

BY WHOSE STANDARDS?

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INTRODUCTION

Some years ago I became convinced that significant savings in the costs of the surveying and mapping processes could be made only by rationalising standards and that the time would come when escalating costs would force the profession to look more closely at standards which had previously been taken for granted.

Articles expressing similar doubts about the different parts of the surveying and mapping processes are increasingly appearing in the journals of some countries. It is right that all professionals should keep asking themselves if they should continue to do things in a certain way merely because that way was developed and accepted by their predecessors.

In this paper 'New concepts of topographic mapping in developing countries' (1) Professor H. G. Jerie said that "... more time and money can be saved by establishing truly realistic product specifications than can ever be saved in designing the most sophisticated and optimum procedures to fulfil established specifications." He then went on to describe methods whereby realistic product specifications can be determined.

The real significance of this quote was perhaps lost in Jerie's paper since most of the paper was devoted to the very laudable objective of describing how to derive realistic specifications for the mapping of developing countries. Although he gave some reasons why such realistic specifications are seldom used, maybe he did not stress sufficiently that the surveyor and the cartographer in their almost exclusive involvement in technological objectives have perhaps failed in their professional responsibilities to their clients whether private or public. Of course they are not unique in this and it is not just personal profit which

makes every professional feel that every job should be done as well as possible—and in so doing lose sight of the cost.

Professor Jerie dealt with topographic mapping in particular but the quotation from his paper applies equally well to any project in the surveying and mapping field and indeed it probably applies to many projects in most fields. He described how the user's requirements must be carefully considered and how an analysis must be made of the purpose the product has to serve in the user's activity. Of course in some ways he chose a very special case since it is impossible to come to any precise conclusions as regards user's requirements for general purpose national topographic mapping, so that ideally the producer designs the specifications to fulfil what he thinks will be the best compromise.

But in practice is this what he does? It is more than likely that he consults the maps produced by other countries, often those much more developed and much richer than his own, but these maps are probably the result of other producers striving to get better and better technical results giving little consideration to increasing costs. Theoretically this is one case where the map producer may well be justified in accepting the responsibility for designing the specifications himself, since as a professional map maker he should be able to reach the right conclusions better than anyone else.

The objective of this paper is to suggest that costs in most surveying and mapping activities could be very much reduced if the interests of the clients received most consideration when specifications are being formulated.

CADASTRAL SURVEYS

Dr. P. F. Dale in his book **Cadastral Surveys within the Commonwealth** has dealt with this problem very comprehensively in so far as cadastral surveys are concerned. But again it must be said that cadastral surveys are a special case since in most countries the specifications are laid down by Governments as regulations to a Survey Law and there is also a legal requirement for the surveys to be carried out following defined procedures. These constraints leave a cadastral surveyor little room for manoeuvre.

This is quite exceptional even in the surveying and mapping field in that cadastral surveyors are told not only what standards their surveys should achieve but also the methods whereby they should be achieved.

Perhaps there is no part of cadastral surveying where people involve themselves in 'traditional' procedures, with no apparent application of common-sense, more than in the checking of such surveys. Checkers quickly become subject to the ".01 syndrome", chasing insignificant errors through voluminous computations, at enormous expense, with no regard that such errors are well within the "noise" level of the field procedures used. It has been said that the use of field surveyors on the checking of cadastral surveys, surveyors who should have a feeling for this noise level, is particularly successful since poachers often tend to make the best gamekeepers.

That professional surveyors have not rebelled against such systems has sometimes given rise to suspicions that the systems lead to profitable careers for these surveyors who fear that any change in them would lead to a great reduction in their number. Certainly Dale's conclusion that "the law should be concerned with the final product not the means of production", seems incontrovertible especially so if the system insists on the use of surveyors it has itself examined before licensing. It is impossible to think of any other profession which allows itself to work in this kind of straightjacket.

However there is another more important point to be made. In this branch of land survey as in all others, surveyors find it difficult to remember or perhaps to accept that there is no part of what they do which is an end in itself: everything they do is devoted to providing a service for other people and in most cases for other professional users. In the case of cadastral surveys they are providing information for the Register of Titles or of Deeds concerning the location of parcels and their extent. It is logical then to assume that the Registrar will have the last word on the specifications for the information he requires. In fact the Registrar is normally not consulted when the Survey Act is being drafted and the Act that is passed reflects what the Survey Department considers should be the standards. To go further, there have sometimes been heated arguments between Registry officials and surveyors on the drafting of these laws with an end result that the protagonists have normally gone their own ways, which in turn has led on occasions to a conflict between the Land Registry Act and the Survey Act.

Of course this results in costs both

to property owners and to Government being much higher than would be necessary if the support service was provided only to the extent demanded by the Registrar who should have the final word since he takes all responsibility for registering titles to land.

Dale has gone into the reasons why this situation has developed but these are many and varied and there seems little point in looking back. What seems incontrovertible is that the people responsible for cadastral surveys should look closely into their own system to see whether they have inherited a similar situation to that described. If they have then it is their duty to advise the Government how it should be rectified. Now that most countries are developing comprehensive control networks it should be possible to fulfil Registrars' requirements by utilising less costly methods of survey and/or plan production.

GEODETIC SURVEYS

The standards set for geodetic surveys are even more questionable but in this case it is difficult to determine not only who should set the standards but also who should carry out the surveys. There is no doubt that the standards for control surveys which are needed by normal professional users are quite different from those discussed and accepted by geodesists at international conferences

of geodesy. The International Association of Geodesy is affiliated to the International Union of Geodesy and Geophysics, which is one of the unions under the auspices of the International Council of Scientific Unions. It is right and proper that the IAG should specify scientific standards for geodesy and that the scientists who take part in the activities of the IAG should adhere to those standards; and it is natural that they should do their best to make sure that those standards are achieved in their own country. What is not so certain, however, is whether the national survey departments should so readily accept responsibility for complying with these standards. At a UN Regional Cartographic Conference held not too long ago the representatives of one country were asked why they intended to improve their geodetic network when they already had one of the best control systems in the world. After some hesitation they replied that they could not answer the question but that undoubtedly what they were doing was very good for geodesists!

A national survey department will normally have quite clearly defined terms of reference, and the provision and maintenance of a control system should of course be included in those terms of reference. However it is doubtful if the department makes clear to those allo-

ating the finance that the standards of control they will be providing and maintaining will be to scientific rather than to practical standards, although the latter would be quite adequate for all normal developmental requirements.

This practice of aiming for scientific standards has been followed in the so called developed countries for many years; but even so, few of those countries have achieved high standards because the instruments and methods which were originally used were often not capable of producing the results which are attainable today. But delegates from the developing countries which are at a comparatively early stage of control development have listened to the discussions at the conference they have attended and have concluded that they also should aim for control networks of scientific accuracy. Organisations which have undertaken control in these countries then find that standards which many developed countries would be pleased to settle for are considered to be not acceptable.

Occasionally it is possible to be encouraged by a country taking a very practical and rational approach to control surveys. One good example is that taken by Australia to its levelling network which was planned on the principle that the levels were required "as a

base for gravity observations, for the topographic mapping programme and for general engineering purposes", so that Australia undertook comprehensive Third order levelling and adjusted it as a whole in a computer. A sensible, practical and much less expensive approach than that of undertaking geodetic levelling over the whole of Australia. Nevertheless few developing countries would be willing to settle for Australia's solution; and this attitude of mind has resulted in many, many miles of geodetic levelling through completely waterless, featureless and desertlike country. The Australians in considering the cost factor stated that "as a rough rule of thumb an increase in accuracy of a survey operation by a factor 'u' involves an increase in time and money of 'u²'".

In the same kind of way, undoubtedly the quickest, cheapest and most practical way of carrying out horizontal control is by means of EDM traverse networks comprehensively adjusted. If Doppler fixes at suitable intervals can be integrated into these adjustments so much the better. But computer analyses will continue to be made of geodetic triangulation networks to ascertain how these networks should be carried out, or how they can be improved. These activities should be left to scientists and/or academics, since it is doubtful if they are

the function of national departments unless the Government has specifically provided finance for them in their budgets.

TOPOGRAPHICAL MAPPING

There is probably no part of the whole field of surveying and mapping which needs objectivity more in specifying standards than does topographical mapping, since this activity tends to be more labour intensive than any other.

Topographic mapping is normally categorised into small, medium and large scale mapping and since there is some disagreement over the definitions of these categories it can be assumed for the purposes of this paper that medium scale mapping is 1/25,000 to 1/125,000 inclusive and the other categories then fall into place.

It is doubtful if any but very exceptional professional users ever use a topographical map to the limits of accuracy which are specified by the map makers as being necessary for its production. For instance, specifications of accuracy generally refer to absolute position whereas the vast majority of users are more interested in relative position. But relative accuracies are comparatively easy to achieve and it is only in the achievement of absolute accuracies that methods have to become so refined that the cost escalates.

In small scale maps at 1/250,000 scale 4 mm on the surface of the map, which is relatively easy to achieve, represents 1 km. But even aircraft navigators flying across the ground covered by a 1/250,000 map would not be disconcerted if they were out by 1 km. The most elementary methods of map production would not result in distances between features relatively close to each other having errors of this size.

Similarly, the vast majority of map users of medium scale maps use the maps for locating position in the broadest sense or for planning purposes. Very rarely are such maps used by professional users who are interested in absolute accuracy of position. Much attention is given to contour accuracies but if only relative accuracies are treated as important much saving in cost could be achieved. Instances have been quoted of professional users enlarging 1/50,000 maps by four times. This supports the contention that often larger scales are specified because of the need to have more paper to annotate. However the specification of the larger scale often automatically involves the increased accuracy defined for that scale.

Large scale maps are mostly produced for professional users so that absolute accuracy does tend to be more important. However no sizeable project

will be planned and implemented using solely a national large scale series. The series will be used for planning and feasibility studies; but before detailed plans and costs can be produced, a more accurate survey of the area concerned must be carried out to specifications devised by the contractors.

Perhaps the factor which allows map makers the maximum discretion is the specification of the appearance of the final map and of what shall be shown on it. There are examples of a complete disregard for cost in devising specifications. 1/50,000 map specifications exist which insist on 25 or more different vegetation classifications or 7 or 8 different road classifications. Of course not only do these requirements greatly complicate the map production processes, they also add appreciably to the cost of the field completion processes and in fact are seldom really monitored or fully implemented. It might be worth while investigating the possibility of limiting the number of colours on any map to four, which would allow the use of a three-colour process plus black and would enable the printing to be accomplished on the four colour machine which is now in quite common usage with a single printing.

In the case of large scale maps it is doubtful if fair drawing is ever justified since, as previously said, they are of interest for the most part to professional users who should be satisfied with content and not appearance, provided the content is neat and legible.

GENERAL

The general tendency to keep high standards and perhaps even to improve on them is encouraged by much of the research work which is undertaken, often sponsored by commissions of international associations. There seems to be an inclination to seek to attain the ultimate in absolute accuracy for reasons which might be compared to that often given for climbing a peak like Everest, that it is there, but of course this is the basic reason for much scientific research. This search for the ultimate is conducted mainly by scientists with such high reputations that it becomes not just respectable but something which everyone should seek to emulate.

Evidence of this can be seen in many of the papers which are published in the various surveying and mapping journals, papers which have little in common with the real world in which surveyors and mappers must operate.

CONCLUSIONS

It seems therefore that surveyors and cartographers should look much more critically at the specifications they have adopted to see if the standards

they have set are to satisfy themselves or to suit the vast majority of the users of their product. It seems possible that with due consideration up to 98% of users could be satisfied with a product which would cost much less than one carried out to higher standards.

The professional land surveyor must always keep in mind his clients, especially so in the case of the national department where the clients are largely unseen. It is his duty to the taxpayer to achieve the maximum from the finance with which he is provided. He will not be doing himself or his country justice if he fails to be realistic and becomes responsible for products with standards few people really require and which are in consequence much too expensive.

Some may see these arguments as inevitably leading to lower standards and hence to the conclusion that the field of surveying and mapping has no place for professionals. The reverse of this conclusion is the case. Whilst the operational aspects of surveying and mapping projects can generally be carried out quite competently by technicians, a professional approach to the design and control of projects is very necessary. It is true to say that changes never will take place if the planning is left to people with an uncritical and unprofessional approach.

The defects in the system as related in this paper are for the most part due to an honest, if misguided, attempt to obtain the best product that can result from the use of modern technology. In other words, at the back of most people's minds has been the thought, "If a thing is worth doing, it is worth doing well". Perhaps it would be better to keep in mind the saying that "he who pays the piper calls the tune", although there can be variations on this theme since there are sometimes vociferous user demands to national agencies for survey information to be shown on maps which is quite outside normal user requirements and in these cases it might be more apt to say that "he who calls the tune should pay the piper".

The following statement appeared in *The Economist* of July 2nd, 1977. "Some American studies suggest that the last 50% of the millions of dollars spent annually on sweeping the streets may clear only an extra 5% of litter. Because no market mechanism has been in operation, nobody can tell how many rulers in bureaucracy get only 5% extra production from the bottom 50% of employees in their empires." Whilst it might seem that comparing the clearing of litter from streets with surveying and mapping is at the best unfortunate and at the worst impossible, the principle underlying this quotation can be taken into many of

man's activities. The chasing of infinitesimally amounts in cadastral surveys is a perfect example of this principle in action. It should be noted that these exact amounts for the cost benefits of cadastral survey were used by the author in the discussion during the cadastral survey session of the 1975 Commonwealth Survey Officers' Conference. "Most of the benefits from Land Registration accrue from the aspects of ease of transfer. One could claim that 95% of these benefits could come from 50% of the cost, since the survey normally costs at least 50% of the total cost of compiling a register . . ." (4)

Of course emphasis has been given in this paper to the case for lowering standards but this may not always be the prime consideration. It is rare that a client, even a professional client, knows what is really required to service his project. Still more rare is any attempt on his part to evaluate what effect changes in surveying specifications would have on costs. In the case of many projects, for instance those involving large engineering works, the cost of surveying and mapping is probably so small a proportion of the total cost of the project that the engineer might feel it appropriate to adopt a "belt and braces" approach and ask for the highest possible specifications.

The ideal way of deciding on the most suitable specifications would be by arranging for a full and comprehensive dialogue between surveyor and/or map-maker and his client. It may be difficult for a professional adviser to be as objective as he would like if he is also a "producer" and in some fields of surveying and mapping there is a genuine need for surveyors to be used as consultants.

But it must be emphasised that the need for a truly professional attitude is very necessary since it is quite clearly the duty of all professionals to provide the best possible service to their clients in the most economical way.

FIELD NOTES FROM THE FENCE

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One final plea. All governments seem obsessed by secrecy these days, and the reason isn't hard to find. If the public can't find out what is in the wind, it's difficult to ask those awkward questions. This might seem to be an effective ploy, but the danger is that the government may realize too late that the policy has no public support. Perhaps the advice about these matters comes from sources too remote from the effects of that advice. Queen's Park, cue us in.