

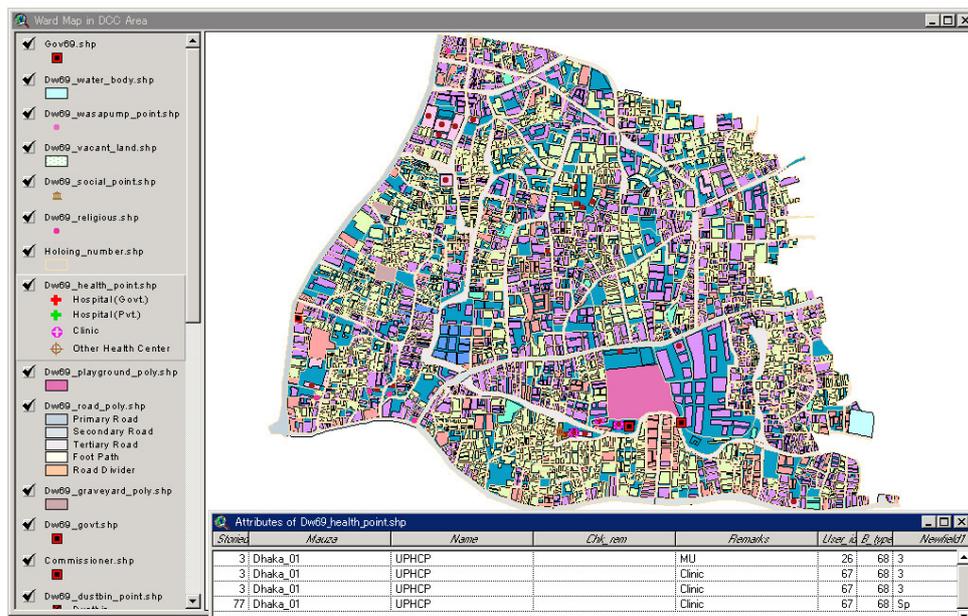
## Chapter 16 Recommendations to SOB

### Ward Map in the Dhaka City Corporation

The DCC so called Dhaka City Corporation, carry out the investigation of utility survey including to buildings, public facilities, utilities in each ward about 90 wards in the whole in addition to the measurement survey for the mapping survey.

The below figure is the Ward map compiled as the GIS data.

This data was produced by the field survey, so the completion of the data is high, but the large scale topographical map to manage investigation data, and the supporting system are required to manage the urban information.





## **Chapter 16 Recommendations to SOB**

The Study team has drawn up its recommendations to SOB as described below from the implementation of the Study.

### **16.1 The Role of Survey Agencies in Various Countries**

The following trends are currently apparent in survey agencies in countries around the world:

- 1) Government survey agencies in the developed countries used to be regarded as survey and topographic mapping agencies, but they are being switched over to planning or data management agencies. The system is shifting to one that the actual work of survey and topographic mapping is contracted to private organizations.
- 2) In the developing countries, there are two trends; there are some countries in which the governmental survey agency is in the process of shifting from being a survey and topographic mapping agency to being a planning agency, as in the developed countries; and other countries in which the survey agency retains its position as implementing agency.

The countries in Central Americans and ASEAN switched their survey and topographic mapping agency to a planning agency. This tendency is often seen in those countries where the technical capabilities and production capacity of private survey organizations have reached a certain level.

- 3) In those developing countries where no private survey and mapping organizations have developed, or even if there are private survey organizations, but problems in technical capabilities or production capacity exist, the governmental survey and mapping agencies are regarded as the implementing agencies for survey and topographic mapping.
- 4) The above-mentioned trends regarding the governmental survey agencies are a question of national policy –whether the aim is for large government, or small. Basically, in an economic situation in which increase in the government budget cannot be anticipated, the working inefficiency of government agencies is seen as a problem, resulting forces pushing for the switch to a more efficient social structure.

Considering from the above viewpoint, SOB of Bangladesh is regarded as the implementing agency for survey and topographic mapping. Considering the present state of affairs regarding private survey organization in Bangladesh, it can be said that there is no private survey company capable of photogrammetric mapping, judging from the present regulations in the country of Bangladesh, and it is also hard to imagine that any private survey company capable of photogrammetric mapping can be developed in the near future.

However, if we consider SOB's present problems, especially its work efficiency, costs, work implementation capabilities and human resource education, there are doubts as to whether SOB should continue to be the implementing agency for survey and topographic mapping or not.

In most of the developed countries, the Government survey agency has moved from being an implementation agency to being a planning agency, and in some developing countries too the same trend can be seen. In Bangladesh also, it may be inevitable that the future form of SOB will shift from the implementation agency to a planning agency.

In consideration of the survey-related conditions SOB facing in Bangladesh, it would be necessary to consider the following middle- and long-term policies:

- 1) Definition of the roles and position of SOB as a government agency
- 2) Establishment of middle- and long-term plans for SOB
- 3) Establishment of a cooperative relationship between SOB and other government agencies in survey and topographic mapping
- 4) Training of engineers capable of planning and work management in survey and topographic mapping
- 5) Prevention of exodus of talent
- 6) Technology transfer between the staffs of SOB
- 7) Quality control and schedule management
- 8) Fostering of private survey companies in Bangladesh

## ***16.2 SOB's Organization and Contents of Work***

The present situation of SOB and the contents of work to be implemented, together with the form of SOB in the near future, can be summarized as follows:

### ***16.2.1 Aerial photography***

Judging from the record of aerial photographs taken in Bangladesh in the past, it is unthinkable that there will be aerial photography to be done every year. In addition, huge expenses are required to maintain the aircraft and aerial camera for aerial photography, and to hire the pilots and mechanics needed for the job, and unless there is a certain quantity of work it would be practically impossible to keep facilities and manpower for the aerial photography. Therefore, for the time being it will be realistic to commission foreign aerial photography companies to do the aerial photography.

### ***16.2.2 Photo processing***

As it has already been stated, the photo processing equipment possessed by SOB is quite old, and because of a lack of maintenance funds a lot of the photo processing equipment is out of order and remains un-repaired. At the same time, under the regulation of the Ministry of Defense, the processing of aerial photographs is

limited to do only in the SOB's photo processing facilities or a designated facility. Thus, as far as the regulation exists, the SOB's photo processing facilities cannot be destroyed.

However, when we consider the actual condition of SOB's photo processing equipment, it is difficult to say that it would be possible to develop, print and enlarge aerial photos using SOB's equipment. On the other hand, since the scanning of aerial photo images has become the main method in the digital photogrammetry, now it is time to revise the approach to photo processing facilities. Specifically, SOB's photo processing facilities should be operated in the following way:

- 1) So long as the Ministry of Defense of Bangladesh regulations prohibit the developing process of aerial photos being undertaken in any facility other than SOB's or a designated facility, SOB's photographic processing facilities cannot be destroyed.
- 2) Therefore, it is necessary to provide SOB's facilities with the minimum equipment needed for the development and contact printing of aerial photographs. However, looking at the quantity of aerial photography work and considering the costs of maintenance and operation, the introduction of automatic developing equipment is deemed to be impracticable.
- 3) However, with the development of digital photogrammetric method, aerial photo images are increasingly being used as digital data. In the production of enlarged photo mosaic and orthophoto, the enhanced performance of the plotter means that processing can be done perfectly using outputs from the plotter, without printing them on paper. It follows that the equipment for enlargement etc. will lose its importance in the future, and any of the equipment that breaks down should not be repaired but discarded as it breaks down.
- 4) Under these conditions, the size of the staff in the photo processing section can be kept to a minimum.

### ***16.2.3 Aerial triangulation***

In implementing photogrammetric mapping, it is necessary to carry out aerial triangulation using the results of ground control point survey. With the development of GPS, the main method of aerial photography at present is the GPS aerial photography in which aerial photography is carried out with measurement of the coordinates values of principal points by the GPS installed in the aircraft. This technology makes it possible to reduce the number of ground control points needed for aerial triangulation.

The GPS aerial photography makes it possible for the aircraft to fly exactly on the planned courses, and for photographs at the location of planned principal points and eliminating the problems of gaps of stereo models, and insufficient side-laps between flight courses. In addition, photo index map can be produced automatically.

Considering the advantages of GPS aerial photography in ensuring a high degree of accuracy in aerial triangulation using a smaller number of ground control points, there is no doubt that future aerial photography will increasingly use the GPS aerial photography. However, should SOB wish to carry out aerial triangulation in the future, SOB must solve the problems described below.

- 1) In the Study, the problems of equipment and software programs were solved by the procurement and provision of equipment, and it makes implementation of aerial triangulation possible with the (SocetSet) and the necessary programs.
- 2) However, in order to carry out aerial triangulation using SocetSet the aerial photographs must be digitized, but the aerial photo film scanner at SOB is out of order and there is no prospect to be repaired. The cost to repair this film scanner is considerably high.
- 3) Considering the present situation of SOB, it is difficult to imagine that aerial triangulation will be carried out several times a year, and so it would be very difficult for SOB to maintain the technical level of aerial triangulation. As the accuracy of aerial triangulation has a great influence on the accuracy of topographic mapping by photogrammetric method, it is essential that the technical level be maintained at all times at a certain level.

Considering these problems, for the time being a realistic way for SOB to deal with aerial triangulation will be to commission the work of aerial photography to a foreign aerial photography company, under the following conditions:

- 1) In order to combine the following three types of job should be issued to the aerial photography company:
  - GPS aerial photography
  - Film scanning
  - Aerial triangulation
- 2) Aerial triangulation should be carried out by the aerial photography company using the results of a ground control point survey necessary for aerial triangulation.

For the time being, aerial photography including aerial triangulation should be carried out using this scheme. When the amount of topographic mapping work by photogrammetric method within Bangladesh increases to the extent that there is enough work for SOB to carry out aerial triangulation, then it would be desirable for SOB to be able to do the aerial triangulation by himself. When the time comes, SOB will have to decide whether to repair the film scanner that is out of order, or to purchase a new film scanner.

#### **16.2.4 Cartography**

In topographic mapping using the analog method, scribing and drawing were carried out in the cartography section, but in topographic mapping by digital photogrammetric method, the skill of scribing and drawing have become unnecessary. With the development of digital photogrammetric mapping method, it is natural that the techniques needed should change. It is, therefore, necessary for SOB to go with the current and modify its organization and personnel structure. SOB's cartography section may need from now on to become specialized in map inspection.

#### **16.2.5 Digital mapping and GIS**

If SOB is to shift to the digital photogrammetric mapping method, the analogue plotting equipment owned by SOB may not be as necessary as before. If broken equipment is left un-repaired, it does not make any sense to own it. However, the analog plotting equipment is a useful device to study and understand the principles of plotting and plotters, and with exception of the one set of plotting equipment that is at present not out of order, it may be practical thought to dispose the other equipment.

In the future, the introduction of digital mapping equipment to replace the analog mapping equipment should be considered; but even if the price of digital mapping equipment has been falling, it is still expensive so that it will be necessary to work out a long-term plan for the introduction, and for the effective program to train the personnel needed to do the actual work. For this it is absolutely essential for SOB to draw up a long-term plan.

About the topographic maps of 1:50,000 already produced with GeoConcept, it is necessary to restructure data in consideration of the correspondence of mapping data to the GIS data. To succeed to the previous data resources in SOB, it is necessary to prepare data without errors according to the adequate editing of data structure.

Background of an extensive knowledge is necessary for persons in charge of GIS and also persons in charge of digital mapping and digital compilation and symbolization. It is necessary to understand the structuralization of data and actual work experience and it is demanded for technology management and quality management to supply precise data there is no waste.

#### **16.2.6 Geodetic survey**

The geodetic section is an active section in SOB, and it is needed to continue to establish the second and third geodetic control point network and benchmark network. There is no difference in the basic observation technology for a GPS observation for establishment of geodetic control point network and ground control point survey for photogrammetric mapping, but a ground control point survey requires the skill of identifying the observation points on an aerial photos (pricking skill).

The ground control point survey is a survey done in order to establish points to provide the heights and horizontal positions for the aerial triangulation. To distinguish this from the GPS observation for

establishment of geodetic control network that is the mainstay of the survey system, it is necessary to prepare an operation manual or rules for ground control point survey for photogrammetric mapping to fulfill the purpose and accuracy of the survey.

In ground control point survey, pricking skill are indispensable, but only a limited number of SOB geodetic engineers and surveyors are able to carry out pricking work reliably. Thus, for SOB to go on in the future to produce medium to large scale topographic maps, the SOB geodetic engineers and surveyors will be required to master pricking skills.

At the same time, recent advance in surveying equipment have made it possible for anybody to obtain the survey results easily if they use expensive equipment and the latest computation and analysis software. However, the engineers and surveyors have to decide whether the computed results are suitable or not. For this reason too, it is necessary to implement accuracy control and process management for each work process, and to train up middle class engineers and surveyors who can do these jobs.

It follows that the engineers and surveyors in the SOB geodetic section will need to have the following knowledge and experience:

- 1) Photo interpretation skill
- 2) Topographic map interpretation skill
- 3) Pricking skill
- 4) Field identification skill for medium to large scale topographic mapping
- 5) Accuracy control and process management

### **16.2.7 Printing**

Like the geodetic section, the printing section in SOB is also an active sector. If we consider the present situation regarding the use of topographic maps in Bangladesh, it is hard to imagine that the volume of map printing will drop in the future. However, with the spread of digital topographic maps, the worldwide trend is changing the data providing method from paper maps to digital topographic map data, and there is no doubt that Bangladesh will be in the same direction in the future.

Within this trend, it is necessary for the printing section to consider at this moment what kind of work it should do in the future. For example, work that should be implemented by SOB in its role of survey and topographic mapping agency could include the production and printing of atlases and the production, printing and publishing geography textbooks to be used in elementary and secondary schools in Bangladesh.

### **16.2.8 Provision of topographic maps and data**

By the fact that it has produced only small scale topographic maps, it appears that SOB has made no effort to build a close relationship with other agencies in Bangladesh. The same kind of tendency is seen in all the government agencies of Bangladesh.

As previously described, the production of medium to large scale topographic maps involves work that cannot be carried out by SOB alone, which makes tie-ups and cooperation with other related agencies indispensable. Further, when the medium to large scale topographic maps are used by the various agencies, the maps will become significant, and through their use, SOB will receive requests for medium to large scale topographic maps to cover new areas, and the revision of secular changes from the user agencies.

In addition to working to deepen connections with other Bangladesh agencies, SOB must strengthen the sections in charge of the provision of topographic maps and map data, and must revise procedures so that it is easier for the other agencies to use them.

At the same time, in order to make SOB profitable, it is also necessary to review the selling prices of topographic maps and digital maps data, and to deal with unauthorized copying in the future. Furthermore, it is necessary to revise the present regulation for the provision of topographic maps and survey data of SOB because there are no rules for digital topographic data.

### ***16.3 Recommendation of Operation***

#### ***16.3.1 Necessity of formulating of long-term plan***

At the present time, when survey technology is so advanced, the huge amounts of money and time required in the past to establish geodetic control points and produce topographic maps are no longer needed. However, the cost and time required for these tasks are still not small. In addition, although the spread of digital topographic mapping through the use of GPS, digital levels and digital photogrammetric method has contributed to higher accuracy and efficiency in surveying and topographic maps production, the electronic equipment needs higher maintenance costs but has shorter life of performance than that of analog equipment, results increase in expenses for equipment renewal, and higher indirect costs for survey and topographic map production.

Against the background, it is considered important for SOB to continue to make efforts to lay down laws, regulations and standards of survey and map production that SOB carries out, and to prepare the standards, the basic specifications of topographic mapping, and the qualifications rules for survey engineers and surveyors in Bangladesh; and also for SOB to formulate plans for the survey and topographic map production projects to be implemented over the next 5 to 10 years. Show them to the users and the other related agencies and have them approve the SOB project plans.

This will allow the users to estimate when the basic survey products and topographic maps will be completed, and to use the data effectively to determine their own plans. In addition, this will bring advantages for the country of Bangladesh as a whole; a reduction of the duplicate costs incurred separately by individual ministries and agencies in producing digital topographic data and GIS data, standardization of the accuracy of the data produced by individual ministries, shared use of data between the ministries and agencies, etc. At the same time, on the basis of these plans SOB will be able to draw up medium- and long-term budget

plans which will be able to use as basic materials when requesting budgets for the budgeting authorities. This will make it possible for SOB to coordinate overall survey and topographic map production and to cooperate with the related agencies to secure budgets, human resources and equipment for the medium- and long-term plans and to put them to effective use.

### ***16.3.2 SOB's role and its relationship with related agencies***

In Bangladesh, SOB carries out the establishment of geodetic control point network and benchmark network, and topographic map production in accordance with the work rules of the Ministry of Defense Bangladesh, and the use of products of these surveys is also in accordance with the rules of the same Ministry. The use of aerial photographs and topographic maps is restricted for reasons of national defense, and as a general rule the use, for which a charge is made, is restricted to those national government agencies and related public corporations. The agencies have to apply to use the maps and data in the prescribed form with official documents and obtain the permission in the name of the Surveyor General of SOB.

Meanwhile, because of the strict restrictions on the use of topographic maps and aerial photographs, the other government ministries and agencies of Bangladesh have developed digital topographic data by themselves using simple methods (satellite images, existing cadastral data, etc) and have built the GIS they needed, based on the digital topographic data created. For this reason, various problems have arisen, including the duplication of the costs of producing the digital topographical data, inconsistency in accuracy, and because of this inability of the agencies, sharing data.

To solve these problems, the Government of Bangladesh and SOB must take the following measures immediately:

- 1) The government of Bangladesh must establish SOB as the agency for the planning of surveying and mapping and data production, and for the supply of topographic maps and data.
- 2) As the agency for surveying, production of topographic maps and the supply of data, SOB must be responsible for supplying the necessary data in line with the requests of the agencies needing the data.
- 3) To this end, the present restrictions on the use of aerial photographs and topographic maps must be deregulated in order to establish a system that will make it easier for the agencies that require the data to use.
- 4) For the above purpose, some organization such as a committee must be set up where the surveying and topographic mapping agency and user agencies can meet regularly or as needed, to exchange information and requests.
- 5) It must be possible to discuss in this committee the medium- to long-term plans for surveying and

topographic maps production in Bangladesh, and the standards for surveying and topographic mapping in Bangladesh.

The mapping data and the geographic information data supported by SOB must be corresponded to the standardization (ISOTC211) of the geographic information that is worldwide trend. In Bangladesh there are dispersions and confusions in the Geographic Information data that each organization produced because the large scale map as a base map for GIS is not supplied.

Therefore, it is necessary to establish spatial data infrastructure to be able to become data arrangement in order to absorb the dispersions of Geographic Information because there is no existence of accurate topographic map. As for the data on the Geographic Information, it is important to compile the data on digital topographic data SOB supplies, which data resources are from government agencies, administrative organizations and private companies.

There are following important data resources in relation to the spatial data infrastructure in Bangladesh.

- 1) Administrative boundary maps in the national census survey in the Statistics Department,
- 2) Administrative boundaries in regulating authorities,
- 3) Election districts and those relating statistic data, and
- 4) Existing Geographic Information data and so on.

### ***16.3.3 Shortage of maintenance budget***

The changes in SOB's budget are described in paragraph 2.3.3 and shown in Table 2.3.1. Although the personnel expenses have slightly increased over the past 5 years, project expenses have fallen. In 2002 and 2003 the budgets were recovered a little. What is seen as a particular problem in the budget of SOB is that in terms of the percentage of the total budget and as a total amount, expenses for maintenance are very low and have no increase at all.

It is unclear whether the maintenance costs are budgeted only for maintenance and repair of equipment or include the maintenance and running costs of the SOB building and other facilities; but from the state of repair of the equipment and materials possessed by SOB, it is patently clear that a sufficient budget has not been allocated to the maintenance and procurement of the equipment and materials owned by SOB.

On the other hand, the electronic equipment now used for surveying has shorter performance life than that of analog equipment. This means that because of the regular renewal of equipment and the use of more computers and plotters, the expenses for supplies and the necessary maintenance costs tend to be higher compared to the time when analog equipment was used. From the above reasons, increased maintenance expenses are absolutely necessary in order to maintain and manage the present surveying equipment.

However, as maintenance expenses are restricted to execution within Bangladesh, it is impossible to order

any maintenance work directly to an overseas manufacturer; domestic agents should do the arrangement on the orders.

For equipment such as computers, there do exist the proper agents in Bangladesh, but for special equipment such as surveying equipment, there is often no agent in Bangladesh. If an agent has sufficient technology and experience with regard to the products, there may be no problem, but when the agent functions only as an importer and marketer, any after-sales services or maintenance are virtually impossible.

In addition, if there is no import and sales agent in Bangladesh, it is practically impossible to procure any repair parts within the country. For this reason, it can be pointed out that there are so many cases that minor trouble makes expensive equipment inoperable and unable to be repaired, and the equipment is thus left unused. Some typical cases in SOB of defective equipment remaining out of order and un-repaired for the above reasons are given below:

- 1) Plotter in the digital mapping section
- 2) UPS in the digital mapping section
- 3) Scanner for negative films in the digital mapping section
- 4) Equipment in the photo processing section

#### ***16.3.4 Provision of data and income***

In the interview survey for the users of digital topographic data and GIS held in the Study, the principal comments of the user agencies regarding to the use of the topographic maps and digital data produced by SOB were as follows:

- 1) The procedures to use the SOB topographic maps and data are burdensome and time-consuming.
- 2) As the topographic maps and digital data supplied by SOB do not contain coordinates values, their use is limited.
- 3) The topographic maps produced by SOB are mainly small-scale topographic maps, but the other agencies want to have large-scale topographic maps.

For these reasons, the other agencies in Bangladesh produce for themselves the topographic maps they need, but because of the problem of accuracy and the problem of the duplication of budgets, the Government of Bangladesh considers that it will be a national interest of the entire country to promote the immediate provision of topographic maps and digital data from SOB. For this reason, the present various rules and regulations for the provision and sale of topographic maps and digital data should be revised into a more user- friendly forms and contents.

In carrying out the work of producing new topographic maps and digital data and revising and correcting

them, naturally SOB needs expenses proportioned to the volume of work. These expenses are for the most part allocated each year by the Government of Bangladesh as a budget, but a system should be adopted whereby the minimum necessary expenses (including the cost of materials and supplies) can be assigned to SOB as an additional budget from the Government of Bangladesh when the work of providing topographic maps and digital data exceeds the planned volume of work (for example, the number of printed sheets, or the replication/processing of digital data) in each fiscal year.

### **16.3.5 Education program**

In order to fulfill its function, officials in SOB will need the following abilities.

#### **1) High-level personnel**

- The ability to maintain and manage SOB organization
- The ability to plan and promote SOB project
- The ability to make appropriate decisions on general technical issues in surveying and topographic mapping
- A basic knowledge of survey and photogrammetric mapping

#### **2) Middle-level personnel**

- The ability to make appropriate decisions on individual technical issues in specific jobs
- The ability to lead and manage a work team on individual jobs
- The ability to coordinate the work processes among the proceeding and following the process and that they are in charge of
- The ability to control accuracy and progress of job
- A general knowledge of surveying and photogrammetric mapping

#### **3) Low-level personnel**

- The technical capability and experience necessary to execute each job
- In particular, the ability to interpret aerial photographs and topographic maps

An evaluation of the abilities of each member of SOB staffs that participated in the Study made it clear that every member of the staffs, from high-level personnel to low level, lacked the necessary abilities in a variety of aspects. From now on, a training program must be drawn up for SOB personnel to improve the following abilities.

#### **1) For high-level personnel**

In view of the future activities of SOB, the most necessary of the abilities required to the high-level personnel is the ability to plan and promote SOB projects. The basic knowledge of surveying and topographic mapping necessary to plan and promote SOB project is indispensable for high-level personnel. It cannot be denied that in the Study too, the obvious lack of an ability in high-level engineers to make a decision on a basic technical problem was in some cases an

impediment to the smooth implementation of the Study.

2) ***For middle-level personnel***

The most generally found lack in the abilities required in middle-level personnel is an all-round knowledge of surveying and photogrammetric mapping. In particular, there is a crucial lack of knowledge of the relationship between the work process that they are in charge of and the processes preceding and following it. This makes them incapable to make an appropriate decision to solve individual technical problems.

Another problem concerning the middle-level SOB personnel that can be pointed out is unevenness of ability. It may also be pointed out that this unevenness in ability has a high potential of being the cause of such problems as unevenness in the accuracy of products, and delays in the entire process due to the unevenness of the work processes of each work item.

3) ***For low-level personnel***

As SOB has had no experience in the full-scale production of topographic maps by photogrammetric methods, it must be said that the ability of the low-level SOB engineers and surveyors to interpret aerial photographs and topographic maps is quite low. In the future, if SOB is to produce medium to large-scale topographic maps by photogrammetric method, an improvement in the ability of the low-level engineers and surveyors to interpret aerial photographs and topographic maps is essential.

## ***16.4 Recommendation on Management***

### ***16.4.1 Anti-virus measures***

As the world is linked via the Internet, the damage caused by computer virus has become a worldwide problem. Developing countries in particular often have taken no measures against computer viruses, so that many computers may be contaminated with viruses.

When topographic mapping was done using the analog method there was no problem in this matter; but since digital data once damaged is difficult to recover, as the production of topographic maps using the digital method and the digital production of various types of data and documents become more common, anti-virus measures have become really important.

No major problems have arisen in SOB so far because the communication of digital data does not occur so often either SOB or between SOB and the outside. But in the future, since SOB will be making more digital data exchanges with the outside, it will be necessary to take the necessary measures to protect SOB computers against the viruses infection.

The following anti-virus measures are needed to take to the SOB computers:

- 1) The installation of anti-virus software in every computer in SOB.
- 2) It is necessary to prepare for the dial-up environment (a telephone line to the outside, dial-up modem and the provider of the Internet use) in order to update the pattern file of virus countermeasure software.
- 3) Regular updating of anti-virus software.
- 4) Computers used for digital topographic mapping (digital plotting, digital compilation, GIS data creation, etc.) should not be connected to the Internet.
- 5) Virus check must be done before the installation of the data to the computers, especially the data obtained from the outside of SOB.

#### ***16.4.2 Digital data backup***

As it is difficult to recover digital data once it has been damaged, backups must be taken. It is also necessary to pay due attention to the fact that computer hard disks and CD-ROMs have a limited life. Special attention should be paid to the fact that the recording section of a CD-ROM is sensitive to ultraviolet rays.

#### ***16.4.3 Filing system***

SOB stores various types of data necessary for surveying and topographic mapping including tidal data, geodetic control point data and interim products in the production of topographic maps. However, in the present situation it also has various problems needed to solve, such as losing the location of needed data or missing data.

There are difficulty to keep data on paper for long time in Bangladesh because of such problems as high humidity in the rainy season, dust in the dry season, poor air conditioning in SOB building, the poor quality of paper available in Bangladesh, etc.

If SOB is proceeding to the digitalization of mapping, then in the future the data should be stored in digital form. In such case it will also be necessary to make back-ups of all data.

#### ***16.4.4 Operation system of computer***

It is recommended that the operation system of the PC will be shifted to Windows 2000 or NT4.0 and Windows XP, taking the recommendation version of software into consideration. In order to improve the working efficiency, it is necessary to select operation system corresponding to multi task (Windows 95 and 98 is a single task operation system).

In the digital mapping section in SOB, the server operated by Windows 98 has been used, but it is not

suitable to correspond to the network management enough, so it is recommended to install the server which manages the network communication specially.

As for the workstation of UNIX, to avoid a trouble in computer system, proper operation at the time of start-up and shutdown is indispensable.

#### **16.4.5 Strengthening the system management**

In order to manage PC properly it is necessary for operator and system administrator to master the basic knowledge for proper operation of the PC and system administrator instructs the operation to operator and also system administrator must manage equipment properly.

It is necessary to strengthen system management to prevent any troubles of the PS such as troubles of PC and the crash of the hard disk. The duty of system administrator will be as follows:

- 1) Hardware maintenance (PC, peripheral device and network)
- 2) Trouble shooting
- 3) Software management
- 4) Data back-up
- 5) Anti-virus protection

#### **16.5 Technical Recommendation**

The technical problems SOB faces at the present time and our recommendations are described in Chapter 13 “Transfer of Technology”. Those are summarized again below.

- 1) The production and revision of small-scale topographic maps carried out so far by SOB has been through two-dimensional data acquisition, and SOB has had no experience in three-dimensional data acquisition. In medium to large-scale topographic mapping, however, the technology of 3D data acquisition by photogrammetric method is indispensable. The staffs of SOB digital mapping section must be familiar with 3D data acquisition, if SOB continues to produce medium to large scale topographic maps in future.
- 2) Some of the SOB personnel lack the photogrammetric mapping skills and a basic understanding of topographic maps. In particular, if SOB continues to produce medium to large scale topographic maps in future they should have a clear understanding of the characteristics of small, medium and large scales topographic maps and of the differences among them.
- 3) Some high-level SOB personnel have a knowledge of surveying and topographic mapping but lack practical experiences, so that they do not have the necessary understanding of the problems involved in undertaking the work, and cannot make decisions for the appropriate solutions.

Therefore, personnel with knowledge of photogrammetry and lots of practical experiences should be appointed as high-level personnel.

- 4) At the same time, the middle- and low-level SOB personnel do have practical experiences, but that experiences are limited to a narrow sphere, and not extended to wider-ranging. In addition, as they do not have knowledge on the whole of topographic mapping, they do not understand the relationship between their own work process and the processes preceding and following it. They do not have clear idea of what kind of data should be handed over from the preceding process, how that data should be processed in their own process, or what kind of data should be passed on to the next process.
- 5) The change in equipment and staffing necessitated by the shift from an analog to a digital topographic mapping system has not yet been made. This is not a problem that arises only in developing countries; in the past, Japan has faced the same kind of problem. In any case, the recent rapid advances in technology (especially computer-related technology) mean that any technology or piece of equipment becomes obsolete in a much shorter time than in the past. SOB must consider the future personnel structure and understand when the equipment is renewed. And the skills of the people concerned also have to be changed.
- 6) The entire SOB staff lack a basic knowledge of computers. This problem is related to item 5) above and for the digitalization of survey and topographic mapping technology, SOB must bring in or train up personnel so that a majority of the staffs have the minimum necessary basic knowledge of computers.
- 7) A lot of the equipment are out of order because of careless use. In particular, it is thought that most of the breakdowns in the equipment in the SOB digital mapping section have been caused by rough use of the equipment. The SOB personnel must be retrained to begin with how to handle precision machinery.

Considering the already small SOB maintenance budget, the first step to take before increasing the budget is to consider how these breakdowns can be prevented.

## ***16.6 Items to be Implemented Urgently***

The Study team hopes that SOB will urgently implement the following items after the completion of the Study.

### ***16.6.1 Production of 1:5,000 scale digital topographic maps covering the remaining area***

The Study was started around the end of November 2002 and completed around the end of August 2004. In the Study, 122 sheets (581 km<sup>2</sup>) of 1:5,000 scale digital topographic maps were produced and aerial

photography, ground control point survey and aerial triangulation were carried out for the area covered by aerial photography (960km<sup>2</sup>).

Thus, as soon as it received the products of the Study from JICA after completion of the Study, SOB will be in a position to produce the 1:5,000 scale digital topographic maps covering the remaining area (379 km<sup>2</sup>) using the equipment provided by JICA.

The aerial photographs in the Study were taken on 3<sup>rd</sup> January 2003. As the Dhaka Metropolitan Area has a strong inflow of population from the surrounding areas, progressive changes in this area is also acute. Thus, from the standpoint of using the products from the Study effectively, it is required that SOB will carry out without delay the work of producing the 1:5,000 scale digital topographic maps to cover the remaining area. In planning the 1:5,000 scale digital topographic mapping project for the remaining area, it is important that SOB consider the following points:

- 1) Priority in the area covered by the 1:5,000 scale topographic maps should be determined through discussion with the users of the topographic maps and digital data, and plans drawn up to produce the topographic maps in the order of priority.
- 2) The 1:5,000 scale digital topographic maps produced under the Study are first to SOB. As these are medium to large-scale topographic maps by digital photogrammetric method (with 3D data acquisition) it cannot be denied that the maps are in many ways the result of trial-and error. Therefore, before planning the topographic mapping project for the remaining areas, it will be necessary to review the contents of the Study and the way with which the work was carried out, and on the basis of the experience gained in the Study to consider how to improve the contents and the methods of implementation.
- 3) In drawing up the work plans, it will be necessary to ensure proportional balance between: a) budget; b) necessary equipment and skills; c) period of work and d) human resources. If the balance between these items is not proportional, problems such as delay, short of budget, insufficient accuracy, etc. will arise when the work is under way.

#### ***16.6.2 Determination of administrative boundaries and revision of digital topographic maps***

As described in Section 3.11 “Conference on Administrative Boundaries with Related Agencies”, it was decided through discussions with the related agencies that the 1:5,000 scale digital topographic maps produced by the Study would not include administrative boundaries.

However, accurate data on administrative boundaries are absolutely essential for each agency, and a basic agreement has been reached that the related agencies will cooperate to implement the work to show the accurate administrative boundaries on the 1:5,000 scale digital topographic maps.

There are some parts of the work to produce medium to large scale topographic maps that cannot be implemented by the surveying and topographic mapping agency SOB alone, and the cooperation of related agencies is indispensable particularly in the incorporation of data such as the administrative boundaries and administrative names.

As mentioned previously, the primary purpose for the production of the medium to large scale topographic maps is for their effective use by the various agencies, and even after the completion of the maps, tie-ups and cooperation between SOB and the other related agencies will be needed for the production of the various types of thematic maps, revision of secular changes, etc.

In addition, on the basis of this kind of tie-up and cooperation with the related agencies, it will be the role of SOB as the survey agency of Bangladesh to discuss with the other agencies that what kind of data should be produced based on the products obtained in the Study, and their requests and plans for the production of medium to large scale topographic maps for new areas; and to propose such requests to the Government of Bangladesh as the representative of the opinions of the related agencies.

On this matter, the actions SOB should implement in the future are as follows:

- 1) In order to show the accurate administrative boundaries on 1:5,000 scale digital topographic maps, an official committee consisting of SOB and other related agencies should be established to discuss technical issues, acquire the necessary budget and implement the actual work. It will be important for this committee to be officially recognized by the Government of Bangladesh.
- 2) On the basis of the results of the future meeting with the related agencies, SOB and the related agencies will hold technical discussion as to how the necessary administrative boundaries are shown on the 1:5,000 scale digital topographic maps. In these discussions, it will be necessary to bear in mind that the necessity of administrative boundaries will differ depending on the agency.
- 3) On the basis of the results of the technical discussions, the time, cost and personnel needed for the implementation should be examined and a detailed working plan should be drawn up. In particular, it will be important to study how much of the field verification survey will need to be implemented.
- 4) It will also be necessary to ascertain whether it will be possible for the necessary personnel to be dispatched from each related agencies to implement the field verification survey.
- 5) On the basis of the above discussions, a concrete working plan and the estimated budget should be prepared, and SOB on behalf of all the related agencies should make a request for the budget to the Government of Bangladesh. A request for technical assistance from foreign countries may also be made through the Government of Bangladesh.

### **16.6.3 Formulation of a maintenance plan for equipment owned by SOB**

As already mentioned several times, the state of maintenance of the equipment owned by SOB, especially the equipment in the digital mapping section and the photo processing section are in negative conditions. If SOB does not implement a survey of the conditions of all the equipment owned, draw up a maintenance plan and start to repair the equipment, it is obvious that SOB's work will run into difficulties in the very near future. The following items should be considered when drawing up an equipment maintenance plan:

- 1) Preparation of a list of the equipment and materials possessed by each section (name of item, date of purchase, etc.)
- 2) Examination of the condition of each piece of equipment
- 3) Examination of the state of any pieces of equipment that are out of order (location and condition of each fault, etc.)
- 4) Estimation of costs and time to repair
- 5) Decision on necessity of repair

### **16.6.4 Promotion of the use of topographic maps and digital topographic data**

The production and provision of small-scale topographic maps covering the whole country is one of the basic jobs that the government should undertake. The first objective is to provide maps to cover the entire country so that they can be useful.

On the other hand, medium to large scale topographic maps are produced mainly to cover the city areas, and they are produced because various agencies and organizations need them. The first objective is not to produce such maps; the maps are produced because they are badly needed. Thus it follows that such medium- to large-scale topographic maps have no significance until they are utilized by the users.

The 1:5,000 scale digital topographic maps produced in the Study too, become worth the making when they are used by various kinds of users. Therefore, it is the role of SOB not only to store away the topographic maps and data within SOB, but to actively promote their use by other agencies.

In addition, if the 1:5,000 scale digital topographic maps and digital topographic data in the Study are utilized by many other agencies, the value and evaluation of SOB as an agency producing and supplying topographic maps and digital topographic data will be higher among the governmental agencies of Bangladesh. In the future, it is expected that SOB will work in a useful direction in the drawing up of middle- and long-term projects and the securing of budgets for them.

It is essential for SOB's further development that SOB make effective use of the products of the Study, to

actively highlight the value of its existence to the Government of Bangladesh and other agencies.

