Report No. CDOT-DTD-R-93-10

Ice Detection and Highway Weather Information Systems FHWA Experimental Project No. 13

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Colorado Department of Transportation

Final Report
May, 1993

Prepared in cooperation with the
U.S. Department of Transportation
Federal Highway Administration

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Technical Report Documentation Page

1. Report No. CDOT-DTD-R-93-10	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Ice Detection and Highway Weather Information Systems, FHWA Experimental Project No. 13		5. Report Date May, 1993 6. Performing Organization Code
7. Author(s) Dave Woodham		8. Performing Organization Rpt.No.
9. Performing Organization Name and Address Colorado Department of Transportaiton Research Branch, 4201 E. Arkansas Ave. Denver, CO 80222		10. Work Unit No. (TRAIS) 11. Contract or Grant No. DTFH71-89-513-CO-19
12. Sponsoring Agency Name and Address Colorado Department of Transportation 4201 E. Arkansas Ave. Denver, Colorado 80222		13. Type of Rpt. and Period Covered Final, 9/89 to 2/93 14. Sponsoring Agency Code 100.01

15. Supplementary Notes

Prepared in Cooperation with the U.S. Department of Transportation Federal Highway Administration

16. Abstract

This evaluation consisted of interviews with SCAN system users and evaluations of the manpower and material savings associated with the use of the system. It appears that use of a road weather information system can reduce the amount of deicing materials used as well as reduce overtime labor costs. Anecdotal information suggests that there have been fewer winter accidents after the instrumentation was installed at one site.

Implementation:

The system provides relevant and current weather information to maintenance decision makers. The overall effectiveness of the system depends on how users accept and use the information.

17. Key Words bridge deck icing, ice detection, SCAN, winter maintenance		18. Distribution Statement No Restrictions: This report is available to the public through the National Technical Info. Service. Springfield, VA 22161	
19.Security Classif. (report) Unclassified	20.Security Classif. (page) Unclassified	21. No. of Pages 30	22. Price

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1. Introduction

The Colorado Department of Transportation (CDOT) installed eight ice detection stations in the Denver Metropolitan area beginning in 1986. CDOT had been investigating the feasibility of using ice detectors to warn of icy bridges since the late 1960's. However, the legal issues of providing this information directly to motorists were never satisfactorily resolved. Ice detection equipment, which was being used at airports, began to be marketed for highway applications. The advantages of having accurate pavement temperatures in real time promised to be useful tool for managing snow and ice control. Advances in personal computers (PC) and PC communications have made it possible to display the results from remote ice detection stations to a central location. More recent technology allows inter-communication between regional clusters of stations. In addition, the reliability and sophistication has increased in ice detection equipment and the cost has been relatively constant in comparison to the winter maintenance budgets of states with significant snowfall.

2. System Description and Costs

2.1 Equipment and Location

The SCAN ice detection system from Surface Systems Inc. (SSI) is the system used in the Denver-metro area. Initial plans called for the installation of atmospheric and pavement sensors in two bridge decks (C-470 at I-25 and I-70 at Washington St. and Colorado Blvd.). Shortly after the first two sites were commissioned, two more sites were instrumented (Evans at Santa Fe and the Walnut St. viaduct) and a request for approval of four more sites was announced (C-470 at SH 121, C-470 at I-70, SH 7 at I-25, and I-70 at Chambers Rd). As of this date, the Colorado Department of Transportation has eight operational sites in the Denver-metro area.

A typical site contains equipment to furnish the following information: wind speed, wind direction, air temperature, relative humidity, precipitation, pavement temperature, relative amount of deicing chemicals, pavement condition (i.e. wet, icy), dew point, and subsurface temperature.

Since the CDOT system was commissioned, several other local agencies have put stations on the system. The City and County of Denver has two instrumented locations and the city of Thornton has one location. This sharing of information has been to the benefit of all parties--the cities have access to all the data from around the metro area and CDOT is able to augment its sensor network. One minor problem with this arrangement is that all agencies on the system need to be careful about equipment maintenance and calibration so that accurate information is furnished to the other users.

Although the first two locations in Denver became operational early in 1987, the system was not fully relied upon until the following winter. During the winter of 1987/88 the system was used extensively by maintenance personnel. Since the winter of 1987/88, the system has become a standard tool for winter maintenance.

2.2 Initial Purchase Costs and Conditions

The Colorado Department of Transportation's ice detection system consists of eight instrumented locations linked by radio and phone lines to a central computer. The computer and the support equipment is located at Section 8 maintenance headquarters, 2000 S. Holly in Denver. A system map is shown as Figure 1. The system has now been used for six full winters.

The initial cost of each ice detection station was approximately $35,000. This included commissioning and some installation by SSI. The equipment required to access each station (computer hardware and software) cost approximately $108,000. Total expenditure for the system at Section 8 has been $457,000 spent over four years.

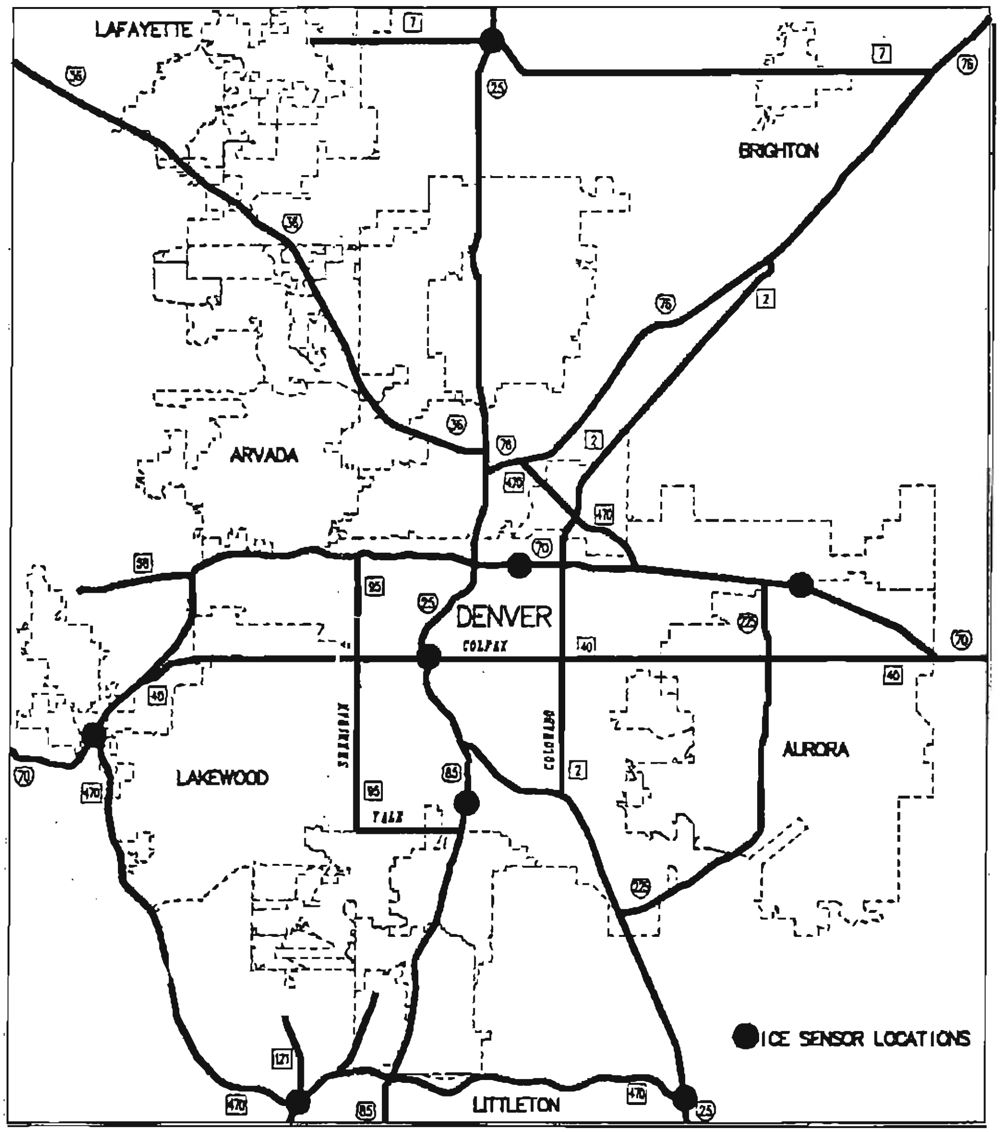

Figure 1. Existing Ice Detection Sites in Denver-Metro Area.

2.3 Vendor Support

Vendor support has been needed primarily for the software running on the central computer. Several problems occurred with the original mass storage device and the long-term history files were not always saved. SSI has since furnished a more reliable product.

CDOT has used a Maintenance Contract with SSI for Maintaining and calibrating the SCAN system in the metro area. After several seasons, it was felt that CDOT crews could respond quicker and at a lower cost than SSI's maintenance people for typical maintenance problems. However, more recently, SSI has a technician in the Denver-metro area.

2.4 Yearly Operating Costs

Operating costs per year have been approximately $6,200 per season for calibration, equipment repairs, or replacement of damaged equipment. On the average, two to three pavement sensors and a modem or radio have been replaced each season [3]. This work has been performed by CDOT traffic forces who have had training with the SSI equipment.

System reliability has been good with the main problem (interference) occurring in the communication links. The sensor readings have been accurate with the exception of the original relative humidity sensor (since improved by SSI). Pavement sensors would rarely drift out of calibration. Evaluation of the pavement sensors was done by comparing radiometer readings with values reported by the SCAN system. Correlation was very good when cloud cover was present. However, during sunny periods, the sensor readings were not as accurate. This is not a serious problem as snowstorms occur with cloud cover.

3. Description of Maintenance Organization and Operations

3.1 Resources

Section 8 Maintenance is responsible for snow and ice removal on most state highways in the Denver-metro area. However, some of the highways are cleared by local government agencies under contract with CDOT. Section 8 has responsibility for approximately 3130 lane miles in the Denver area and has had an annual winter maintenance budget of $1.9 to $2.1 million for the last several years. This budget has been fairly stable despite additional traffic and lane-mile coverage in the section.

There are 30 maintenance patrols in Section 8, each with three to five people. However, during snowstorms other maintenance crews are brought in (sweeper operators, traffic signal crews, and paint striping crews). During snowstorms there are typically about 60 snowplows out on the roads in the section. The Maintenance Superintendent estimates that costs are approximately $60,000 per hour for a full crew, equipment, and materials. Salt and sand mixtures are used exclusively in the metro-Denver area by CDOT maintenance. CDOT's specification for sanding materials calls for a durable aggregate containing very little fines (<2% passing the #200 sieve) and a minimum 18% salt.

3.2 Method of Operation

The Section maintenance superintendent is responsible for all maintenance activities in a section. There are six maintenance foremen, each responsible for a portion of the metro area, who report to the superintendent. Under each foreman, are several patrols which are responsible for certain sections of roads in the vicinity of the patrol garage. Each patrol has three to five people who work different shifts so that roads are covered with basic maintenance during weekdays. On weekends minimal coverage is provided and standbys are called in if necessary.

Decisions on whether to call for snow shifts are made at the section level. These decisions are often based on information from the SCAN system or on the current SCANCAST forecast. The snow shifts run as follows:

1st shift:	5:00 a.m. to 1:30 p.m.
2nd shift:	1:00 p.m. to 9:30 p.m.
3rd shift:	9:00 p.m. to 5:30 a.m.

Snow shifts are used so that shift changes do not occur during morning and afternoon rush hours and overtime is usually reduced.

During very large storms, local contractors are alerted that their equipment and personnel may be needed. However, standby time is not paid for. In most cases, the SCAN system is used in the decision when to use contractors and when to stop using them (e.g. when a storm is abating and pavement temperatures are rising).

4. Evaluation

This evaluation focused on the use of the system and whether the information provided is worth the costs of buying and maintaining the system. In addition to the collected data, efforts were made to determine how the information provided by the system actually was used in snow and ice control strategies.

4.1 Typical Use of the System

In order to familiarize the reader with how the system is used, a typical winter operation will be described. A Winter storm began early Friday March 3, 1990 with freezing rain and temperatures in the 8-14° F range. The rain changed to light snow by 7:30 a.m. During the day, snow fell (sporadically) with some periods of extremely heavy snowfall. Total accumulations were between 4 and 6 inches. Winds were present for most of the day and were generally 8-14 mph (steady) and from the northeast and east. The snow stopped Friday night and although it remained cold Saturday, the sunshine (beginning about 9:00 a.m.) helped to dry the roads and eliminate most of the slick conditions.

The SCAN system use was monitored during the day on Friday, March 3 at the Section 8 maintenance office. The Maintenance Superintendent had used the system the previous night at about 11:00 p.m. (along with local weather information) to advise the night foremen to change to snow shifts if conditions worsened. Snow shifts were begun at 5:00 a.m. on March 3.

The SCAN system was most used at the beginning and end of the storm. During the middle of the storm, maintenance was constantly patrolling the roads so that there was little need for the type of information that the system provides. However, the maintenance superintendent used the system several times during the day to check on the chemical factor at several locations. The system appears to be most used in projecting what the manpower requirements will be for the next shift(s), based on pavement temperature trends, current atmospheric conditions, and the time period (night/day, rush hour, weekend/weekday, etc.).

A log of radio requests for sand and reports of accidents was kept and is given below as an indication of the severity of the storm.

Time	Information Passed
9:27	request for sand, WB I-70 at Sheridan
9:38	slick conditions reported, EB I-70 Pecos to I-25
9:45	approx 1/4" of snow on ground a District VI
10:19	more sand requested on I-225
10:44	request for sand, WB I-70 Harlan to SH121
12:25	snowing very hard at District VI
12:27	more sand, US 36
13:00	light snow at District VI
13:10	request for sand, N&SB I-25 at 19th St.
13:27	request for sand, 600 to 700 block Sheridan
13:30	more sand from 88th & Sheridan North
13:35	6 car accident, I-25 at 58th
13:59	request for sand, E&WB I-70 Wadsworth to Kipling
14:42	request for sand, SB I-25 and I-76 near 50th
14:30	approx 1/2" of snow on ground at District VI
14:31	more sand, WB 6th Ave ramp to Indiana
14:53	2 car accident, Sheridan and Alameda

The forecasts, from SSI (SCANCAST) and the National Weather Service, as well as the SCAN system reports are shown in Appendix A for this storm.

4.2 Ease of Use

The SSI software provides the main link between the user and the large amount of collected data. The software runs on an IBM AT or compatible and, because of its graphic capabilities, works best with a higher resolution (EGA/VGA) monitor attached. The program is able to display the data in either text or graphic form depending on the situation. The text listing provides an overview of the system as well as more specific data (current readings, past readings, tendencies, etc.). The text data is also color coded (at the central location only) to draw attention to hazardous or near hazardous conditions.

The graphic mode is useful in order to quickly scan the stations and determine where trouble spots are. The graphics are also able to show several layers of detail for the system (please see Photographs 2-6 in Appendix B). At the system level, each station is shown on a map with several color codes to represent different pavement conditions and the communication status of each station.

At the station level, a graphic of the structure (with sensor locations) is shown with color coded information about individual pavement sensors and the atmospheric conditions at the station.

It appears that both modes of data display are useful. However, field supervisors are not able to use the graphic displays if calling in from another location since the information is sent as plain ASCII text.

4.3 Safety Aspects

Data was gathered on the effect of the SCAN ice detection equipment on accidents rates. Elevated I-70 in Denver, is a 9066 foot structure which was one of the first sites to be instrumented. Accident data for this site was compiled for the years 1983-1990, inclusive. The number of accidents occurring when pavement conditions were snowy or icy were tabulated. Since these types of accidents depend on the number and intensity of winter storms, the multiple regression technique was used to predict the number of accidents based on the number of storms and the amount of snowfall for each winter season. An equation was developed based on the years previous to the installation of the ice-detection equipment. This equation predicted the number of accidents very well ($R^2 = 0.96$). For the period after the installation of the ice-detection equipment, the actual number of accidents fell to half the predicted numbers (Figure 2). This indicates that some factor was reducing winter accidents.

However, after talks with traffic engineers, it was discovered the reporting threshold for accidents was raised from $500 to $1000 beginning January 1, 1988. Further, the effects of "accident alerts" were discussed on these statistics. Accident alerts are called when local police cannot investigate the large number of accidents which occur during major winter storms. During accident alerts, if no injuries occurred or the use of alcohol was not involved in an accident, motorists need only to call the information into the local police within 24 hours. However, CDOT accident records do not include accident data which were not filled out at the scene. This means that many of the accidents which occurred during winter storms were never entered into the CDOT database. In light of these complications, there were no further attempts at quantifying the effect of the ice-detection equipment on winter accident rates.

Maintenance forces in Section 8 have pointed out that there have not been major multi-car accidents on elevated I-70 since the SCAN system was installed [2]. This had occurred several times during winter storms previous to 1987.

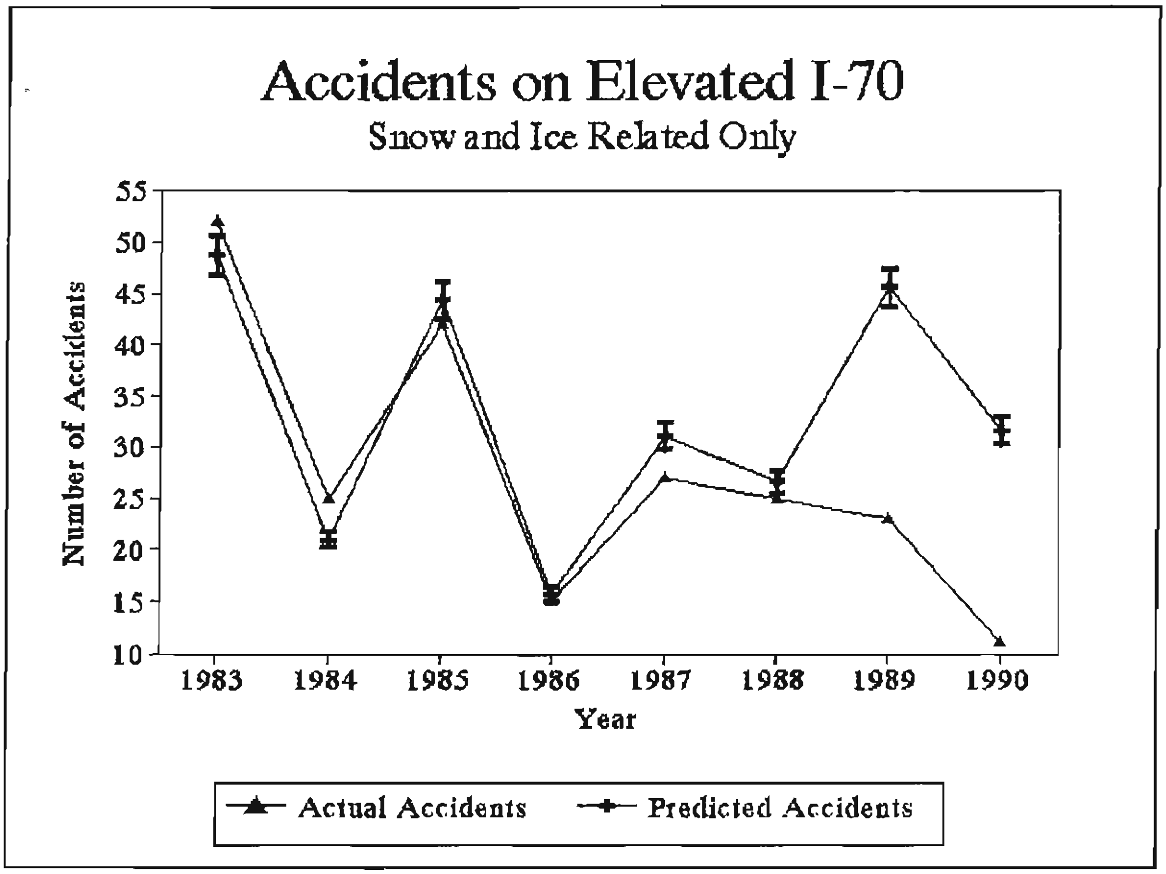

Figure 2. Accident Prediction Model Based on Linear Regression.

4.4 Salt/Sand Usage

The amount of salt/sand used during the winters 1982-1983 through 1992-1993 was also investigated. The amount of salt/sand used is weather dependent and the multiple regression technique was again used to predict salt/sand use based on three factors: the sum of the deviation from the mean monthly temperatures for winter months, the average snowfall for the winter, and the number of lane miles plowed (all for the years prior to installation of the SCAN system). The equation developed predicted the salt/sand usage well for all 11 winters ($R^2 = 0.90$). A plot of the salt/sand use versus the predicted use is shown in Figure 3. The reduction in salt/sand use outside the error bar shown during the winters of 1990-91, 1991-92, and 1992-93 can possibly be attributed to the use of the ice-detection system. The reduction in use of about 8300 tons represents a approximate savings of $83,000 in material costs, $74,000 in labor costs (to distribute the material only), and $46,000 in vehicle operating expenses. This three-year savings represents approximately 44% of the cost of the installed ice-detection system.

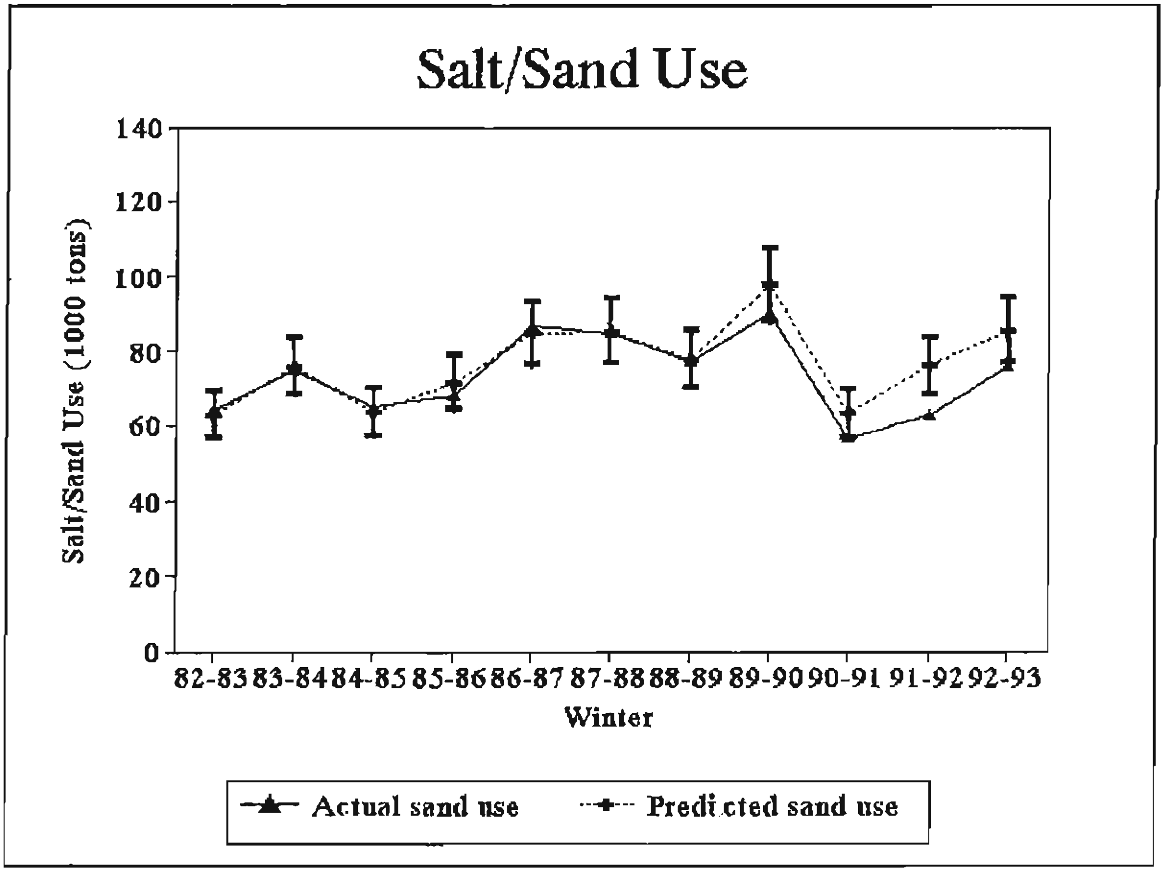

Figure 3. Salt/Sand Prediction Model for Use in Metro Denver Area.

4.5 Overtime

Overtime paid for snow and ice control was another parameter which was investigated. The additional information provided by the ice-detection system has the potential to reduce overtime though more efficient scheduling.

The quantitative comparison of overtime before and after the installation of the ice-detection equipment was not possible due to several problems. The records previous to 1988-89 were stored on another computer which has since been decommissioned. The data is stored on tape but as of this time, the data is inaccessible. Another factor is that maintenance workers often take their overtime in "comp time" which would not show up in the records.

Users of the system have stated that overtime reductions have occurred during storms. These reductions are hard to quantify but seem to occur at the beginnings and ends of storms and generally during fall and spring storms. The reasons for this is that often pavement temperatures are higher in the fall and spring and the crews can be delayed several hours at the onset of a storm or released earlier at the end of a storm based on accurate pavement temperature information.

Based on the available information, it appears that overtime has been decreasing for the last several years despite the fact that one winter (89-90) was more severe than the base year (arbitrarily taken as 1988-89).

	Winter				
	88-89	89-90	90-91	91-92	92-93
Overtime Charged to Activity Code 402	\$307,385	\$237,529	\$194,471	\$310,754	\$319,805
Winter Severity Index From Linear Regression (88-89 as base year)	1.0	1.26	0.82	0.98	1.01
Base Year x Index + 5% Inflation per Year	\$307,385 ±\$30,700	\$406,680 ±\$40,700	\$277,900 ±\$27,800	\$343,720 ±\$34,400	\$377,366 ±\$37,700

Table 1. Overtime Use by Winter (Snow and Ice Control Only).

While overtime costs decreased between the winters of 88-89 and 89-90, the winter severity index (based on miles plowed, total snow, and temperature deviation from average) increased by approximately 25%. In this case, the predicted expenditure would be some \$406,680 based on the winter index and an assumed 5% per year inflation rate. The results from other years are also shown in Table 1.

However, it should be stressed that the amount of overtime is highly dependant on storm timing and duration. Storms which reach the Denver area on weekends are going to require more overtime as do storms which arrive at an odd hour of the night (e.g. 11:30 p.m.). It appears that some of the savings in the winters of 1989-90 and 1990-91 could be attributed to the use of the ice-detection system.

5. Results

This evaluation consisted of interviews with SCAN system users and estimations of the manpower and material savings associated with the use of the system and possible influences the system may have on traffic safety during winter conditions. These estimations are based on the best information available but with the many variables present in a metropolitan highway system, these numbers need to be treated with some caution.

It appears that material usage and overtime costs have both been reduced by the use of the SCAN system. Anecdotal information suggests that there may be some reductions in winter accidents for one site.

There exists a learning period for the effective use of the SCAN system in which the users develop a "feel" for the numbers and begin to trust the information seen on the computer screen. Therefore, it seems reasonable that there will not be dramatic changes in a given parameter immediately after commissioning an ice-detection system but rather a gradual increase in the efficiency of winter operations. Acceptance by the users plays a large role in possible efficiency gains.

It has been difficult to establish cost differences due to the use of the SCAN system mainly due to the large effort required to track the decision-making process during winter storms and due to the many variables which influence the costs of snow and ice control. Another major difficulty is that it is often not possible to determine what decisions might have otherwise been made, had the SCAN information not been available. Variations in the severity of every winter make before/after type comparisons difficult.

5.1 Recommendations

At least one weather station should be installed in the direction from which major winter storms arrive. Typically, problem sites are instrumented first with the idea that these sites will provide a warning of future conditions at other sites. Other areas of concern are locations where traffic problems would cause extreme complications for the road network.

Weather instrumentation is very useful; however, if two stations are very close to each other, then one set of instruments will be unnecessary.

Determine ways to encourage maintenance people to "buy into" the system. This may require several days of training in both how to use the equipment and strategies for improving efficiencies.

6. Other Uses of the System

The SCAN system generates data that has other applications within a transportation agency. The system has been used during summer months by nighttime paving crews to establish if pavement and air temperatures meet the minimum specifications for paving. The long-term history files provide a record of the actions taken during snowstorms (mainly by the chemical factor) which can be used as documentation in legal actions involving road conditions during accidents. In addition, the system may have other applications in pavement designs where the number of freeze/thaw cycles is a factor.

7. Other Systems

Several other companies are becoming active in the U.S. market as of this date. Several Europe-based corporations are importing road weather systems which have been used extensively in other countries. These systems provide information similar to the SCAN system.

At this time, the various systems are not compatible although standards may be recommended by the contractor working on Strategic Highway Research Program (SHRP) contract H-207. However, even if standards are recommended, it may be several years before these standards are implemented. In the meantime, organizations which have begun with one system are obligated to purchase additional equipment from the same manufacturer for expansion.

In Colorado (and most likely in other western states), there is a need for low-cost equipment for low-volume roads. This equipment would have applications, as an example, on remote mountain passes where the traffic is very low but the distance involved in making a routine "run" is large. Low-cost equipment would also bring road weather information capability to counties, smaller cities, or school districts.

8. Future Uses

Ice-detection equipment is only one area in which highway agencies need information from remote sites. For the sake of economy, future road weather information systems should be capable of a variety of tasks. Weigh-in-motion, traffic volumes, vehicle classification, and stream water level information are only a few of the applications which could "piggyback" onto the logic and communication equipment already used at a typical ice-detection site.

References

[1] Nelson, Thane, "Evaluation of Ice Warning Systems" Oklahoma Department of Transportation, February, 1989

[2] Conversation with Gordon Bell, Assistant Maintenance Superintendent, Section 8

[3] Conversation with Chris Lillie, Traffic Signal Electrician

APPENDIX A

SCAN System Printouts

Weather Forecasts

COLORADO D.O.H. DIST. 6 Summary Page Time 09:11 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip	Surf	Air	Dew pt	CF
1	I25NB-C470WB-WAP-SHD	Chemical wet	Y	v 25	v 14	* 12.5	^30
2	I25NB-C470NB-WDK-LN1	Chemical wet	Y	v 20	v 14	* 12.5	v35
3	I25NB-C470WB-EDK-LN1	Snow/ice alert	Y	v 20	v 14	* 12.5	v25
4	I25NB-C470WB-EAP-SHD	Chemical wet	Y	^ 26	v 14	* 12.5	v50
5	C470EB-I25NB-DK-LN1	Snow/ice alert	Y	v 22	v 14	* 12.5	v10
6	C470EB-I25NB-AP-SHDR	Chemical wet	Y	v 24	v 14	* 12.5	v35
7	C470EB-I25NB-DK-LN2	Chemical wet	Y	v 22	v 14	* 12.5	^35
8	I25NB-C470-ML-LN3	Chemical wet	Y	v 25	v 14	* 12.5	^50
9	I70WB-ML-AP-LN1		Y	^ 60	v 11	* 6.4	
10	I70WB-ML-DK-LN1		Y	^ 60	v 11	* 6.4	
11	I70WB-ML-DK-LN3	Dry	Y	^- 41	v 11	* 6.4	
12	I70WB-ML-VAS-LN3		Y	^ 60	v 11	* 6.4	
13	I70EB-ML-WSH-DK-LN1	Wet	Y	^ 175	v 11	6.4	
14	I70EB-ML-DK-LN3	Chemical wet	Y	v 21	v 11	6.4	v70
15	I70EB-ML-AP-LN3	Chemical wet	Y	v 21	v 11	6.4	^50
16	I70EB-WSH-GRDPRB		Y	v 37	v 11	6.4	

Enter system command and press <RETURN> :[

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 . Summary Page Time 09:12 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip	Surf	Air	Dew pt	CF
17	EVNS-EB-SANFE-AP-LN3	Chemical wet	Y	v 27	v 14	9.3	^75
18	EVNS-EB-SANFE-DK-LN2	Chemical wet	Y	v 23	v 14	9.3	v65
19	US85-SB-OFFRMP	Chemical wet	Y	v 23	v 14	9.3	v55
20	US85-NB-ML-LN3	Snow/ice alert	Y	v 28	v 14	9.3	^05
21	WLNT-WB-AP-LN3	Chemical wet	Y	v 23	v 12	* 11.4	^95
22	WLNT-WB-DK-LN2		Y	v 14	v 12	* 11.4	
23	WLNT-WB-DK-LN1		Y	171	v 12	* 11.4	
24	121NB-C470-LN2	Chemical wet	Y	v 26	v 15	* 13.3	^45
25	C470EB-121-AP-LN2	Snow/ice alert	Y	^ 25	v 15	* 13.3	v05
26	C470WB-121-DK-LN2	Snow/ice alert	Y	v 24	v 15	* 13.3	v10
27	C470WB-121-AP-LN1	Snow/ice alert	Y	v 25	v 15	* 13.3	v10
28	C470SB-I70-DK-LN2		Y	v 20	v 12	9.7	
29	C470SB-I70-AP-LN2	Chemical wet	Y	v 23	v 12	9.7	^70
30	I70WB-C470-LN2	Chemical wet	Y	v 24	v 12	9.7	^90
31	C470NB-I70-DK-LN2	Snow/ice alert	Y	v 20	v 12	9.7	v05
32	C470NB-I70-AP-LN2	Chemical wet	Y	v 23	v 12	9.7	^35

Enter system command and press <RETURN> :[

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 09:59 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Temperatures Surf		Air		Dew pt	CF
1	I25NB-C470WB-WAP-SHD	Chemical wet	Y	^	27	v	10	*	8.1	^30
2	I25NB-C470NB-WDK-LN1	Chemical wet	Y	v	19	v	10	*	8.1	v65
3	I25NB-C470WB-EDK-LN1	Chemical wet	Y	^	20	v	10	*	8.1	^40
4	I25NB-C470WB-EAP-SHD	Chemical wet	Y	^	28	v	10	*	8.1	v50
5	C470EB-I25NB-DK-LN1	Chemical wet	Y	v	21	v	10	*	8.1	v45
6	C470EB-I25NB-AP-SHDR	Chemical wet	Y	v	25	v	10	*	8.1	^65
7	C470EB-I25NB-DK-LN2	Chemical wet	Y	v	21	v	10	*	8.1	^60
8	I25NB-C470-ML-LN3	Chemical wet	Y	v	24	v	10	*	8.1	v45
9	I70WB-ML-AP-LN1		Y	^	60	v	9	*	3.9	
10	I70WB-ML-DK-LN1		Y	^	60	v	9	*	3.9	
11	I70WB-ML-DK-LN3	Dry	Y	^-	41	v	9	*	3.9	
12	I70WB-ML-VAS-LN3		Y	^	60	v	9	*	3.9	
13	I70EB-ML-WSH-DK-LN1	Wet	N	^	175	v	8		2.7	
14	I70EB-ML-DK-LN3	Chemical wet	N	v	20	v	8		2.7	v75
15	I70EB-ML-AP-LN3	Chemical wet	N	v	20	v	8		2.7	^50
16	I70EB-WSH-GRDPRB		N	v	37	v	8		2.7	

Enter system command and press <RETURN> :

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 10:01 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Temperatures Surf		Air		Dew pt	CF
17	EVNS-EB-SANFE-AP-LN3	Chemical wet	Y	v	26	v	11		5.6	^80
18	EVNS-EB-SANFE-DK-LN2	Chemical wet	Y	v	22	v	11		5.6	^70
19	US85-SB-OFFRMP	Chemical wet	Y	v	23	v	11		5.6	^90
20	US85-NB-ML-LN3	Dry	Y	v	27	v	11		5.6	
21	WLNT-WB-AP-LN3	Chemical wet	Y	v	22	v	9	*	7.3	^95
22	WLNT-WB-DK-LN2		Y	v	13	v	9	*	7.3	
23	WLNT-WB-DK-LN1		Y		171	v	9	*	7.3	
24	121NB-C470-LN2	Chemical wet	Y	v	25	v	12		9.7	^45
25	C470EB-121-AP-LN2	Chemical wet	Y	v	23	v	12		9.7	^35
26	C470WB-121-DK-LN2	Snow/ice alert	Y	v	23	v	12		9.7	^25
27	C470WB-121-AP-LN1	Snow/ice alert	Y	v	24	v	12		9.7	^20
28	C470SB-I70-DK-LN2		Y	^	20	v	8		5.4	
29	C470SB-I70-AP-LN2	Chemical wet	Y	^	24	v	8		5.4	^95
30	I70WB-C470-LN2	Chemical wet	Y	v	23	v	8		5.4	v50
31	C470NB-I70-DK-LN2	Snow/ice alert	Y	v	20	v	8		5.4	v05
32	C470NB-I70-AP-LN2	Chemical wet	Y	^	24	v	8		5.4	^35

Enter system command and press <RETURN> :

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 11:07 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Surf		Air		Dew pt	CF
33	I70EB-C470-LN2	Chemical wet	Y	v	22	v	5		2.1	v35
34	SH7WB-I25-DK	Wet	N	^	33	^	9	*	7.5	v90
35	SH7EB-I25-AP	Chemical wet	N	^	28	^	9	*	7.5	^95
36	SBI25-SH7-LN3	Dry	N	^	29	^	9	*	7.5	
37	I70EB-CHMB-RAMP	Dry	N	^	29	^	5		2.1	
38	CHMBNB-I70-DK-LN2	Chemical wet	N	^	24	^	5		2.1	v50
39	CHMBSB-I70-AP-LN2	Dry	N	^	28	^	5		2.1	
40	I70WB-CHMB-LN3	Chemical wet	N	^	22	^	5		2.1	^65
41	CLFXEB-COLO-LN2	Absorption	N	^	29	^	8		3.3	
42	CLFXWB-COLO-LN2	Absorption	N	^	28	^	8		3.3	
43	COLONB-CLFX-LN3	Absorption	N	^	29	^	8		3.3	
44	COLOSB-CLFX-LN3	Absorption	N	v	27	^	8		3.3	
45	SHERSB-NYALE-LN2	Communication Fail								
46	SHERSB-@YALE-LN1	Communication Fail								
47	SHERNB-@YALE-LN1	Communication Fail								
48	SHERSB-@BATES-LN2	Communication Fail								

Getting history data for LTH :[

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 11:08 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Surf		Air	Dew pt	CF
49	THRNPRKY-I25SB-RAMP	Chemical wet	Y	^	29	v	7	4.8	^45
50	THRNPRKY-EB-LN1	Chemical wet	Y	^	28	v	7	4.8	^95
51	THRNPRKY-WB-LN1	Chemical wet	Y	^	26	v	7	4.8	^80
52	THRNPRKY-WB-LN2	Chemical wet	Y	^	28	v	7	4.8	v95

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 12:28 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip	Surf	Air	Dew pt	CF
1	I25NB-C470WB-WAP-SHD	Chemical wet	Y	^ 31	^ 8	5.8	v25
2	I25NB-C470NB-WDK-LN1	Chemical wet	Y	^ 32	^ 8	5.8	v70
3	I25NB-C470WB-EDK-LN1	Chemical wet	Y	^ 29	^ 8	5.8	v45
4	I25NB-C470WB-EAP-SHD	Chemical wet	Y	^ 31	^ 8	5.8	v45
5	C470EB-I25NB-DK-LN1	Chemical wet	Y	^ 27	^ 8	5.8	v55
6	C470EB-I25NB-AP-SHDR	Wet	Y	^ 34	^ 8	5.8	^95
7	C470EB-I25NB-DK-LN2	Chemical wet	Y	^ 30	^ 8	5.8	^95
8	I25NB-C470-ML-LN3	Wet	Y	^ 35	^ 8	5.8	v70
9	I70WB-ML-AP-LN1		Y	^ 60	^ 8	* 2.7	
10	I70WB-ML-DK-LN1		Y	^ 60	^ 8	* 2.7	
11	I70WB-ML-DK-LN3	Dry	Y	^- 41	^ 8	* 2.7	
12	I70WB-ML-VAS-LN3		Y	^ 60	^ 8	* 2.7	
13	I70EB-ML-WSH-DK-LN1	Wet	Y	^ 175	^ 9	3.7	
14	I70EB-ML-DK-LN3	Chemical wet	Y	v 22	^ 9	3.7	^70
15	I70EB-ML-AP-LN3	Chemical wet	Y	v 22	^ 9	3.7	v50
16	I70EB-WSH-GRDPRB		Y	v 37	^ 9	3.7	

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 12:28 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip	Surf	Air	Dew pt	CF
17	EVNS-EB-SANFE-AP-LN3	Wet	Y	^ 35	^ 10	2.9	^95
18	EVNS-EB-SANFE-DK-LN2	Chemical wet	Y	^ 31	^ 10	2.9	^90
19	US85-SB-OFFRMP	Chemical wet	Y	^ 30	^ 10	2.9	^60
20	US85-NB-ML-LN3	Chemical wet	Y	^ 31	^ 10	2.9	^70
21	WLNT-WB-AP-LN3	Chemical wet	Y	^ 27	^ 9	5.3	^95
22	WLNT-WB-DK-LN2		Y	^ 18	^ 9	5.3	
23	WLNT-WB-DK-LN1		Y	171	^ 9	5.3	
24	121NB-C470-LN2	Wet	Y	^ 35	^ 9	6.6	v85
25	C470EB-121-AP-LN2	Dry	Y	^ 45	^ 9	6.6	
26	C470WB-121-DK-LN2	Dry	Y	^ 47	^ 9	6.6	
27	C470WB-121-AP-LN1	Dry	Y	^ 47	^ 9	6.6	
28	C470SB-I70-DK-LN2		Y	^ 19	^ 6	3.5	
29	C470SB-I70-AP-LN2	Chemical wet	Y	^ 26	^ 6	3.5	^95
30	I70WB-C470-LN2	Chemical wet	Y	^ 26	^ 6	3.5	^40
31	C470NB-I70-DK-LN2	Snow/ice alert	Y	^ 27	^ 6	3.5	v05
32	C470NB-I70-AP-LN2	Chemical wet	Y	^ 28	^ 6	3.5	^35

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 13:36 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Surf		Air	Dew	pt	CF
1	I25NB-C470WB-WAP-SHD	Wet	Y	^	34	v	7		4.8	^30
2	I25NB-C470NB-WDK-LN1	Wet	Y	^	33	v	7		4.8	^95
3	I25NB-C470WB-EDK-LN1	Dry	Y	^	32	v	7		4.8	
4	I25NB-C470WB-EAP-SHD	Chemical wet	Y	^	31	v	7		4.8	v40
5	C470EB-I25NB-DK-LN1	Dry	Y	^	30	v	7		4.8	
6	C470EB-I25NB-AP-SHDR	Wet	Y	^	37	v	7		4.8	v10
7	C470EB-I25NB-DK-LN2	Chemical wet	Y	^	32	v	7		4.8	v70
8	I25NB-C470-ML-LN3	Dry	Y	^	40	v	7		4.8	
9	I70WB-ML-AP-LN1		Y	^	60	^	8	*	2.7	
10	I70WB-ML-DK-LN1		Y	^	60	^	8	*	2.7	
11	I70WB-ML-DK-LN3	Dry	Y	^-	41	^	8	*	2.7	
12	I70WB-ML-VAS-LN3		Y	^	60	^	8	*	2.7	
13	I70EB-ML-WSH-DK-LN1	Wet	Y	^	175	^	8		2.4	
14	I70EB-ML-DK-LN3	Chemical wet	Y	^	24	^	8		2.4	^80
15	I70EB-ML-AP-LN3	Chemical wet	Y	^	23	^	8		2.4	v50
16	I70EB-WSH-GRDPRB		Y	v	37	^	8		2.4	

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 13:37 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Surf		Air	Dew	pt	CF
17	EVNS-EB-SANFE-AP-LN3	Wet	Y	v	35	^	9	-	0.2	^95
18	EVNS-EB-SANFE-DK-LN2	Chemical wet	Y	v	29	^	9	-	0.2	v75
19	US85-SB-OFFRMP	Chemical wet	Y	v	30	^	9	-	0.2	^95
20	US85-NB-ML-LN3	Dry	Y	v	31	^	9	-	0.2	
21	WLNT-WB-AP-LN3	Chemical wet	Y	^	29	v	[illegible]		4.0	^95
22	WLNT-WB-DK-LN2		Y	^	17	v	8		4.0	
23	WLNT-WB-DK-LN1		Y		171	v	8		4.0	
24	121NB-C470-LN2	Chemical wet	Y	^	30	^	9		6.6	v75
25	C470EB-121-AP-LN2	Dry	Y	v	38	^	9		6.6	
26	C470WB-121-DK-LN2	Dry	Y	v	41	^	9		6.6	
27	C470WB-121-AP-LN1	Dry	Y	v	39	^	9		6.6	
28	C470SB-I70-DK-LN2	•	Y	v	20	v	6		3.1	
29	C470SB-I70-AP-LN2	Chemical wet	Y	^	27	v	6		3.1	v35
30	I70WB-C470-LN2	Chemical wet	Y	v	26	v	6		3.1	^45
31	C470NB-I70-DK-LN2	Snow/ice alert	Y	v	25	v	6		3.1	^05
32	C470NB-I70-AP-LN2	Chemical wet	Y	^	29	v	6		3.1	^75

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

Enter system command and press <RETURN> :

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 14:32 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Surf		Air	Dew pt		CF
1	I25NB-C470WB-WAP-SHD	Chemical wet	Y	v	31	v	7		4.8	^30
2	I25NB-C470NB-WDK-LN1	Chemical wet	Y	v	24	v	7		4.8	v80
3	I25NB-C470WB-EDK-LN1	Snow/ice alert	Y	v	25	v	7		4.8	^05
4	I25NB-C470WB-EAP-SHD	Chemical wet	Y	^	31	v	7		4.8	^45
5	C470EB-I25NB-DK-LN1	Dry	Y	v	26	v	7		4.8	
6	C470EB-I25NB-AP-SHDR	Chemical wet	Y	v	31	v	7		4.8	v35
7	C470EB-I25NB-DK-LN2	Chemical wet	Y	v	25	v	7		4.8	^95
8	I25NB-C470-ML-LN3	Dry	Y	v	30	v	7		4.8	
9	I70WB-ML-AP-LN1		Y	^	60	v	7	*	1.4	
10	I70WB-ML-DK-LN1		Y	^	60	v	7	*	1.4	
11	I70WB-ML-DK-LN3	Dry	Y	^-	41	v	7	*	1.4	
12	I70WB-ML-VAS-LN3		Y	^	60	v	7	*	1.4	
13	I70EB-ML-WSH-DK-LN1	Wet	Y	^	175	^	8		2.7	
14	I70EB-ML-DK-LN3	Chemical wet	Y	^	23	^	8		2.7	^80
15	I70EB-ML-AP-LN3	Chemical wet	Y	v	21	^	8		2.7	^60
16	I70EB-WSH-GRDPRB		Y	v	37	^	8		2.7	

Arrows=select(map only) F1=Help F2=Map F8=Logon F9=Logoff F10=Quit

COLORADO D.O.H. DIST. 6 Summary Page Time 14:33 March 03, 1989
Power on at: 07:44 on 02/01/89

Sensor No.	Sensor location	Status	Precip		Surf		Air	Dew pt		CF
17	EVNS-EB-SANFE-AP-LN3	Snow/ice alert	Y	v	32	v	8	-	2.4	v05
18	EVNS-EB-SANFE-DK-LN2	Chemical wet	Y	v	26	v	8	-	2.4	v75
19	US85-SB-OFFRMP	Chemical wet	Y	v	27	v	8	-	2.4	^95
20	US85-NB-ML-LN3	Dry	Y	v	28	v	8	-	2.4	
21	WLNT-WB-AP-LN3	Chemical wet	Y	v	26	v	7		2.3	^95
22	WLNT-WB-DK-LN2		Y	v	15	v	7		2.3	
23	WLNT-WB-DK-LN1		Y		171	v	7		2.3	
24	121NB-C470-LN2	Chemical wet	Y	v	24	v	7		4.1	v65
25	C470EB-121-AP-LN2	Chemical wet	Y	v	25	v	7		4.1	v45
26	C470WB-121-DK-LN2	Chemical wet	Y	v	27	v	7		4.1	^40
27	C470WB-121-AP-LN1	Snow/ice alert	Y	v	27	v	7		4.1	v20
28	C470SB-I70-DK-LN2	Chemical wet	Y	v	17	v	4		0.9	^55
29	C470SB-I70-AP-LN2	Chemical wet	Y	v	24	v	4		0.9	^50
30	I70WB-C470-LN2	Chemical wet	Y	v	24	v	4		0.9	v35
31	C470NB-I70-DK-LN2	Snow/ice alert	Y	v	23	v	4		0.9	^05
32	C470NB-I70-AP-LN2	Chemical wet	Y	^	29	v	4		0.9	^80

Getting history data for LTH :[

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IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM;
:                       SCANCAST(sm) _______ PAVEMENT   Forecast                    :
:                      SCAN  Highway  &  Runway  Prediction  Model                  :
:  DENVER METRO - EAST        Issued: Mar  3  2:34 MST                              :
:   Valid 24 hours starting at   6am Mar  3 1989                                    :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
                              Snow  Accumulation  Forecast
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    ------------------------------------------------------------------------------
     6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6
    ------------------------------------------------------------------------------
            Units:   Inches
   +-------------------------------------------------------------------------------+
    !!!!!!!!!!!!!!#!#!#!#!#!##############################################
     #:Snow   !:Freezing drizzle
    NE 8     NE13      NE18      NE20      NE25      NE25      NE25      NE20
    20 AirT  21        22        22        21        18        16        15        15
     5 Chill  -4        -9       -11       -17       -21       -24       -20       -20
    ------------------------------------------------------------------------------
     CLOUDY WITH FREEZING DRIZZLE CHANGING TO SNOW BY AFTERNOON AND
     CONTINUING INTO SATURDAY MORNING. STRONG WINDS WILL CAUSE BLOWING AND
     DRIFTING SNOW. 3 TO 5 INCHES ACCUMULATION BY SATURDAY MORNING.
   +-----------------------------------------------------------------------------&
  -----+ - -  -------------------------------------------------------------------&
    8
Va444   9 +03@s*h; hh3666VhuePhb 8JqX8  6GF    h{h}
    8 ul111@-------------------------------------------------------------
 H=hold          PgUp,PgDn=discussion    P=print         F=forecast        Esc=exit


1;36;40m
_m

echo off
0;59;"1";13p0;60;"2";13p0;61;"3";13p0;62;"4";13p0;63;"5";13p0;64;"6";13p0;65;"7"
;13p0;66;"8";13p0;67;"9";13p0;68;"10";13p
27;"_e";13p13;13p

                          SCAN Color Terminal Menu

 These choices are available:

 F1   Help
 F2   Scan Color Terminal (connect to Scan systems)
 F3   Long Term History display (view stored data from Scan systems)
 F4   Scan Color Terminal menus and setup
```

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IMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM;
:                     SCANCAST(sm) ________ PAVEMENT   Forecast                  :
:                    SCAN  Highway  &  Runway  Prediction  Model                 :
:  DENVER METRO - EAST        Issued: Mar  3  2:34 MST                           :
:   Valid 24 hours starting at   6am Mar  3 1989                                 :
HMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMMM<
                        Pavement Temperature Forecast
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        < = below freezing temperature
  ---------------------------------------------------------------------------
   6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6
  !!!!!!!!!!!!!!!#!#!#!#!#!##################################################
   #:Snow   !:Freezing drizzle
  NE 8     NE13     NE18     NE20     NE25     NE25     NE25     NE20
  20 AirT  21       22       22       21       18       16       15       15
   5 Chill  -4       -9      -11      -17      -21      -24      -20      -20
  ---------------------------------------------------------------------------
   CLOUDY WITH FREEZING DRIZZLE CHANGING TO SNOW BY AFTERNOON AND
   CONTINUING INTO SATURDAY MORNING. STRONG WINDS WILL CAUSE BLOWING AND
   DRIFTING SNOW. 3 TO 5 INCHES ACCUMULATION BY SATURDAY MORNING.
 +---------------------------------------------------------------------------&:
-----+ - -  -----------------------------------------------------------------&
   8
Va444   9 +03@s*h; hh3666VhuePhb 8JqX8  6GF    h{h}
   8 ul111@-----------------------------------------------------------
H=hold        PgUp,PgDn=discussion    P=print       F=forecast       Esc=exit
```

METRO DEN
COZ011-021945-

DECO-DENVER METROPOLITAN FORECAST
NATIONAL WEATHER SERVICE DENVER CO
1245 PM MST THU MAR 2 1989

.THIS AFTERNOON....MOSTLY CLOUDY. COOL BELOW 6000 FEET WITH AREAS OF FOG AND FLURRIES OR LOCAL FREEZING DRIZZLE..HIGHS IN 30S. MILD AND WINDY ABOVE 6000 FEET WITH HIGHS IN MID 40S TO MID 50S AND WEST WINDS 15 TO 30 MPH..SOME STRONGER GUSTS.
.TONIGHT...MOSTLY CLOUDY. AREAS OF FOG BELOW 6000 FEET ALONG WITH POSSIBLE FLURRIES. GUSTY WEST WINDS ABOVE 6000 FEET. LOWS IN 25 TO 30 EXCEPT 30S IN FOOTHILLS.
.FRIDAY...MOSTLY CLOUDY WITH RAIN LIKELY...CHANGING TO SNOW LATE IN THE DAY. HIGH IN THE MID 40S...BUT FALLING TEMPERATURES IN THE AFTERNOON. CHANCE OF PRECIP 70 PERCENT.
$$
HOLZINGER

+STATE CO

FPUS1 KDEN 022143

STATE FORECAST FOR COLORADO
NATIONAL WEATHER SERVICE DENVER CO
310 PM MST THU MAR 2 1989

...WINTER STORM WATCHES AND WARNINGS MUCH OF MOUNTAINS AND ALL OF EAST STARTING TONIGHT AND CONTINUING IN SOME AREAS INTO SATURDAY.
...SNOW AND BLOWING SNOW ADVISORIES NORTHERN MOUNTAINS AND WEST TONIGHT AND FRIDAY.

SNOW DEVELOPING MOUNTAINS AND WEST TONIGHT AND SPREADING TO THE EAST FRIDAY. SNOW DECREASING MOUNTAINS AND WEST LATE FRIDAY THROUGH SATURDAY WHILE CONTINUING IN THE EAST. HEAVY SNOW IS EXPECTED TONIGHT AND FRIDAY MORNING IN PARTS OF THE MOUNTAINS. SNOW MAY ALSO BECOME HEAVY IN THE EAST FRIDAY THROUGH SATURDAY. GUSTY WINDS IN MANY AREAS WILL RESULT IN BLOWING AND DRIFING SNOW. LOWS TONIGHT 20S AND 30S WITH SOME TEENS IN MOUNTAINS AND HIGH VALLEYS. HIGHS FRIDAY RANGING FROM 20S AND 30S IN MOUNTAINS AND ACROSS THE NORTH TO 40S AND LOWER 50S ACROSS THE SOUTH. LOWS FRIDAY NIGHT 10 TO MID 20S WITH 15 ABOVE TO 15 BELOW MOUNTAINS AND HIGH VALLEYS. HIGHS SATURDAY TEENS THROUGH 30S.

HOLZINGER

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+----------------------------------------------------------------------------+
:                SCANCAST(sm) _______ PAVEMENT   Forecast                     :
:               SCAN  Highway  &  Runway  Prediction  Model                   :
:DENVER METRO - WEST        Issued: Mar  3  2:37 MST                          :
: Valid 24 hours starting at   6am Mar  3 1989                                :
+----------------------------------------------------------------------------+

+----------------------------------------------------------------------------+
:                       Pavement Temperature Forecast                         :
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: 6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6 :
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:MST
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:       < = below freezing temperature                                        :
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: 6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6 :
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:                Precipitation and Pavement Condition Forecast                :
~----------------------------------------------------------------------------~
:                                                                             :
:!!!!!!!!!!!!!#!#!#!#!!##################################################    :
: #:Snow  !:Freezing drizzle                                                  :
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:                       Snow  Accumulation  Forecast                          :
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: 6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6 :
~----------------------------------------------------------------------------~
:          Units:   Inches                                                    :
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| 6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6 |

|        Units:   Inches                                                      |

|                        Wind Speed/Direction Forecast                        |

|NE 8      NE13      NE18      NE20      NE25      NE25      NE25      NE20   |

| 6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22 23  0  1  2  3  4  5  6 |

|               Air and Wind Chill Factor Temperature Forecast                |

|20 AirT  21        22        22        21        18        16        15    15 |
| 5 Chill  -4        -9       -11       -17       -21       -24       -20   -20|

|                         Forecasters Discussion                              |

| CLOUDY WITH FREEZING DRIZZLE CHANGING TO SNOW BETWEEN 8AM AND 10AM AND      |
| CONTINUING INTO SATURDAY MORNING. STRONG WINDS WILL CAUSE BLOWING AND       |
| DRIFTING SNOW. 4 TO 6 INCHES ACCUMULATION BY SATURDAY MORNING.              |

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