

UNITED STATES
DEPARTMENT
OF AGRICULTURE

Radio Service

OFFICE OF
INFORMATION

CHATS WITH THE WEATHER MAN

Friday, March 3, 1933.

(FOR BROADCAST USE ONLY)

Reading Time: 10 Minutes.

ANNOUNCEMENT: And now the Weather Man with another story for you from the United States Weather Bureau. Today, the Weather Man chats with you about frost -- not the white, glistening crystals you see on the grass and leaves, but the frost in the ground that gives so much worry to engineers and builders.

-----ooOoo-----

Those of you who have ever done any kind of building or construction work know the importance of having information about the depth of the frost line.

Even if you were only building a house, or putting in a small sewer or water line, you naturally tried to find out how deep the ground is apt to freeze below the surface. You wanted that information to help you decide how deep to lay the pipe for your water or how deep to run the foundation.

If those facts were important to you in your small job, they are immensely more important to the man handling a job costing thousands or millions of dollars.

For instance, take the engineer putting in a water system for a big city.

During unusually cold winters, some cities have found themselves with frozen or bursted water mains. The cities have been without water for several hours -- or even several days because some engineer made a mistake in estimating the depth of the frost line for that particular city. An engineer designing a water system for a big city is going to try to get accurate facts on the depth of frost penetration to help him avoid similar errors.

Or, take the contractor putting up a big office building.

Suppose the contractor fails to run the foundation of the building below the frost line. As the ground below the foundation freezes and thaws, it may let the foundation sink and crack the walls and floors of the building.

The depth of the frost line is also important in road building.

Road builders putting down a new concrete road in one of the colder sections of the country don't try to go below the frost line. That would be too expensive. But they do take the depth of frost penetration into account in deciding how thick to make the road.

3/3/33

When the contractor or engineer wants information about the frost line in a particular community, he usually can find somebody who has a pretty good idea as to just how deep the frost goes. In some communities, he may be able to get hold of accurate records on frost penetration over a period of several years. But a man's memory about the freezes in his community -- especially over a long stretch of time -- may be rather hazy. Besides, the contractor who wants to know about the frost penetration in some neighboring, or some distant state, may not care to make a special trip to that state to get his information. He wants some convenient record he can turn to.

Many builders and engineers turned for such information to the United States Weather Bureau. So, the weather men set about to get a nation-wide chart, or map, of frost penetration.

In most cases, the weather men and their more than 5,000 cooperative weather observers didn't have the frost information themselves. They got their facts from engineers, and water works officials, and -- maybe you wouldn't think it -- also from grave diggers. Yes sir, those men who pick away at the same ground year after year, winter after winter, digging graves were about the most reliable source of information the weather man found. The diggers always had a pretty good idea where the frozen earth stopped and the soft earth began.

But, of course, the weather men had to keep their eyes peeled to prevent mistakes creeping into their charts.

For example, J. B. Kincer, chief of the division of climate and crop weather, told me of one frost depth report that showed an average frost penetration of 12 feet, while the average of other records from that region was only two feet. When the weather men checked up, they found the reason for the difference. The man who sent in the record of 12 feet got his measurements in some loose filled-in ground along a highway. Since the fill was loose, the cold soaked down into the ground like water into a sponge -- and hence the report showing a frost line 12 feet deep.

Well, after the weather men got in their reports -- and they got more than 1300 covering every state -- they made up two maps, or charts, of the entire United States.

One map shows the average depth of frost penetration for every part of the country over a long period of years.

But is information about the average depth of penetration enough? How about those unusual winters when the mercury shoots down to record low temperatures and freezes things up solid? For instance, if you look at the average depth of frost penetration for Jacksonville, you find it's less than an inch. Jacksonville's winters are ordinarily very mild. Only twice in the past 100 years has the temperature been as much as 20 degrees below the freezing point -- once during President Jackson's administration and again in February, 1899. But who knows when Jacksonville may get another one of those record cold snaps. Water systems must be laid, and buildings put up, to meet not only average winter conditions, but also conditions when the frost goes two or three times as far into the ground as usual.

So, the weather men made up a second map. The second map shows the deepest frost penetration on record for various parts of the country.

At New Orleans you find the deepest the ground has ever frozen is about two inches. As you move up the Mississippi Valley, you find the record, or maximum, frost line going deeper and deeper. At Vicksburg, the record is 10 inches---St. Louis, 30 inches---and around St. Paul and Minneapolis, 108 inches, or exactly 9 feet.

Generally speaking, you find the maximum frost penetration for a particular locality is just about twice the average frost penetration. In most of the country, if you find the frost goes into the ground on the average of about 5 inches, you can expect it to go about 10 inches in one of those bitter cold winters we have every so often. So, in most parts of the country---especially in the colder sections---you run your foundation, or lay your pipes, about twice as deep as the ground freezes, on an average.

But that little formula doesn't hold good for all sections. In the warm fringe across the southern part of the country and up the Pacific Coast, you may have winter after winter with little or no freezing at all. Then comes the record cold snap. Although the ground may freeze down only an inch, or even less, that inch may be six or eight times the average depth. So, to know what to expect in the way of frost penetration, in those unusual years, you really have to have the records of maximum frost penetration covering a long period of years.

Now, here's an interesting thing about those two maps.

As you would naturally expect, the frost goes deeper and deeper into the ground in a rather gradual fashion as you move from the Gulf Coast up toward the Canadian Border. It also goes deeper and deeper at a fairly steady rate as you move from the warm Pacific Coast eastward into the mountains and Northern Great Plains region.

Well, that increase in frost penetration as you move toward the country's refrigerator around Minnesota, the Dakotas, and Montana is not only fairly steady but also an increase you can predict by a kind of rule. The rule is very simple. Here it is:

The frost line drops about one inch for every 25 miles you travel from the Gulf northward and from the Pacific Coast toward northern Minnesota.

In other words, if you started at the Gulf Coast during a severe cold snap and walked northward, this is about what you'd find: After you once struck frozen ground, you'd likely find the soil frozen one inch deeper for every 25 miles you moved toward the Canadian border. If you happened to be traveling in one of those record cold winters I was telling you about a moment ago, by the time you got to St. Paul, you might have to go down 9 feet before you struck soft earth.

3/3/33

That drop in the frost line as you go northward from the Gulf or eastward from the Pacific is at about the same rate as the drop temperature. The average winter temperature drops about one degree for every 25 miles you move northward from the Gulf or eastward from the Pacific toward Minnesota.

But that doesn't mean you'll find the ground frozen to the same depth at two different places just because the temperatures happen to be the same.

For example, a week of zero weather at Hastings, Kansas, is apt to send the frost much deeper into the ground than a week of zero weather at Columbus, Ohio, or some other Eastern city. Why?

Well, the depth to which the ground freezes depends, among other things, on the amount of snow on the ground. The snow keeps the ground warm and keeps the frost from going as deep as it otherwise would. Since the North-Central and North-Eastern sections are apt to have much more snow than the dry, wind-swept Plains, the frost usually doesn't get as deep into the ground in the North and East as it does in the Plains country.

But the difference in the amount of snow isn't the only reason for the difference in the frost line at two places with the same temperature.

Trees, and leaves, and grass also help keep the frost out of the ground. And, of course, the eastern part of the country has a much heavier covering of trees, and grass, and other vegetation than the Great Plains. So, that's another reason why a week of zero weather in the neighborhood of Hastings, Kansas, might send the frost much deeper into the ground than a week of the same weather in the neighborhood of Columbus.

Then, of course, the depth of the frost line depends a great deal on the kind of soil. A sandy soil is open and porous; cold can sink into the sandy soil very quickly. But a loam or clay soil is tight and tends to keep out the cold. That explains why you sometimes find considerable difference in the frost line in adjoining fields or lots; the two fields or lots simply have different kinds of soil.

But, the important thing to remember out of all of this is that the weather men now have accurate charts and records showing the average and maximum depth of the frost line for all parts of the country. You no longer have to guess about the depth of frost penetration in a particular community.

#####

ANNOUNCEMENT: And that concludes today's Chat With the Weather Man, brought to you through the cooperation of Station _____ with the United States Weather Bureau.

National Oceanic and Atmospheric Administration

ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

Discolored pages
Faded or light ink
Binding intrudes into the text

This has been a co-operative project between the NOAA Central Library and the Climate Database Modernization Program, National Climate Data Center (NCDC). To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or Library.Reference@noaa.gov

HOV Services
Imaging Contractor
12200 Kiln Court
Beltsville, MD 20704-1387
July 23, 2010