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Abstract

Verglimit is a calcium chloride based material that is incorporated into bituminous surface mixes to prevent ice and snow from sticking to the pavement. Two test sections were installed and the effectiveness of the Verglimit was evaluated for two winters. There were design and construction problems associated with the specified high density of the experimental mix, safety problems with skid resistance, and a lack of positive performance. The durability of the mix appeared to be adequate after nearly two years of service.

FINAL REPORT

FIELD INVESTIGATION OF VERGLIMIT

By

G. W. Maupin, Jr.
Research Scientist

(The opinions, findings, and conclusions expressed in this report are those of the author and not necessarily those of the sponsoring agencies.)

Virginia Highway and Transportation Research Council
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ABSTRACT

Verglimit is a calcium chloride based material that is incorporated into bituminous surface mixes to prevent ice and snow from sticking to the pavement. Two test sections were installed and the effectiveness of the Verglimit was evaluated for two winters. There were design and construction problems associated with the specified high density of the experimental mix, safety problems with skid resistance, and a lack of positive performance. The durability of the mix appeared to be adequate after nearly two years of service.

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INTRODUCTION

Verglimit is a calcium chloride based material that is incorporated into bituminous surface mixes to prevent ice and snow from sticking to the pavement. It consists primarily of deicing salt ($CaCl_2$) and caustic soda (NaOH) coated with linseed oil to prevent hygroscopicity. Supposedly, traffic continually exposes particles of Verglimit that dissolve in moisture to produce a brine, and the action of traffic breaks and removes ice particles.

Because it produces a relatively low concentration of salt solution, Verglimit is not intended to melt large quantities of snow, and because of its high cost, it should be used only at locations where icing occurs quickly and maintenance personnel are not able to treat the dangerous condition quickly. Locations at which it might be used most advantageously are bridge decks, shaded areas of pavement, and steep and curving sections of roadway.

Although Verglimit is quite expensive,* the potential economic savings from fewer accidents, not to mention fewer injuries, would probably justify its use on short sections of highway.

PURPOSE AND SCOPE

The Research Council was requested by district personnel to evaluate the installation and performance of two test sections containing Verglimit. Information on the installation was gathered by research and district personnel, and the effectiveness of the Verglimit in preventing the accumulation of ice and snow was monitored by maintenance personnel.

*The Verglimit cost $0.53/lb and was used at a rate of 5.8% by weight of the total mix, for an additional cost of $61.50/ton of mix.

CONSTRUCTION OF TEST SECTIONS

Route 58 - Lee County

A test section comprised of an experimental mix containing Verglimit and a control mix containing no Verglimit was placed on Route 58 in Lee County on September 10, 1984 (Figure 1). The two-lane section carries approximately 3,000 vehicles per day. The modified Surface Paving Mix gradation and asphalt content (Table 1) were chosen to produce a high-density mix. The average voids in the pavement layer containing Verglimit was 3.5%, which was within the limits of from 3% to 4% suggested by the manufacturer.

Table 1

Design and Extraction Results of Modified Surface Paving Mix

Sieve	Design	Extracted Verglimit Mix
3/4"	100	100
3/8"	89	83
#4	64	61
#8	47	36
#30	20	12
#50	13	8
#100	6	5
#200	3	3
Asphalt content, %	5.6	*

*Several AC determinations yielded a range of from 8.3% to 9.6%.

Asphalt contents were determined on field samples by ASTM Test Method D2172-81 (Method B) and the gradation was obtained from the extracted aggregate (Table 1). The extraction results are suspect because the solvent dissolved some of the Verglimit.

Two 55-lb bags of Verglimit were added by hand to each 1,800-lb batch of mix. The asphalt cement was added to the aggregate and mixed briefly, then the Verglimit was added during a 12- to 20-second interval, and additional mixing was done to give a total mixing time of 1 minute.

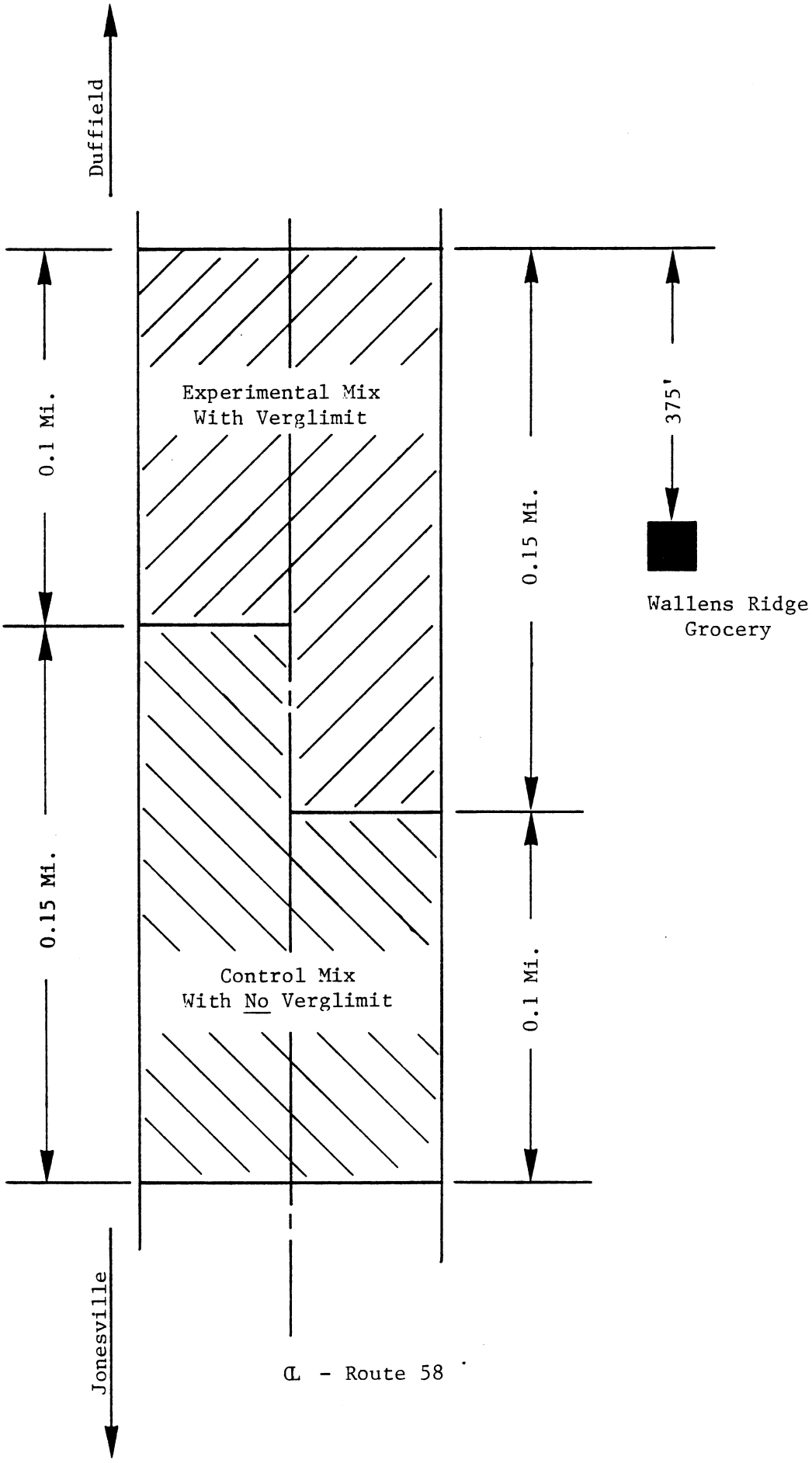


Figure 1. Test Section - Route 58.

After the mix had been down for several hours, a slick looking liquid film began to develop on the surface. The next morning the surface was wet enough that passing traffic created a spray. When a rear-end traffic accident occurred on the section of pavement containing Verglimit several days after construction, sand was applied to the surface to improve the frictional characteristics. The surface had to be treated with sand for one week after construction to maintain adequate skid resistance.

Route I-64 - Nelson County

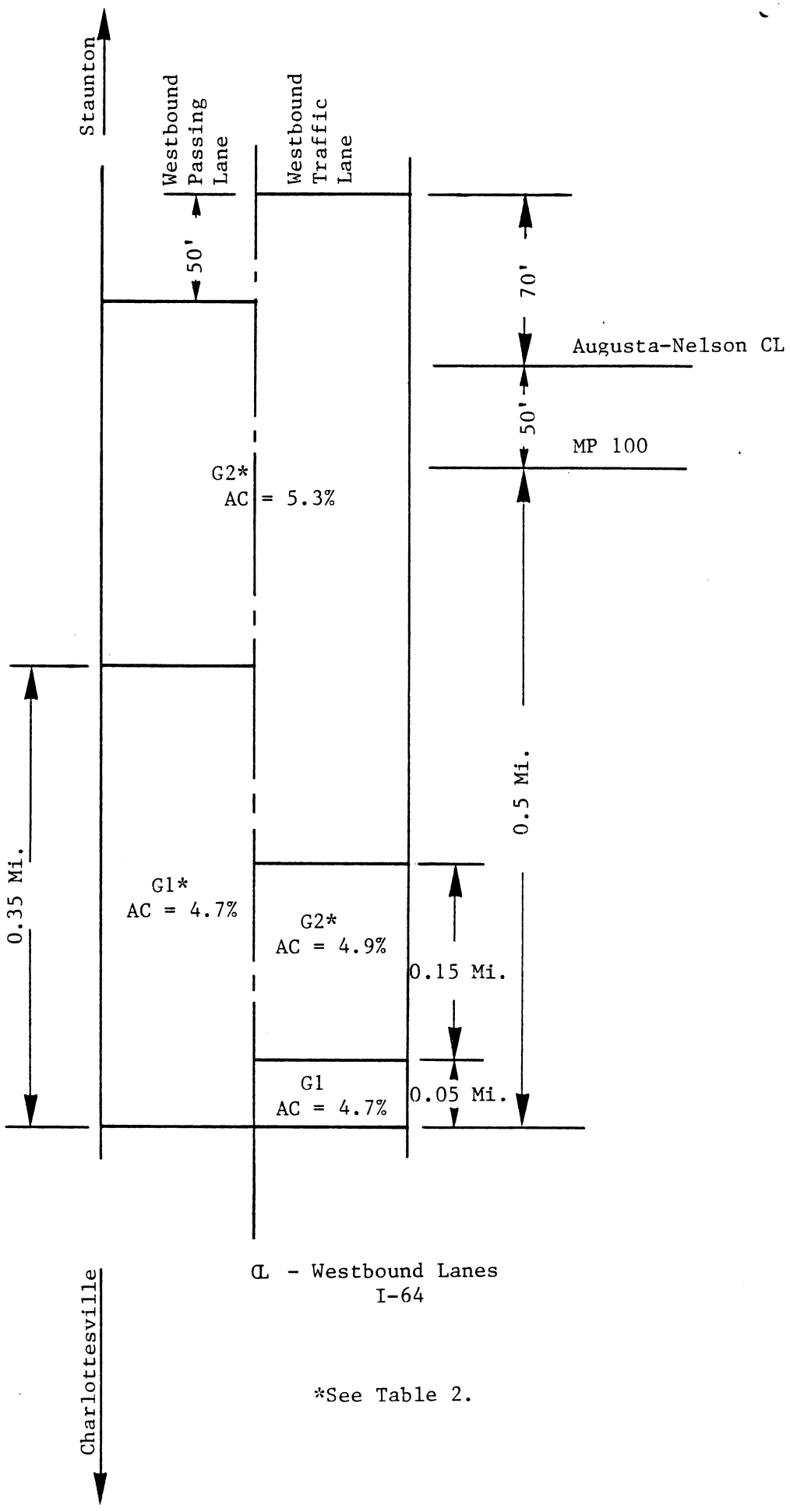
A mix containing Verglimit was placed in the westbound lanes of I-64 in Nelson County on October 23rd and 26th, 1984 (Figure 2). Rain prevented paving on the 24th and 25th. The westbound lanes carry approximately 7,000 vehicles per day.

The I-2 mix (Table 2) was designed by the Marshall method, and there was some reluctance to create a low-void mix as suggested in the Verglimit literature, because the mixes produced from this plant have had a tendency to overdensify under traffic. The range of voids in the pavement was from 8.8% to 13.1%, which was considerably more than the 3% to 4% recommended by the manufacturer. The asphalt content was increased and the gradation was adjusted (see Figure 2) during construction in an attempt to achieve a higher density. The final gradation, G2, and an increase in asphalt content to 5.3% decreased the pavement voids from approximately 12.1% to 8.8%.

Table 2

Mix Gradations

		Hot Bin Gradation	
Sieve	Design	G1	G2
1"	100.0	100.0	100.0
3/4"	99.0	99.0	99.0
1/2"	79.0	80.0	82.0
3/8"	64.0	62.0	67.0
#4	55.0	43.0	49.0
#8	42.0	29.0	34.0
#30	16.0	14.0	16.0
#50	8.0	9.0	10.0
#200	2.7	4.6	5.3
Asphalt content, %	4.7	4.9	4.9 and 5.3



*See Table 2.

Figure 2. Test Section - I-64.

Five 55-lb bags of Verglimit (5.8%) were added by a portable conveyor to each 4,750-lb batch of mix. Some bags were broken during the shipping; therefore, improvements were needed in the crating and shipping containers to prevent spillage and possible access of moisture to the Verglimit. The mixing cycle consisted of 11 seconds of wet mixing, 29 seconds of mixing while adding the Verglimit, and approximately 20 seconds of additional mixing after the Verglimit had been added.

In an attempt to eliminate the skid resistance problem that had been experienced on Route 58, sand was spread upon the mat before the finishing roller was used. The sand appeared to absorb some of the liquid that immediately formed on the surface; however, traffic quickly threw the sand from the pavement surface and it appeared that little, if any, sand was embedded permanently. During the following several weeks traffic tracked the liquid film from the pavement containing Verglimit onto an adjacent slurry seal surface and made it quite slick. Although no accidents occurred, the district engineer was quite concerned about the potential for accidents.

EVALUATION OF TEST SECTIONS

The effectiveness of the Verglimit during icy conditions and snowstorms and the durability of the pavements containing Verglimit were evaluated.

Maintenance personnel were asked to complete and return a questionnaire (Figure 3) each time that a storm with freezing precipitation occurred during 1984, 1985, and 1986. Information was requested on the severity of the storm, amount of deicing salt and sand used, and opinions regarding whether the pavement with Verglimit was safer than the control pavement. Seven snowfalls ranging from 0.5 inch to 13.0 inches were reported on Route 58. No differences between the section containing Verglimit and the control section were observed by the maintenance personnel who cleared the pavement. In all instances, one to three applications of a salt-stone combination were applied, usually commencing soon after the storm started; therefore, sufficient time may not have been allowed for the Verglimit to work.

Four snowfalls ranging from 1.5 to 4.0 inches were reported on I-64. In one storm involving freezing rain and 4.0 inches of snow, it was reported that ice on the section with Verglimit seemed to break up sooner than that on the control section. The test section always received two to four applications of salt, abrasives, or both, rather soon after the storm; therefore, the pavement containing Verglimit may not have had enough time to work.

The following form should be completed each time there is any type of freezing precipitation (snow, sleet, etc.) or icy conditions caused by freezing rain. Verglimit is a material that was added to the asphalt to prevent or decrease the accumulation of snow and ice.

1. Date of precipitation_____.

2. Approximate air temperature during storm _____ ^{o}F.

3. Type of precipitation (snow, sleet, freezing rain, etc.)_____.

4. Accumulation on pavement with no Verglimit _____ inches.

5. How long was required to completely clear the pavement with no Verglimit?____

6. Accumulation on pavement with Verglimit _____ inches.

7. How long was required to completely clear the pavement with Verglimit?_____

8. Was chemical or sand required on pavement with no Verglimit?_____
   If so, indicate which and the approximate amount (number of applications, etc.)_____.

9. Was chemical or sand required on pavement with Verglimit?_____
   If so, indicate which and the approximate amount (number of applications, etc.) _____.

10. Do you think that the pavement with Verglimit provided a safer riding surface than pavement with no Verglimit at any time during the storm or soon after the storm?_____
    If the answer is "Yes" explain._____

_____

_____

Comments_____

_____

_____

_____

When form is completed return to :

G. W. Maupin, Jr.
Research Scientist
Virginia Highway & Transportation
Research Council
Box 3817, University Station
Charlottesville, Va. 22903-0817

Figure 3. Performance Report on Experimental Pavement Containing Verglimit.

Both test pavements are performing adequately after nearly two years of service even though the section of I-64 had a low density. More time is needed for determining the long-term durability of the mixes.

SUMMARY

The design and construction problems associated with the specified high density of the experimental mix, the potential safety problems with skid resistance, and the lack of positive performance combined to make the potential benefits of Verglimit questionable. The pavement void content of 3% to 4% required for pavement durability is difficult to obtain; furthermore, pavements with low void contents are susceptible to permanent deformation such as rutting.

Skid resistance was a problem for a short period after construction for both test sections. The sand applied during construction on one test section did not prevent traffic from tracking the liquid film onto the adjacent pavement. Washing the pavement surface with water has been suggested as another way to improve skid resistance, but this method was not attempted.

The maintenance personnel did not observe any difference in the performance of the test pavements vis-a-vis that of the control, except during only one of eleven storms. However, these observations may not have been a fair evaluation, since the deicing chemical was usually applied in a routine manner rather quickly after the storm started.

The durability of the test sections was satisfactory after nearly 2 years in service.

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Messrs. R. H. Connock, Jr. and R. Riner from the Culpeper District, and R. Hawkes of the Bristol District supplied construction and cost information. Resident Engineers J. P. Hughes and D. S. Roosevelt and their maintenance personnel are commended for their excellent job of observing and reporting the performance of the test sections during storms.

SI CONVERSION FACTORS

To Convert From	To	Multiply By
Length:		
in	cm	2.54
in	m	0.025 4
ft	m	0.304 8
yd	m	0.914 4
mi	km	1 . 609 344
Area:		
in^2	cm^2	6.451 600 E+00
ft^2	m^2	9.290 304 E-02
yd^2	m^2	8.361 274 E-01
mi^2	Hectares	2.589 988 E+02
acre (a)	Hectares	4.046 856 E-01
Volume:		
oz	m^3	2.957 353 E-05
pt	m^3	4.731 765 E-04
qt	m^3	9.463 529 E-04
gal	m^3	3.785 412 E-03
in^3	m^3	1.638 706 E-05
ft^3	m^3	2.831 685 E-02
yd^3	m^3	7.645 549 E-01
Volume per Unit Time: (NOTE: $1m^3$ = 1,000 L)		
ft^3/min	m^3/sec	4.719 474 E-04
ft^3/s	m^3/sec	2.831 685 E-02
in^3/min	m^3/sec	2.731 177 E-07
yd^3/min	m^3/sec	1.274 258 E-02
gal/min	m^3/sec	6.309 020 E-05
Mass:		
oz	kg	2.834 952 E-02
dwt	kg	1.555 174 E-03
lb	kg	4.535 924 E-01
ton (2000 lb)	kg	9.071 847 E+02
Mass per Unit Volume:		
lb/yd^3	kg/m^3	4.394 185 E+01
lb/in^3	kg/m^3	2.767 990 E+04
lb/ft^3	kg/m^3	1.601 846 E+01
lb/yd^3	kg/m^3	5.932 764 E-01
Velocity: (Includes Speed)		
ft/s	m/s	3.048 000 E-01
mi/h	m/s	4.470 400 E-01
knot	m/s	5.144 444 E-01
mi/h	km/h	1.609 344 E+00
Force Per Unit Area:		
lbf/in^2 or psi	Pa	6.894 757 E+03
lbf/ft^2	Pa	4.788 026 E+01
Viscosity:		
cS_t	m^2/s	1.000 000 E-06
P_t	Pa·s	1.000 000 E-01

Temperature: $(°F-32)^5/9 = °C$