

Report of The Metric Task Force

BY HANS J. KOESTER

The Metric Task Force undertook a point-by-point study of the report of the Committee on Metric Conversion by Mr. John Goltz, OLS, Ottawa, as published in the annual report 1975, and my own report to the South Central Group in 1974.

Task Force Members are the following:

Hans J. Koester, OLS, chairman, private practice.

Prof. Oscar J. Marshall, OLS, former Head of the Surveying Course of the U. of T., also private practice.

Prof. David Lambden, OLS, Professor in Survey Science, Erindale College, formerly in private practice.

Bruce Wright, OLS, Ministry of Transportation and Communications.

Henry Roeser, OLS, Land Boundary Program, Legal Surveys Standards Branch.

By this time, as I hope you are all aware, Day-M (the introductory day of metric plans of survey) has reached our doorsteps. We have to face the facts and prepare ourselves for the trying days ahead. We all have to change our way of thinking from the former **Imperial** system to the new **Système Internationale des Unités** — short SI.

The members of the Metric Task Force have chosen not to duplicate the work done by Mr. John Goltz and his committee in 1974 by going through each individual Act with reference to measurements and areas. We are pleased to report that the necessary legal changes pertaining to the SI units became effective July 1, 1976. The Act enables the surveyor to use the Regulations in the field and on his plans.

Before we go any further we would like to draw your attention to the specific rules under the Metric System. We would prefer to limit our report to those SI units most commonly used by the Ontario Land Surveyor and his staff, such as: units of length, area, volume, weight (mass), weight (force), temperature and pressure.

Rules of writing SI Units

- Symbols of SI units, and not written words, should be used wherever possible.
- The plural form is used when units are written out in full, provided the magnitude of quantity is more than one.
- Units which require several words

when written out in full are **not** hyphenated.

d. Units which involve division, when written out in full, require the word "per".

e. Where a specific numerical quantity occurs it is recommended to use symbols in full sentences.

Example: That lot has an area of about 450 m².

The Symbols

a. Shall be written in lower case letter, except that the first letter is written in upper case when the name of the unit is derived from a proper name of a famous scientist.

(m - metre, s - second, A - ampere, W - watt, K - kelvin, etc.)

b. Shall remain unaltered in plural.

Example: My weight (mass) is 82 kg and my height is 178 cm. (NOT kgs or cms).

c. Shall be written without a final full stop, except at the end of a sentence.

d. Shall be placed after complete numerical value in the expression for a quantity, having a space between the numerical value and the letter of the symbol.

Example: 65 m (not 65m), 182 cm, 50 km.

For angles, such as 75° 25' 30" no space is required.

e. Symbols are the same in all languages using roman letters.

f. In headings written entirely in upper case, the symbol must be written in lower case.

Example: LAND FOR SALE \$2000./ha

g. Do not start a sentence with a symbol.

Example: The symbol m² denotes square metre. **not:** M² is the symbol for square metre.

Writing of Numbers

a. Decimal notation should be used to express fractions.

b. In any number expressing a value of less than one, a zero is placed to the left of the decimal point.

c. Space must be used instead of commas to divide a long row of digits in a numeral into easily readable blocks of 3 digits, starting from the decimal point. This applies to the left and right of the point.

d. A dot, even in the raised position, shall not be used as a multiplication symbol in conjunction with numerals.

Now we come to the above-mentioned units with which the Ontario Land Surveyor has to deal in his everyday practice.

Units of Length

Linear dimensions are expressed in multiples and sub-multiples of the metre. Metric linear units include the following:

millimetre mm
centimetre cm
metre m
kilometre km

There are three more units of length which are **not** commonly used: decimetre, decametre and hectometre.

The relationship between the above-mentioned four linear units are:

1 cm = 10 mm
1 m = 100 cm = 1000 mm
1 km = 1000 m

Units of Area

The following units of area will be commonly used:

square centimetre cm²
square metre m²
hectare ha
square kilometre km²

The relationship between these units are as follows:

1 m² = 10 000 cm²
1 ha = 10 000 m²
1 km² = 100 ha

The hectare is new to many Canadians but it is a very useful unit of area for land measure. It will replace the acre for the surveyor on Day-M, but for the general public — hopefully in the next century.

1 are = (10 m)² = 100 m²
1 ha = 100 ares
1 ha = (100 m)² = 10 000 m²

Hecto, or **hect** before a vowel, comes the Greek word Hekaton — a hundred. (Hectoliter, hectogram, hectometre and hectare)

Units of Volumes

Precise volumes, actual physical volumes and the volumes of solids should be expressed in:

Cubic millimetre mm³
Cubic centimetre cm³
Cubic decimetre dm³
Cubic metre m³

The NON SI units, litre (l) and the millilitre (ml) may be used for liquids and for some commercial measurements:

1 cm³ = 1 ml (millilitre)
1 dm³ = 1 litre
1 m³ = 1 kl (kilolitre)

and:

1 dm³ = 1 000 cm³ or 1 l = 1 000 ml
1 m³ = 1 000 dm³ or 1 kl = 1 000 l

The term **milli** comes from the Latin word *mille* and means the thousandth part of a unit.

The word **kilo** is derived from the Greek word *khilioi* (thousand) and meaning one thousand units.

Units of Temperature

Temperature in the modern metric system is expressed in degrees Celsius ($^{\circ}\text{C}$) (NON SI Unit).

The symbol $^{\circ}\text{C}$ is read as degree Celsius (not centigrade).

The official unit of temperature in SI is kelvin (K), but this is used almost exclusively in scientific work.

Units of Pressure

Pressure in liquids and gases is expressed in pascal (Pa), kilo pascal (k Pa), or mega pascal (M Pa).

Note: The pascal is the pressure (or stress) which is produced when a force of one newton is applied to an area of one square metre.

Units of Weight

Weight should be measured in newtons.

Let's discuss weight (mass) first. The weight (mass) is expressed in gram, g, and kilogram, kg, and tonne, t. Tonne is the Metric ton.

$$1 \text{ kg} = 1\,000 \text{ g}$$

$$1\,000 \text{ kg} = 1 \text{ t (Metric ton)}$$

As surveyors, we have to use the kg when we want to express the weight of any mass (amount of meat, grain, ore, etc.).

As a rule of thumb, may we state that 1 litre of fresh water at 4°C has a weight of 1 kg and the specific weight of water, as stated above, is also approximately 1.

The other weight (force) unit is called NEWTON.

$$1 \text{ newton} = 1 \text{ kg } 1 \text{ m/s}^2$$

$$N = \text{kg m/s}^2$$

So much for the units of SI, which will affect the Ontario Land Surveyor in his daily routine work.

The ratio scales have been discussed enough, so that your Task Force would only like to mention here that the ratio should preferably be 1, 2 and 5 and multiples by 10 thereof.

Various Ministries of the Province of Ontario have developed ratio scales which have a read-out for the former Imperial units, and which are very handy tools for the first few years to relate back to old systems.

Lengths

The only unit of length to be shown on a plan of survey shall be the metre. The symbol m for metre shall not be

used behind any distance on the face of the plans.

In urban and suburban areas, we would like to recommend that:

The dimensions should be shown to the nearest mm and in rural areas to the nearest cm. This matter is being dealt with by the Committee on Standards. Hence the above suggestion is the only comment from your Task Force.

Any conversion from the former Imperial dimensions to Metric dimensions should rest fully on the shoulders of the OLS and is his responsibility.

Monumentation

As the regulations under the Surveys Act dealing with monumentation have not been converted to SI at this time, the recommendation of the Task Force is that the surveyor should make a soft conversion and round off to the nearest 10 metres less than the converted distance. When dealing with dimensions of monuments not prescribed in regulations such dimensions shall be shown in mm and not as decimals of a metre.

Bearings

The angular unit should stay in the presently used sexagesimal system. Your Task Force recommends that we also convert from bearings, showing direction of lines in relation to East and West of North, to the azimuth system, showing the directions clockwise from North only. This would involve amending the regulations.

Curves in the SI system are expressed in radii, not in degree of curve. Information given for a curve on a plan of survey consists of the radius, arc, chord and chord bearing identical to present practice.

Lot Sizes

CIS Metric Newsletter No. 5 (29 May 1974) agrees with Koester report to the South Central Group (Jan. 1974) with respect to lot sizes and various dimensions relating to existing requirements of zoning By-laws.

Mr. George W. Slee had asked for comments from other interested groups but obviously his appeal for comments was not heard by our colleagues across Canada.

This Task Force advises each OLS to convert totally to SI now that the empowering legislation has been enacted. We do not agree with dual dimensioning on a plan of survey. Total conversion will automatically encourage other professions and users to adopt the new system more rapidly.

The effect of Conversion on the Surveyor

This Task Force is not in agreement with Mr. John Goltz's report 1974, nor with Mr. A. Orr's report in 1975.

In both reports, the suggestion was

made to have measuring tapes with dual graduation in metres on one side and feet on the other side. This way, we will never be able to convert to the proper metric system. I would like to compare it with an immigrant who arrives in Canada and tries to speak in English, while thinking in his mother tongue. He will never learn to speak English unless he is able to think in English.

We would, therefore, recommend that each surveying company set their own date of total conversion, possibly not later than July 1, 1977. With the term "total conversion" we mean that all imperial chains and rods are returned to the company and metric chains and rods are issued to the crews. Soon the crews will not notice any difference. The conversion of imperial measure to metres or from metres to feet (at the specific request of the client) can either be done prior to the commencement of the work or in the field by the party chief who is properly equipped with a modern hand or pocket calculator by multiplying the old measurement by the conversion factor 0.3048. The new metric rods should show the E graduation in centimetres. These rods are very easy to read and enable the instrument man to estimate, without too much difficulty, to the nearest millimetre, if required.

As far as the field notes are concerned, we would recommend a rubber stamp being used to show that the figures shown on the field notes are metric. This procedure is designed to avoid confusion later, even if the date is not shown in the notes. Any future user is then immediately aware that all distances are recorded in metres.

Paper Sizes

At the present time your Task Force recommends to go slow on the change-over to the new paper sizes. The paper industry, as well as the legal profession, seem to object strongly to the recommended new sizes of the various papers. Let those people make up their minds first, since we cannot advise anybody to use a paper size which is not readily available on the market.

The plan sizes will hopefully be standardized by the Government of Ontario. Each plan of survey prepared in SI must show:

1. A ratio scale bar. It is recommended that the bar show to the right of zero the unit of the plan, and to the left of zero 1/10 of the unit of the plan.
2. The following block shall appear on the face of a plan of survey:

METRIC

MEASUREMENTS SHOWN ON
THIS PLAN ARE IN METRES
AND MAY BE CONVERTED TO
FEET BY DIVIDING BY THE
FACTOR 0.3048

METRIC TASK FORCE—cont'd.

The above note on the face of the plan will automatically eliminate the symbol 'm' after the linear measurements.

No dual dimensioning (Imperial and metric) shall appear on the plan.

Descriptions

The present regulations do not provide for the use of the symbol (m) for metres in the preparation of metes and bounds descriptions. In such cases, metre must be spelled out.

This Task Force recommends that each OLS firm obtain a copy of a government issue Metric Guide. One is published by the federal government, and one by the provincial.