DIGITAL MAP COMPILATION

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1. INTRODUCTION

The process of digitisation of Topograhic sheets has by now stabilised in Survey of India Department and pilot studies are being made to carry out compilation of the sheets on smaller scale from the available larger scale database. In the conventional method of map compilation say on 1:50,000 or 1:250,000 scale from the component 1:25,000 scale or 1:50,000 scale sheets respectively, because of the constraint of the space, the details are manually smoothened in case of linear features or reduced in case of point features. However, in the digital environment need has always been felt to adopt certain measures whereby manual discretion could be reduced wherever possible. The authors of this Paper have discussed the existing technique of compilation briefly with emerging techniques.

2. CONVENTIONAL METHOD

The detailed instructions regarding compilation of small scale sheets have been given in the Departmental Publication Hand-Book of Topography, Chapter VI wherein the procedures to be adopted have been explained in detail for elimination of details since the extent of the area on the smaller scale map is the same as that of large scale components sheet. Accordingly, there is need for proportionate amount of information appearing on the smaller scale map. The guidelines are prepared by the compiling officer keeping the general principle in view that though important details should not be obsecured by unimportant ones, the line features of the countryside must be distinctly shown. Every name that appears on map has to be clear and legible and minor details may be sacrificed if found necessary. While no hard and fast rules have been laid down as to the details shown on smaller scale map e.g. 1:250,000 scale, however details to be omitted have been outlined in the departmental publication.

3. DIGITAL ANALYTICAL METHOD

(i) The data of the component sheets is expected to be of desired level and must satisfy all the standards of Quality Control.

(ii) Usually the component sheets are surveyed/digitised treating them as independent entity. However, during computation, the projection frame is generated taking the centre of the compiled sheet as origin, i.e. in case of 1:50,000 scale sheet the projection frame should be generated taking the intersection of 1:25,000 scale sheets as the origin and then the data of the component sheet is fitted in position.

(iii) MSPM utility of MGE i.e. Modular GIS Environment of Microstation Software has been used for transfering the input data of larger scale into required projection of smaller scale. Since the edges of the component sheets have already been adjusted in the field/while carrying out digitisation of the component sheets, the mis-match of details will be very minimal. However, this aspect cannot be overlooked and may be kept in mind at this stage.

(iv) Generalisation: Generalisation process in digital environment has evolved in two complimentary ways which are usually referred to as Cartographic and database generalisation. The data generalisation is based on an information perspective whereas cartographic generalisation is related to visualisation. Both the process are however not independent and one process follows the other.The techniques which are presently available for cartographic generalisation tend to deal more with the representation level i.e. cartographic level that the map objects and map may take. Some of the procedures are curvilineality of features, simplification & smoothening, displacement, typification etc., There are two objects that the caratographic process must meet. First is the need to accommodate features in whatever form they may be within the reduced space of small scale presentation. And the second objective is that the resulting details should effectively communicate the map theme, cartographically legible and understandable. Because of the enormous volume of the digital database a need arises for another type of generalisation i.e. database generalisation. It involves making an extract from the existing database of the component sheets at reduced level of density i.e. to derive a new adjusted database with coarser spatial and photogrammetric information than that of the original base.

4. MAP GENERALISATION VS. MAP SCALE

The shape representation depends upon the scale factor. In addition contextual factors may also influence shape representation i.e. simplifying features could require more than merely removing vertices. Some times entire shapes could be deleted on certain scale. In other instances entire features, polylines, polygons or sets of them would need to be transformed or eliminated. However, before it is eliminated a feature will tend to lose much of its character, as a consequence of vertices reduced. This needs to be done in a very judicious way and cannot be described by any numerical criteria.

5. METHODOLOGY

In the digital environment, the generalisation of features is carried out by following ways:-

(i) Point Features: Generalisation of point features is done by visual perception keeping the factors of legibility, clarity and appearance of the map in mind. The other important factor is the density of the point feature. This has to be done by interactive method.

(ii) Linear Feature: In this case also generalisation is done by visual perception keeping in mind the continuity and contiguity of linear features for which verification and correction can be done keeping in view the node concept for red, blue and black details and chaining concept for tag (contour) file, because the digital topographic database could be used for various purposes e.g. GIS, DTM etc., The streams less then 6 mm are required to be deleted on 1:50,000 scale and then graduation of streams accordingly be given as per the laid down norms. The same is applicable on small power lines and small area features also.

(iii) For smoothening and filtering the I-GEOVEC, Module of Mapping Office is used which is very useful for linear features. The four options for smoothening and filtering are segment filter, point filter, smooth filter and smooth point filter. We use normally smooth/point filter with various combinations of smooth and point filter for generalisation. We have found good results with the following parametres:

Point Filter -- 0.000015 mtrs and

Smooth Filter -- 0.0004 mtrs.

The file size is considerably reduced this way.

(iv) For mapping conversion, as pointed out earlier, MSPM software is used. In this there is option of retaining text and cell size & rotation.

(v) Generalisation of Area Features extending in other component sheets:

This is also done by visual perception but the most important thing is to maintain the continuity of features wherever necessary in component sheets in black, blue, red, green and tag files in accordance with each other. This is useful for creation of digital topographical database.

vi) Text:

The names falling on common edges on the component sheets are required to be deleted as per the common practice and the administrative names and the forest names as per their extent are required to be readjusted. Similarly railway, river, road, tank names etc., also need to be replaced with focus on legibility and clarity.

vii) Contours:

For deletion of contours as per increased contour interval on smaller scale, an algorithm has been written. The flow diagram of which is enclosed as per Annexure A . The software requires two aspects:-

(i) Source DVD1 file.

(ii) Vertical Interval of the compiled sheet.

We have found very encouraging results and lot of manhours can be saved in a high hill area sheet with dense contours.

6. MAP GENERALISATION FOR ON-DEMAND-MAPPING

In the INTERNET context, the Web Browser requests a remote database for transfering digital maps to the on-site computer. The Viewer-Client i.e. the Web Browser is connected to the map/application server through a Web Server. The Map/application server has access to different databases and is able to use the data for the creation of the requested map. Work is going on these type of projects which aim at building more flexible solutions and easy adoption to user requirement by integrating methods on multi-scale databases and on-the-fly generalisation so as to create dynamically tailor-made maps upon users request. The research essentially follows the following sequence/modular design:

(i) Front-end module: This forms interface between user and the system.

(ii) Multi-scale databases module: which is responsible for the organisation of the requested data from the databases.

(iii) Scale changing module: which transforms the scale of the databases extracted from the databases to the scale required by the user.

(iv) Map making module: which creates map from the data pre-modified by the scale changing module. This involves symbolisation, conflict detection and generalisation. These modules, in fact, respond to user request by extracting data from the multi-scale databases and merge them to a map.

7. CASE STUDY

A 1:50,000 scale sheet was taken up for compilation from the four component 1:25,000 sheets and the results were very encourasing. It was seen that mandays saved in the two processes i.e., the digital envinronment/conventional environment was 1:10, while registration accuracy in the digital environment was found to be very superior and the mandays taken for text placing and cartographic enhancement was of the order of 1:3.3.

8. CONCLUSION

Undoubtedly, the digital compilation is very cost effective, time-saving and accurate indeed. Interactive software are required to be developed to minimise the individual manipulation factor.