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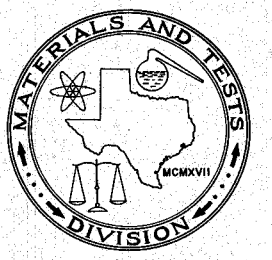
BY

SURFACE SYSTEMS, INC.



STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

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MARCH 1979

I. SUMMARY

This Division wrote six states to determine their actual field experience with the Highway Condition Surveillance System manufactured by Surface Systems, Inc. of St. Louis, Mo. Their replies and other reports indicate that this ice and moisture detector system is much better than other detectors previously used. Problems still exist and the company seems to be continually improving its equipment (including that already in use). Only in one case has a sensor head actually failed. Most problems are those of missed alarms. These range from none noted up to almost 60% of actual icing conditions.

II. RECOMMENDATION

The purchase of any ice detection equipment is not recommended at this time. The present state of development, while advanced, is such that the equipment will miss or give false calls much of the time. With the Highway Condition Surveillance System built by Surface Systems, Inc., these will usually be missed alarms due to dry snow (packed or unpacked) and frost conditions. This can result in a loss of confidence by operating personnel. This can quickly lead to nonuse of the system and the waste of its cost. It is further recommended that the status of this equipment be evaluated again in one to two years to determine what improvements have been made.

III. DISCUSSION

There have been many methods proposed for determining the presence of ice, snow, frost, or liquid water on a roadway. Many types of detectors have been built and sold. Few have

had any great degree of success. One of the more successful designs has been a device manufactured by Surface Systems, Inc. of St. Louis, Mo. This unit uses a dual element moisture sensor and a roadway temperature monitor. One sensor, a capacitance bridge, senses the presence of water. A second sensor, a surface resistance probe, determines whether it is in a liquid or solid state (the resistance of ice is very high). Various logic elements and voltage level monitors determine when a dangerous combination exist and indicate an appropriate warning.

The SSI system includes a remote monitor which indicates the following conditions:

Roadway Temperature

Local (Monitor) Air Temperature

Roadway Surface Condition; i.e., Clear, Wet, Alert (wet and near freezing), and Ice.

Each monitor can scan conditions for up to five sensor locations. The connection between the sensor control unit and the monitor may be by twisted wire pairs, telephone lines, radio systems, or a combination of these.

Last Fall, this Division wrote six states known to be using equipment from Surface Systems, Inc. (SSI). Replies were received from five states (see Appendix). Some included reports with their reply. Additional information was found in TRB publications and in a draft copy of an in-house FHWA report.

The following paragraphs summarize the comments from these five states about their experience with the SSI equipment.

Arkansas: They have had two systems for about five years. SSI has modified them seven or eight times. During winter of '77-78 they operated properly 70% of time. Personnel now question all readings from the system. SSI is to make another modification. Arkansas will then make a final determination of system's operation in May 1979.

Colorado: Two systems are in operation. One has had some cases where light frost or dew was shown as icing conditions. They think the newer models correct their problem. The second model has worked satisfactorily. A report was included that briefly discussed their use of the detector in a bridge heating study.

Illinois: A system was installed for evaluation. For two years it was used with recorders but has been modified to send data via radio to a maintenance center. Quoting: "Through our operation, we have found it necessary to include the bridge deck temperatures; the ice detecting system could not be considered a tool for maintenance action. It is more valuable as a management tool. By monitoring the conditions as they change, the snow and ice removal management can predict and initiate action or decrease action more rapidly."

Additional literature was included.

Nebraska: They installed three SSI systems in 1973. In the first three months of 1974, they correctly identified the road condition only 42% of the time. All detectors were replaced by SSI. Accurate records were not kept for the next two winters. Operation is thought to have improved. SSI again modified the equipment in 1977. The following comments were included from the Omaha District personnel.

District Maintenance Superintendent - "Has possibilities, however, the systems presently available do not have the electrical or physical reliability needed for us on a highway system. I do not recommend installing additional units unless more reliability can be shown."

Maintenance Superintendent - "Present detectors are approximately 75 percent accurate. I would not recommend additonal installations unless improvement is made. The system is not dependable enough to trust without a visual inspection. The system requires considerable maintenance and adjusting."

Wyoming: They have one system in operation. It uses two sensor heads.

"They appear to operate accurately when the system is completely operational. We have had problems in the past with the detector heads malfunctioning. When the heads malfunction, false calls are usually generated."

"At the maintenance shop we have an SSI monitor which provides road surface temperature and road surface conditions. This monitor has proven to be very effective in providing information on system malfunctions and it has also built confidence in the maintenance personnel who rely on the system."

They also note that two other SSI systems used to automatically turn on ice signs are no longer used due to false calls. From reading this reply, it is easy to assume accurate records of actual vs. indicated conditions were not kept.

Actual breakdowns seem to be rare. One report noted that a sensor head in Kentucky had failed soon after installation but was replaced by SSI.

The in-house FHWA report seems to be written in 1978 after the first six months of their testing (no date is on my copy). This report states that the system worked "reasonably well" but no data is given. In this test there were both missed

and false alarms. When a roadway was drying after rain or snow, the monitor would sometimes continue to indicate a wet road for some time after it was dry visually or to touch. It missed alarms when even one-quarter inch of dry snow had fallen on a wet road. The temperature was at or near freezing and the monitor continued to show an Alert signal. This would be a difficult situation for any detector since the road was still wet under the snow.

Based on these letters, comments, and reports, it is concluded that although the SSI system is good, it is not accurate enough to warrant the full confidence of maintenance personnel. The manufacturers seem to have steadily improved the equipment. When the improved system can be documented to have an accuracy of 90-95%, the State should consider their use.