

Technical Summary:

**GUIDELINES FOR SPRING ROAD
USE RESTRICTIONS**

A Publication of

The University of New Hampshire

Technology Transfer Center

33 College Road, Kingsbury Hall
Durham NH 03824-3591
603-862-2826
800-426-0060
www.t2.unh.edu

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George Leel, Senior Training Instructor at UNH T2

GUIDELINES FOR SPRING ROAD USE RESTRICTIONS

Introduction

This document provides a summary of the guidance and use of “Degree Days” for determining Spring Road Use Restrictions, as outlined in the full publication, “Guidelines for Spring Road Use Restrictions.”

This technical summary and the corresponding full Guide are intended to assist municipalities with assessments of their local roadways and during considerations of Spring roadway use. Neither is all-encompassing and should not be considered legal documents. The suggestions and guidance are for many typical situations that arise on local roads during Spring and other times of year, but specific site conditions may make that guidance inappropriate, so while this document and the full document provides guidance neither should be considered a substitute for engineering judgment or escalation to an engineer or other Technical Assistance (including through UNH T2).

Degree Days

The guidelines on when to apply and remove load restrictions are based on air temperature data. From average daily air temperatures, the user calculates *degree days*.

Degree days are the number of degrees between some datum and the average temperature for a particular day. The datum for freezing Degree-Days is 32 degrees. The summation of Freezing Degree-Days is a measure of the extent to which the road surface and base are subject to below-freezing temperatures. This summation, called Cumulative Freezing Degree-Days indicates the depth of freezing that has occurred.

The datum for Melting Degree-Days is 29 Degrees. An air temperature datum of 29 degrees is used to account for bituminous pavement surface heating effects since the pavement surface is about 32 degrees when the air temperature is 29 degrees the 29 degree datum is also used for unpaved roads for consistency.

The summation of Melting Degree-Days is a measure of the extent to which the road surface and base are subject to above freezing, i.e, melting temperatures. This summation, called Cumulative Melting Degree-days indicates the rate of thawing over time.

Calculating Cumulative Freezing Degree Days

Freezing Degree-days (FDD) are the difference between 32 degrees and the average daily temperature. Cumulative Freezing Degree-Days (CFDD) are the amount and duration of temperature differences during the freezing period. CFDD are the sum of FDD over time.

The Degree-Days Log at the end eases calculation of CFDD. In many instances, average daily temperatures for each are available from Newspapers, government weather stations, private meteorologists, or businesses such as heating oil companies. These are entered into Column E,

if average temperatures are not available from these sources. Highs and lows are entered in to columns C and D of the log and divided by 2 is entered in Column E

Subtraction of the average from 32 yields the Freezing Degree-Days for that day, and is entered in Column F. The CFDD, the running total of these values is recorded in Column G

To minimize errors, one should indicate positive and negative values when recording FDD. For an average temperature less than 32 degrees, the FDD should be recorded with a + sign and the value added to the CFDD from the prior day. Conversely, an average greater than 32 degrees yields a negative FDD, which should be recorded with a – sign and its value subtracted from the CFDD for the previous day.

The positive and negative notation also helps the user determine when to start the accumulation for CFDD. Average daily temperatures often fluctuate above and below 32 degrees during November and early December. As the fluctuate, the road base freezes but then thaws. To be a measure of the freezing depth, CFDD must be for period of continuing freezing temperatures. Therefore, when the user identifies a clear pattern of positive FDD he or she continues calculation of CFDD

When it is clear that the maximum CFDD has been reached, recording FDD and CFDD can cease. It is the maximum CFDD that will be used later to calculate road use restriction duration.

Calculating Cumulative Melting Degree Days

Melting Degree-days (MDD) are the difference between the average daily temperature and 29 degrees. Cumulative Melting Degree-Days (CMDD) are the amount and duration of temperature differences during the thawing period. Cumulative Melting Degree Days are the sum of MDD over time.

The Degree-Days Log also eases the calculation of CMDD. When averages occur above 29 degrees, subtract 29 from the average and enter it in Column H. This is the MDD for that day. CMDD is the running total of these values and are recorded in Column I.

One should also indicate positive and negative values when recording MDD. When an average for a given day is more than 29 degrees the MDD should be recorded with a + sign and the value added to the CMDD from the prior day. Conversely, an average less than 29 degrees should be recorded with a – sign and its value subtracted from the CMDD for the previous day.

Similar to the CFDD calculation, the positive and negative notation helps determine when to start CMDD calculation. In the spring, average daily temperature vary above and below 29 degrees. The user begins CMDD when there is a clear pattern of positive MDD. This will indicate a period of consistent melting of the road base.

CMDD are used to determine when to establish load limits. CFDD and CMDD are used together to determine when to remove them.

Guidelines for When to Apply Load Restrictions

Should Post: The should-post load restriction application occurs after pavements accumulate 10 Cumulative Melting Degree-Days. For thick pavements, load restrictions should begin when they accumulate 25 CMDD following the start of the thawing period. These thresholds are estimates of when thawing will be sufficient to reduce pavements strength. The should-post threshold of 10 CMDD for thin pavements is recommended for unpaved roads.

Must Post: The must-post load restriction application time occurs after thin pavements accumulate a 40 CMDD and thick pavements accumulate 50 CMDD following the start of the thawing period. These thresholds are estimates of when thawing will reach approximately four inches into the base course.

Discussion

A note should be entered in Column J of the Degree-Days Log when should post and must post values are calculated in Column I in addition, users should note road conditions in Column J

It is recommended that users apply the most conservative values during the initial years of application. Then using the suggested documentation, they can determine the best thresholds for all groups of their roads.

The above criteria are best suited for use during the start of the spring thaw period, generally February through April.

The temperature-based Melting Degree Days criteria are best applied to fine grained soils. These soils are common in local roads in New Hampshire.

Duration of Load Restrictions

The length of the load restriction period should approximate the time required to achieve complete thawing.

Cumulative Melting Degree Days for ending load restrictions equals 0.3 times the maximum value for Cumulative Freezing Degree Days (CFDD). Experience in New Hampshire, however, has indicated that the 0>3 multiplier varies due to a number of factors.

- 1 Variations in road construction – pavement thickness, base thicknesses and materials, shoulders and ditches.
- 2 Shaded areas that limit sunlight reaching the road surface.
- 3 Elevation differences sufficient to influence daily temperatures.
- 4 Water remaining on the roadsides due to residual snow and ice.

Summary of Restriction Start And Duration

The following is a summary of the steps to determine when to begin and how long to apply spring load restrictions.

- 1 Using the Degree Days Log to calculate degree days, freezing degree days (FDD), and melting degree days (MDD)
- 2 Begin calculating CFDD – cumulative freezing degree days – when there is a clear pattern of positive FDD
- 3 Begin calculating CMDD –cumulative melting degree days – when there is a pattern of positive MDD
- 4 Continue to calculate CMDD to determine the duration of load restrictions. During the first years of applying the guidelines, make duration judgements based of judgement, and experience.

Degree-Days Log

A	B	C	D	E	F	G	H	I	J
Month	Day	High Temp	Low Temp	Avg. Temp (C-D)/2	FDD 32-Avg.	Cumulative FDD	MDD Avg.-29	Cumulative MDD	Notes
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
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FDD = Freezing Degree Days
MDD = Melting Degree Days

Acknowledgment and History

The full Spring Road Use Restriction Guide was published in December 1996 and was prepared from Guidelines for Spring Highway Use Restrictions, Report No. FHWA TS-87-209, published by the Federal Highway Administration. Dr. David H. Fluharty, Director of the University of New Hampshire Technology Transfer Center, edited it. He was assisted by David Rand, a consultant to the Center. It was revised to reflect users' experiences, especially Douglas Dowey, Maintenance Supervisor, NH Department of Transportation District 3.

This guide was most recently reviewed in May 2021 by George Leel, UNH T2's Senior Technical Instructor.

This Technical Summary was developed by George Leel in May 2021, and represents a condensed version of the information in the full guide. For additional details and information on Spring Road Restrictions, please review the full guide.

Thank you also to our NH LTAP sponsors, FHWA and NHDOT.



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UNH Technology Transfer Center (UNH T2)

33 Academic Way
Durham, NH 03824
603.862.0030
T2.Center@unh.edu

