

The Presentation of Road Weather and Condition Information to the Public:
The Results of an Aurora Pooled-Fund Study

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Aurora is a consortium of agencies focused on collaborative research, evaluation, and deployment of advanced road weather information systems (RWIS)* technologies. Current membership in Aurora includes nine state departments of transportation in the United States, the ministries of transportation in two Canadian provinces and the Swedish National Road Administration. Aurora also works closely with a number of sections of the Federal Highway Administration in the United States. To learn more about Aurora and its program, I refer you to the Aurora website <http://www.aurora-program.org>.

Aurora currently has a number of projects under way. One of these projects has as its goal to standardize presentation of road weather and condition information** so the public can readily understand and interpret the information regardless of the presentation format.

The ultimate goal of the Aurora's Standardized Road Weather and Condition Presentation project is to define a set of best practices for use in promulgating and promoting standards among national and international Standards Development Organizations. Our first step was a study and report (1) that identifies current and planned implementations of road weather and condition information dissemination systems. While the study focused primarily on systems within the United States, there was some information gathered from the international community. This paper presents some findings from the study that have

* RWIS is a leading ITS technology area in the highway maintenance field. The term "RWIS" refers to the whole spectrum of data collection, analysis, dissemination and display of road weather information. To distinguish RWIS, the system from the data collection station one sees along the road, the maintenance community has begun to call the roadside facilities environmental sensor stations (ESS).

** For the purpose of this report, "road weather" refers to the effect of weather on the roadway surface (e.g. above or below freezing), including bridges, and "road conditions" refers to the surface condition that may be affected by maintenance action (e.g. wet, dry, icy, etc.).

significance to the international community, the conclusions and recommendations of the study and the action taken by Aurora as a result.

Ed Boselly of the Weather Solutions Group located in Chesterfield, Missouri was the principal investigator for this study. He is the author of the report produced from this study and this paper is taken from that report. A complete copy the report can be found at <http://www.aurora-program.org/pdf/standardinforpt.pdf>. Dan Roosevelt served as project champion for Aurora.

THE PROBLEM

Aurora commissioned this project in response to a growing problem. Real-time road weather and condition information is becoming increasingly available to the traveler and there are no standards for the display of this information. Information dissemination devices include in-vehicle units, kiosks, the Internet, the media, and the telephone, both wire and cellular. As the number of receivers increase, so do the number of agencies transmitting information. Typically these agency programs are independently initiated. To date there has been little coordination between agencies. This lack of coordination has resulted in many formats for presenting road and weather information.

Few people today remember the early years of automobile travel. In the United States at that time each state and locality developed their own shape and layout for roadside signs. By the early twenties a condition existed similar to what we face today with road weather presentation. Each village, city and state had its own standard for road signs. Travelers moving from one jurisdiction to another had to adjust to a new standard, often on the fly. The result was confusion and an understanding that standards were needed for the shape, message and color of signs. A concerted effort in the early 1920's, led by the American Association of State Highway Officials (AASHO, the forerunner of AASHTO) and the Bureau of Public Roads (the forerunner of the FHWA), resulted in a set of common shapes, colors and messages for signs. Aurora believes we have reached a condition in the development of road weather displays similar to signing in the early 1920s.

The procedure followed in the 1920s and thirties to develop standardized signs is a good guide for us to follow today, but should also give us cause for concern. While AASHO adopted standardized shapes and colors in 1924 and published the first Uniform Manual of Highway Signs (the forerunner of the MUTCD) in 1927, these standards applied only to state DOTs. A survey of signing practices in large cities and a report on these findings in 1929

eventually led to the adoption of truly national standards, which finally were applied to all jurisdictions in 1935. (2)

The lessons learned are that national organizations, such as today's AASHTO, NACE and AWPAA in the United States, must be involved for any chance of success, but even then it took over eleven years to resolve a problem almost everyone recognized. We are not sure everyone recognizes consistent display of road weather and condition information as a need or that they recognize the states, cities, and counties as an important part of the solution.

Aurora's goal is to marshal support for a concerted national and international effort to standardize road weather and condition information presented to the traveler. Aurora believes that the first step in attacking this problem is to know the current condition. Our study asked the question, "What is the status of road weather and condition information?"

FINDINGS

The study, completed in December 2000, reports on traveler information presented on the Internet, variable message signs (VMS), in-vehicle information systems, highway advisory radio and telephone. Most of the information refers only to United States experience, but the VMS information includes some international experience.

At that time, really mid-year 2000, twenty-nine states listed road condition reports for their main roads, but only 18 also displayed the information in a GIS format. Of those eighteen states only twelve used a color code to designate condition. One point to be made here is that the state road condition reporting is in flux and new presentation formats appear monthly. These figures have changed significantly in the past year.

Figure 1 indicates the color-codes used by a few of the eighteen state DOTs for their Internet display of traveler information. While there is some consistency in color-coding and description between agencies, there is far more inconsistency; for instance, the color yellow:

- In North Dakota it indicates "ice, frost or compacted snow"
- Iowa defines it as "partly to mostly snow or ice covered." That is close to North Dakota, but not quite the same.
- Virginia describes the condition as "moderate," which is somewhere between good and severe. I can tell you that Virginians don't interpret that as "ice, frost or compacted snow." To us that is severe.
- Montana defines it as "icy or frost on road," but "snowpacked and icy" is pink
- Missouri doesn't even use yellow

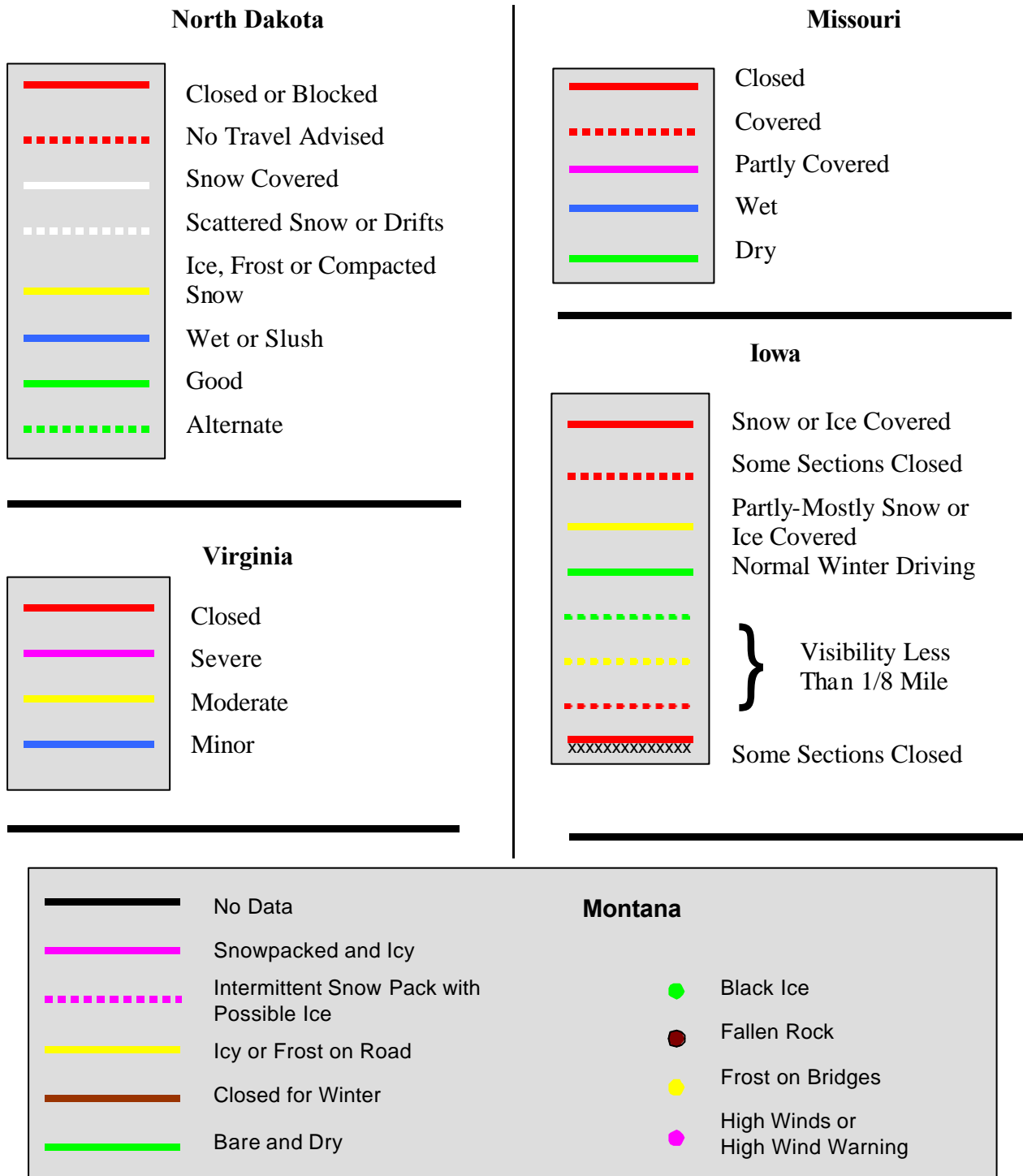


Figure 1. Road Condition Color Schemes from Five State DOT Web Sites.

The consistency of VMS messages is also of concern to Aurora. At the time of our study they were not commonly used in the United States to provide weather or road condition information, but the use is growing. When the information is weather related, the signs usually only provide regulatory information such as changeable speed limits

and traction device requirements. Road closures for weather-related conditions are provided in Wyoming and Idaho. Nearly all signs display manually inserted information.

Examples of automated input include changeable speed limits in Nevada (and similar work is ongoing in Arizona) using fuzzy logic algorithms based on sensor input, and icy road or bridge conditions in Minnesota at the entrance/exit to a tunnel and in Oregon on a bridge. The latter uses only a small fixed-message sign. Arizona plans to add variable message signs (VMS) along its I-40 corridor for weather-related information.

VMS are also a key component in active systems monitoring reduced-visibility situations and provide various warnings of fog or other visibility problems. A number of states have installed or are developing systems as a result of serious visibility-related crashes, which have frequently included numerous fatalities. To date, no standardized message or icon format has been established.

The International community is further along in the use of VMS and the task of standardizing messages. VMS are commonly used in Europe to provide road and weather condition information. Figure 2 shows a reconstruction of a set of signs used in the Netherlands for warning motorists of reduced visibility. The term, “MIST” is the European English term for fog. The TROPIC project (3) identified a need for standardizing icons (pictograms is the term used in Europe).



Figure 2. Representation of Matrix Signs of a Fog Warning System in the Netherlands.

Figure 3 shows currently used weather-related warning and control pictograms from Great Britain and France. The pictograms in the red triangles are warnings; the

pictogram in the red circle (maximum speed limit, e.g., for reduced visibility or other reason) is a control message requiring compliance.

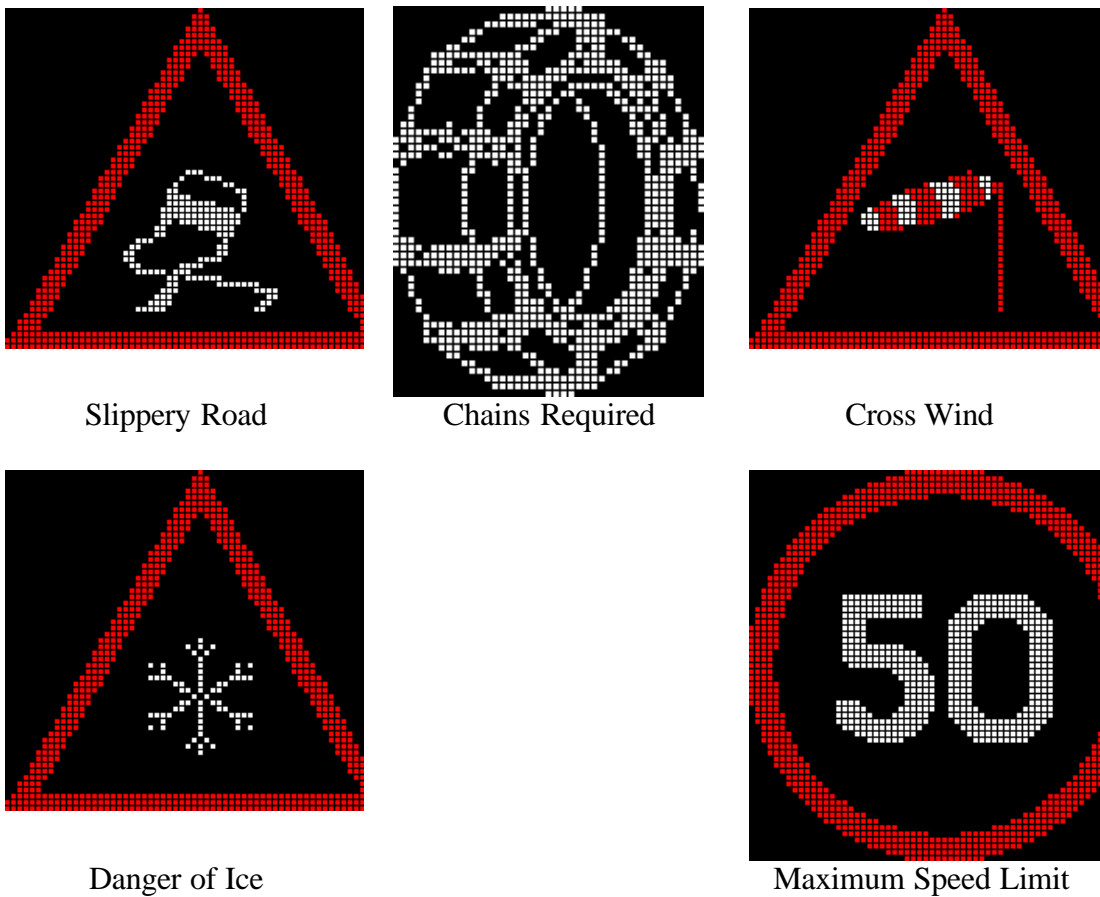


Figure 3. Existing Pictograms in Europe, Courtesy of the TROPIC Project.

Following surveys of motorists, and based on pictogram recognition and preference ratings, additional pictograms for reduced visibility have been developed. Figure 4 shows a TROPIC-recommended set of fog icons developed in France and Great Britain.

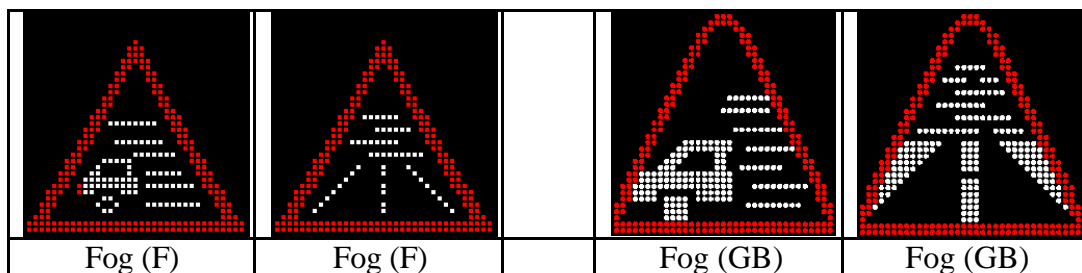


Figure 4. TROPIC-Recommended Newly Developed Pictograms for Fog from France (F) and Great Britain (GB). Courtesy of the TROPIC Project.

The questions arises whether this lack of consistency in presenting road weather and condition information is truly a problem to the public and especially the traveler and, if so what should the standards be? Are we underestimating the ability of the traveler to view and comprehend road weather information? A search of the literature identified no research on comprehension that was specific to road weather information. Also, no research seems to have been undertaken that would identify a set of standards for presentation that would be best recognized by the traveler.

To date travelers have obtained most of their weather information presented in a GIS format from the Internet or at kiosks and rest areas. Under those conditions it may be reasonable to expect the traveler to take the time to discern the meaning of the symbols used. The growth of telematics will soon allow this information to be viewed in moving vehicles. Information presented during the current debate concerning cell phone use and the operator's ability to handle additional chores or distractions support the view that the less distraction the better. Intuitively, consistent presentation of information should produce less distraction.

CONCLUSIONS AND RECOMMENDATIONS

No standard method of presenting weather and road condition information via the Internet exists. This includes a lack of standard color-coding of road segments and the use of a standard set of icons. Transportation agencies should develop and implement a standard map format for weather and weather-related road condition information dissemination and adopt a standard set of road condition descriptors and implement those with a standard color-coding.

No standards exist for the display of weather or road condition information via VMS. Transportation agencies should develop a minimum set of icons for depicting weather or road conditions on VMS.

The report presented some specific recommendations for standardizing color-codes, icons and VMS messages.

AURORA ACTION

Aurora accepts and supports the study recommendations, but recognizes that its influence is limited to its membership. To press for implementation of the study recommendations, Aurora has adopted the following plan:

- The suggested standard set of color-codes for road conditions, icons and VMS messages should be considered a starting point in future discussions of standardized presentation descriptors, not an adopted Aurora recommendation.
- Aurora will advise national organizations, such as AASHTO, of the findings of the Part I report and promote a joint project to:
 - Assess the efficiency and effectiveness of information presentation formats,
 - Develop a set of guidelines covering presentation techniques to suit the needs of general road users.
- Aurora will participate in any national or international efforts to develop standards for the presentation of road weather information to the traveler.

Aurora has allocated \$60,000 to be used as its contribution to efforts to implement the study recommendations.

REFERENCES

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3. Hubert, R. (Ed.). *Pictogram Presentation and Recommendations*, TRAFFIC OPTimisation by the integration of Information and Control (TROPIC), Trial Phase Report. WS Atkins Consultants, Birmingham, United Kingdom, December 1998.