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## Map Revision in Developing Countries

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#### ABSTRACT

The up-to-date topographical maps are essential prerequisites for planned economic development of a country. The rapid changes in the map contents have focussed the attention of the photogrammetrists for development of faster and more economical map revision methods. In India topographical maps are published on 1:25,000, 1:50,000 and 1:250,000 scales. The revision cycle of 1:25,000 and 1:50,000 maps is 25 years and of 1:250,000 maps is 10 years. The experience of map revision on the above scales by the different methods of space imagery, simple photogrammetric instruments and terrestrial methods have been discussed.

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### INTRODUCTION

Due to increase in the pace of economic development of the country and rapid development taking place in different parts of India, the topographical maps are now becoming out of date within a short period. Therefore, map revision work has increased gradually during the past decade. The rapid changes in the map contents and the need for up-to-date maps have compelled the cartographers to focus their attention for development of faster and more economical map revision methods.

The question of map revision was first discussed in the International Symposium of International Society for Photogrammetry [ISP] Commission IV in Paris in 1974 when the foundation was laid for an international enquiry about the status of map revision in different countries of the world. Professor G.Birardi, President ISP Working Group IV/2 submitted a comprehensive report to 13th ISP Congress at Helsinki in 1976 based on the information received from 63 cartographic agencies of 14 countries. This report has brought out the great variations in the map revision policy, methods and equipment in the different countries of the world.

Survey of India like many other developing countries is about to complete the primary mapping of the country on the metric scale 1:50,000 from the original scale of 1 inch to 1 mile. The revision of topographical maps on 1:50,000 scale surveyed over twenty years ago has now become due. In addition, 1:25,000 scale maps of selected developed areas were commenced in 1956. Due to the fast pace of development in these areas, revision of these 1:25,000 maps is also becoming due. 1:250,000 maps need revision at shorter intervals. Survey of India has therefore, diverted its attention to map revision techniques suitable for these scales. It is believed that majority of the developing countries will be faced with the map revision

problems of similar nature, and will therefore, find the experience of Survey of India useful.

### REVISION CYCLE

In India the primary scale maps are on 1:50,000 and 1:25,000 scale. Primary scale maps are revised and kept up-to-date at regular intervals, the actual revision interval depending largely upon the available survey potential of the department for revision surveys. The target fixed for revision surveys of primary scale maps is 25 years. Unverified corrections are not normally accepted for publication on 1:50,000 and larger scales.

In addition to the primary scale maps, 1:250,000 scale maps are maintained covering the whole of India. These are derived or compiled from primary scale maps and have a revision cycle of 10 years.

Thus, in India according to the specified revision cycle, the maps on 1:250,000 scale are to be revised at 10 years' intervals and the maps on 1:50,000 scale are to be revised at 25 years' intervals.

In addition to the revision cycle a study of maps of eighteen different urban areas of India revealed that in urban areas primary scale maps are required to be revised at shorter intervals viz. 5 to 10 years because the major developments reveal significant changes.

In order to decide when a map should be revised it is necessary to consider the following steps in map revision:

- [a] collection of information on changes in the map contents.
- [b] assessment of the amount of change and decision on map revision and on the method for incorporating the changes.
- [c] technical execution of revision and production of revised maps, of which 20% work is photogrammetric work and 80% work is cartographic work.

Thus, there must be established a system for collection of data on changes in the map contents continuously. From this accumulated data when it is found that 60% or more of the map sheet has undergone extensive changes, the map sheet should be revised. If this criterion for decision for map revision is followed for a number of widely distributed map sheets, a realistic picture for revision interval or cycle will emerge.

## REVISION METHODS

Map revision by ground survey methods was practised in India before the introduction of air survey methods. The blue print survey method of revision where revision is carried out on the blue print of an existing published map by actual verification on the ground of the changed details, is used when the need for revision results from moderate developments in the area and some physical changes of rivers. The colour print survey method of revision where the combined colour print of the outline and names in dark grey and the contours in brown is verified on the ground, is used where it is anticipated that major portion of details and physical features will remain unchanged and limited changes result from development.

With the introduction of simple air survey methods in India in 1919 soon after the First World War, two other map revision methods viz. Purple Print method and Kodaline Print method came into use. In Purple Print method of revision survey, a combined print of the map in purple colour is obtained from the standing plates in reverse on the glossy side of kodatrace. By comparison with photographs brought to the same scale as the purple print, insertions and deletions are transferred to the kodatrace, and inked up in black. This corrected print is verified on the ground after clearing purple from the back of kodatrace. The purple print method is suitable for heavy revision.

In Kodaline Print method of revision survey a Kodaline print which is a film positive print in black complete with the headings, details and contours of the existing map is obtained. By comparing this print with air photographs on same scale, new details are directly inserted and inked ;up and obsolete details are erased from the Kodaline print which is ground verified. The Kodaline print method is suitable for light revision.

It will be seen that all the above methods are manpower intensive and are therefore, suitable for developing countries where trained manpower can be built up more easily than buying costly photogrammetric instruments.

The use of simple photogrammetric instruments like Zesiss Sketchmaster and Bausch and Lomb Zoom Transferscope for map revision is of recent origin. These direct optical projection instruments provide a rapid and fairly accurate method of map revision and are suitable for use in terrain with low relief. With the acquirement of these instruments in Research and Development Directorate, Survey of India, Hyderabad in 1978 it was possible to carry out some practical tests with these instruments under Indian conditions.

## REVISION EXPERIENCES

Map revision in India will be carried out mainly on the medium scales of 1:25,000 and 1:50,000. We were looking for some map sheets which were surveyed between 1956 and 1966 and for which recent air photographic cover of about 10 years later than the last edition of the map was available. After some search in April 1978 twenty-five map sheets on 1:25,000 scale were located in south-western part of India. These maps were surveyed during the years 1963 to 1965. Air photographic cover of these sheets on 1:25,000 scale taken during the flying season 1973-74 was available. In India the method of complete cyclic revision is followed for the medium scales of 1:25,000 and 1:50,000. It was decided to carry out complete revision of these twenty-five sheets utilising the recent air photography of 1973-74 using Zeiss Sketchmaster and Bausch and Lomb Zoom Transferscope.

The map revision procedure involved the following phases of work:-

- [a] Indexing of air photos and selection of single air photos to cover each 1:25,000 sheet for comparison.
- [b] Comparison of air photos with the published 1:25,000 maps, and identification and listing of major changes using stereoscope.
- [c] Inking of listed changes on air photos under stereofusion.
- [d] Transfer of chalked detail from air photos to published maps using Sketchmaster as well as Zoom Transferscope. For transfer by Sketchmaster, a tracing paper placed over the map was used because the map itself was used for Zoom Transferscope.
- [e] New details transferred on map sheets and tracing paper were inked up in proper colours and reference numbers were allotted for changes marked.
- [f] Time taken for carrying out each step of the above phases was noted.
- [g] Certain percentage of the changed details were checked on Zeiss Topocart stereoplotting instrument for ascertaining the accuracy of changed details.

Out of the twenty-five sheets on 1:25,000 -scale revised, three sheets cover urban areas, four sheets cover suburban areas and eighteen sheets cover rural areas. In almost all the sheets the cultivation pattern has changed. New tracks have come up in all the sheets. One or more new metalled roads either as a bye-pass or upgradation of existing roads appeared on all sheets. Minor changes in river bends occurred in some sheets. New bridges on roads have come up in urban and suburban areas.

The number of complete air photographs covering each sheet on 1:25,000 scale varied from 5 to 13 with an average of 9 air photographs per sheet. While the total revision operation from indexing, comparing, chalking of changed details and transfer of details from air photographs to map took an average of 5 hours per sheet, actual transfer of changed details by Zoom Transferscope to map took an average of 1 hour 15 minutes per sheet. The time taken for transfer of detail by Sketchmaster to map is about 2 to 3 hours.

The operation of Zoom Transferscope is more convenient because the field of vision is larger and continuous magnification, rotation and affine transformation help in superimposition of the photo images on to map sheet expeditiously. The air photo scale of 1:25,000 was found very useful for change detection of new details by comparison of air photos with map because one to one scale eye scanning was possible.

While comparing stereoplotting on Zeiss Topocart instrument with details transferred by Zoom Transferscope an average lateral shift of 1 mm in position was noticed at several places. From this it appears advisable to carry out the actual map revision on twice the scale of the map scale to reduce such discrepancies, as was done in the experiments carried out in Bonn-Bad Godesberg, Federal Republic of Germany.

In India, the revision cycle of 1:250,000 scale maps which cover about 100 Km by 100 Km area in latitude and longitude is 10 years and is shorter than the revision cycle of 1:50,000 maps which is 25 years. Therefore, it is necessary to devise methods of revising 1:250,000 maps independent of 1:50,000 scale maps.

The study of use of Landsat satellite imagery for revision of some seventeen 1:250,000 sheets was carried out. Cultural details and limits of urban areas were not discernible on the satellite imagery. In hilly and mountainous areas the main drainages can be seen, hill ranges and hill features or shapes can also be seen. In high hill areas, the glacial lakes can be seen, though the limits of lakes were not always well-defined. Since in India we have an accurate map coverage on 1:250,000 scale, the use of satellite imagery for map revision is not necessary. The quality of Landsat satellite imagery made available to developing countries is not suitable for 1:250,000 scale map revision.

In India the revision of 1:250,000 map sheets is carried out by revision of component 1:50,000 sheets from air photographs on 1:50,000 scale. In addition to air photographs two other sources of information for map revision on 1:250,000 scale are maintained. One source is the maintenance of office copy corrections of maps on primary scale from the information on major items collected by the field parties working in the area.



The second source is the state governments whose public works departments, irrigation departments, electricity departments and survey departments send information about changes in roads and settlements, irrigation canals, power lines and administrative boundaries. Both these sources should be continuously approached for supply of map change information at regular intervals.

## CONCLUSION

The map revision in India will normally be carried out on the medium scales of 1:50,000 and 1:25,000 and on small scale of 1:250,000. The map revision in developing countries will follow the same pattern.

From the experience gained in revision of 135 maps on the scales of 1:25,000, 1:50,000 and 1:250,000 in India by different methods of space imagery, simple photogrammetric instruments and terrestrial methods it has been found that the use of aerial photographs and simple instruments like Zoom Transferscope increases the efficiency of map revision.

The revision of 1:250,000 scale maps is better done by revising its component 1:50,000 sheets using aerial photographs assisted by the continuous collection and supply of information about cultural changes by the state government departments.

The present study of map revision problems in revising twenty-five 1:25,000 sheets with 10-years later aerial photography has revealed the pattern of changes which are likely to come up in 10-years interval. It seems appropriate to have a 10-years revision cycle for 1:25,000 sheets in urban and suburban areas while the 25-years revision cycle may continue for rural areas.

It is hoped that the map revision experience in India discussed above will be helpful to other developing countries.

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