



# Seasonal Load Restriction Tool

## *Clarus Regional Demonstrations*

State transportation agencies have wanted to improve the techniques that lead to the decisions to impose and subsequently lift restrictions on selected roads that are prone to road damage due to subsurface freezing/thawing processes. The Seasonal Load Restriction (SLR) Tool uses observations from the *Clarus* and other non-*Clarus* systems to generate the information they need.

The SLR tool is part of the *Clarus* Initiative's regional demonstration projects where state and provincial departments of transportation provided ideas for five new potential uses for *Clarus* data.

The *Clarus* Initiative, a joint effort of the U.S. Department of Transportation Intelligent Transportation Systems (ITS) Joint Program Office and FHWA's Road Weather Management Program (RWMP), is a six-year effort to develop and demonstrate an integrated weather observation data management system that can reduce the impact of adverse weather conditions on surface transportation.

Participants in the SLR *Clarus* regional demonstration project included State Maintenance Operations personnel in Montana, North Dakota, and South Dakota.

SLR uses *Clarus* and other observations and a numerical model output as input to a subsurface model that generates weight restriction guidance based upon simulated structural stability in the subpavement soil profile. The decision support tool also uses past and current weather observations, long-lead time weather forecasts, and characteristics of the subpavement thermal and moisture profiles to create its soil stability assessment.

### **Activities**

Participating state departments of transportation identified desired test locations and supplied detailed information on pavement and subpavement characteristics.

A subpavement model, driven by forecasted weather conditions for the upcoming two weeks, was run daily to

project temperature, resilient modulus, pore pressure, percent pore ice, and percent pore water for three hours at a series of vertical nodes at each location.

Daily initialization of the subpavement condition model was accomplished using accumulated *Clarus* environmental sensor station data extending back to the previous fall before a winter freeze-up.

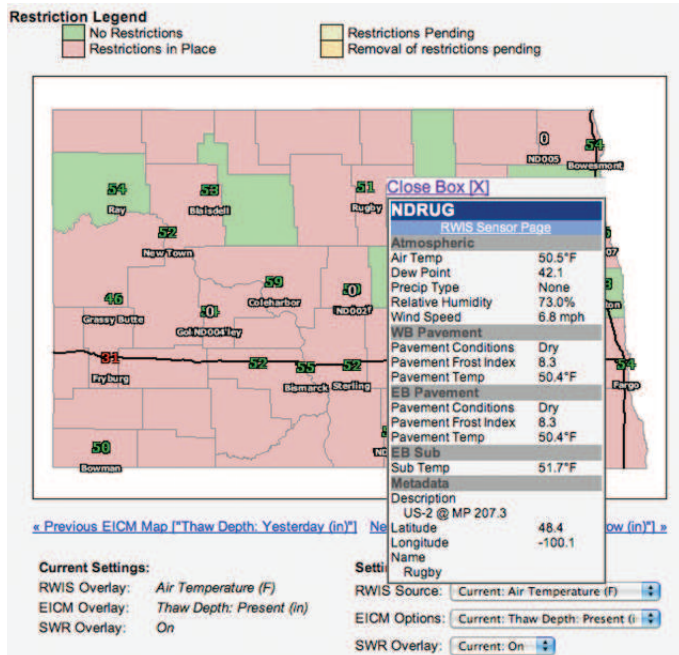
A web site was created to provide tools for the SLR support system which included the following:

- Site-specific soil temperature and resilient modulus profiles;
- State maps with displays of SLR, weather, and current restriction status overlays;
- A multistate display of the current seasonal weight restriction status by county; and
- A user interface to update SLR status.



*Freezing and thawing during winter months causes problems for roadway pavement that is exacerbated by semi-tractor trailers carrying heavy loads. That is why the SLR tool is valuable for state departments of transportation.*

**Figure 1. SLR Support System**

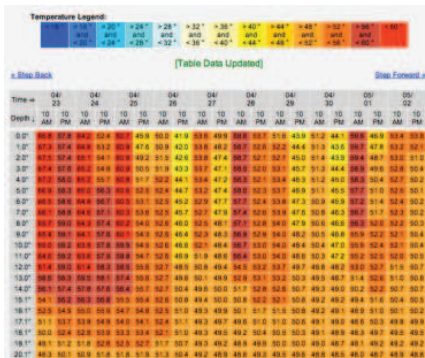


This is a map of North Dakota, courtesy of the RWMP, that provides sensor locations, which allows users to choose displays of Seasonal Load Restrictions, weather information, and the status of current restrictions.

Figure 1 shows the information available on the web site regarding weight restrictions. Below is a photo that shows what happens when roads freeze and thaw during the winter months.



**Figure 2. Temperature Chart, courtesy of the RWMP**



## Findings

The freeze/thaw simulation process provides a good representation of conditions beneath the pavement at the sites in Montana, North Dakota, and South Dakota that were part of the study.

The simulations indicate periods when subpavement conditions may be inadequate to resist loading from heavy vehicles. The forecasted conditions provided useful guidance on potential conditions that suggest projected times when the application or lifting of load restrictions might be appropriate.

Agencies typically do not lift restrictions until there is indication of a final thaw period; however, the subpavement simulation suggests that temporary thaws during the winter may provide conditions that could lead to subsurface damage that does not manifest itself until later in the spring.

Figure 2 is a diagram, courtesy of the RWMP, of the temperature in degrees Fahrenheit for the designated depths beneath the pavement surface for the forecasted times indicated on the horizontal axis.

## Summary

The Seasonal Weight Restriction Decision Support Tool provides a better understanding of subsurface conditions that may be associated with conditions observed on the surface or tied to existing thaw assessment techniques.

To obtain a copy of this software, please contact Paul Pisano of the RWMP.

All photos courtesy of the FHWA Road Weather Management Program.



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Federal Highway Administration  
Research & Innovative Technology Administration

*"Anytime, Anywhere Road Weather Information"*

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