Protection of Thermometers A Necessity

BY PAUL KUBECKA

The following first appeared in Surveying and Mapping, the journal of the American Congress on Surveying and Mapping in the U.S.A. for June 1980, on page 213 in "Comment and Discussion." It is reproduced here by kind permission of that organization and the editor of the journal.

The meteorological services of the world, in order to obtain accurate and representative values of air temperature, shield their thermometers from radiation effects from any source, protect them from precipitation, provide them with an obstructed flow of air, and position them at a standard height above a standard surface.

Reading a paper on electronic distance measurement (EDM) presented recently at an ACSM meeting, I was surprised and amazed at the author's suggestion that air temperature be taken without shading the thermometer because taking the "sunshine temperature" gives the actual temperature of the air through which the energy waves travel. This is certainly news to meteorologists, and contrary to accepted exposure of thermometers to obtain air temperature, which appears in texts on meteorology.

Byers covers the subject of exposure of thermometers quite well. Quoting, "One often hears people talking about the temperature 'in the shade' as against that 'in the sun.' Actually, the temperature we measure is that of the air, and it is about the same whether is is over a shady spot or a sunny one. The air is perfectly free to move about to equalize itself by stirring any purely local horizontal heat differences that may develop. We feel cooler when we are in the shade, not because the air around us is cooler, but because our bodies are no longer receiving and absorbing the powerful rays of the sun. A thermometer is also capable of absorbing heat if exposed to the sun or to radiation from any other surface. Since the air absorbs an almost negligible amount of solar radiation, a thermometer in the sun will be warmer than the air, and the temperature it records will not be that of the air but that of its radiation-warmed bulb. The temperature thus recorded would be different for every design of thermometer, depending to a large extent on its mass and absorbing properties. By means of thermocouples or other suitable apparatus we can measure the temperature of such things as solid objects exposed to the sun and find that they are much warmer than those in the shade, but this will not be found to be true of air. In order for a thermometer to have the same temperature as the air, it must be protected from all kinds of radiation that it can absorb but which the air can not."

Due to the very large temperature gradients that may occur near the ground, the heights of thermometers above the ground are standardized or placed at the level where the temperatures are required.

Thermometers with a very rapid response should not be used for obtaining routine temperature readings. Temperatures are continually fluctuating a few degrees within seconds and in order to obtain a representative reading with a quick-responding thermometer a mean of a number of readings would be necessary. Therefore, thermometers with a lag coefficient of between 30 and 60 seconds in a wind speed of 11 mi. an hour are recommended. Munn suggests a lag coefficient of at least one minute in order to obtain meaningful vertical profiles of temperature and less than one second for temperature studies of rapid turbulent fluctuations. The lag coefficient or sometimes called time constant is the time required by a thermometer to respond to 63 percent of a total change in temperature for a given wind speed. Most meteorological mercury in glass thermometers falls in the 30- to 60-second lag coefficient category. However, thermocouples and resistance thermometers do not, as they usually have lag coefficients of 10 seconds or less.

Therefore in summary, to obtain an accurate and representative measurement of air temperature for EDM, the thermometer should be:

1. Protected from: (a) radiation from the sun, sky, earth, and any surrounding objects; (b) precipitation;
2. Adequately ventilated.
3. At the height of the energy wave path; and
4. Of the type that has a lag coefficient of 30 to 60 seconds in a wind speed of 11 mi. an hour. ●

SURVEYORS ON THE MOVE

As the Association offices have been rather delinquent in forwarding news for this column, we will try and catch up at this time.

Out-of-province moves have been made by several of our members during the past months. British Columbia is the new home for **Ross Balmer,** formerly with J. Kirkup in Kenora, and for **Ron Cuthill,** who returned in 1980 from England. **Gary Sawayama** has left Prince Edward Island where he was with the L.R.I.S. to settle also in the most Westerly province of British Columbia.

William Buck and **Richard Barrow** are now with the J. D. Barnes Office in Edmonton. **Janis Simanovikis** has notified us that he too is now situated in Edmonton.

Riyadh, Saudi Arabia, is the new address for **Bruce Fulford** who is with Saudi Photocan Ltd., and for **Brian Williams,** who is with Cansult Ltd.

John Halsall is off to Egypt on assignment for Kenting Earth Sciences, while **Carleton Clarke** has taken a position with Span International, Scottsdale, Arizona.

A. J. Flatman, formerly in private practice in Brockville, is now with the Province of Alberta, in Fort McMurray.

Surveyors recently opening up private practice firms are:

Vladimir Krcmar in Toronto, **Doug Dalrymple,** in Exeter, and **Bas Stassen,** in Whitby.

Fazio and Papa Ltd. have moved their offices to 2300 Finch West, Unit 38, Weston.

Bruce McMurchy formerly with McLean, McMurchy and Biason is now with Marshall, Macklin, Monaghan Ontario Limited in Toronto. **Ernie Biason** is continuing in practice in Bolton, and **D. McLean** in Brampton.

Yates and Yates Ltd. have purchased the firm of R. Sewell in Burlington. **Michael Terry** O.L.S. is resident surveyor in this office.

H. Meldrum of Cornwall, has opened a consultation office in Alexandria, Ontario. **Denis Dutrisac** is the surveyor in charge of this office. ●