggregate flow in the drum when introduced at the midpoint.

It should be noted that the small quantities in this project, and the previous projects using Verglimit, make the production of a consistent mix difficult. As a rule, it takes a period of time, and a number of tons of mix, to bring an asphalt plant into specification. This was not possible with the limited quantities on this job.



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PERFORMANCE EVALUATION

SUMMER 1987

A white powdery appearance was reported during the summer on the west bound lanes. New York State D.O.T. reported similar findings during humid summer days. The higher moisture content in the air caused the calcium chloride to dissolve leaving a white dust when it dried.

WINTER 1987 - 1988

Maintenance personnel from Richland observed the performance through the months of January and February of 1988. Generally, the Verglimit did retard the formation of pack snow and ice in the 25° to 32° range. Below that range, the deicing effect was not as evident. There was a tendency for the Verglimit to stay wet and actually retain snow, while the control section would be dry. At times, the control section was free of snow due to wind and abrasion, but the Verglimit section would be icy. This generally happened when the air temperatures were 20° or below.

In February, it was apparent that the Verglimit surface was beginning to exhibit distress in the form of ravelling and potholes.

Local drivers commented on the fact that a section of road that was different in appearance from the rest was disconcerting.

SPRING 1988

In the Spring of 1988, a decision was made to grind out the Verglimit section and replace with conventional bituminous mix. An on-site inspection showed significant ravelling, particularly in the area where there was a significant delay in the laydown (1.5 hrs) where the mix was getting cold. Other forms of distress included cracking and ravelling. Generally, the distress was concentrated at the northeasterly end of the test section. There were some cracks that appeared to have bled calcium chloride and formed a translucent, brownish colored glaze along the length of the crack.

Despite the decision to grind out all of the Verglimit, there were large areas of pavement in both lanes that appeared sound and serviceable. However, due to the cost of the operation and the remoteness of the site, there would have been a significant risk in leaving any of the suspect material in place.

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CONCLUSIONS

1. Verglimit provides benefits as a deicer.

This conclusion is based on a limited observation period so the level of improvement and a cost/benefit ration could not be determined.

2. The Modifications required to use drum dryer mixers for small quantities will significantly increase the unit costs.
3. Suppliers have difficulty producing small quantities of mix in conformance with unique mix designs.
4. When a Verglimit mix is not in close conformance with the mix design, it is more likely to fail than conventional mixes.
5. The corrosion effects could not be evaluated due to the short evaluation period.

RECOMMENDATIONS

The durability problems on this, and the previous projects were influenced by poor construction practices. However, asphaltic concrete with Verglimit appears to be much less "forgiving" if not mixed and placed in very close conformance with the mix design and specification limits. Because of the durability problems, we recommend no further installation of Verglimit unless a future review of performance in other states indicate that success can be expected.