# *Chapter 17 Recommendations for the Use and Application of Data Created in the Study*

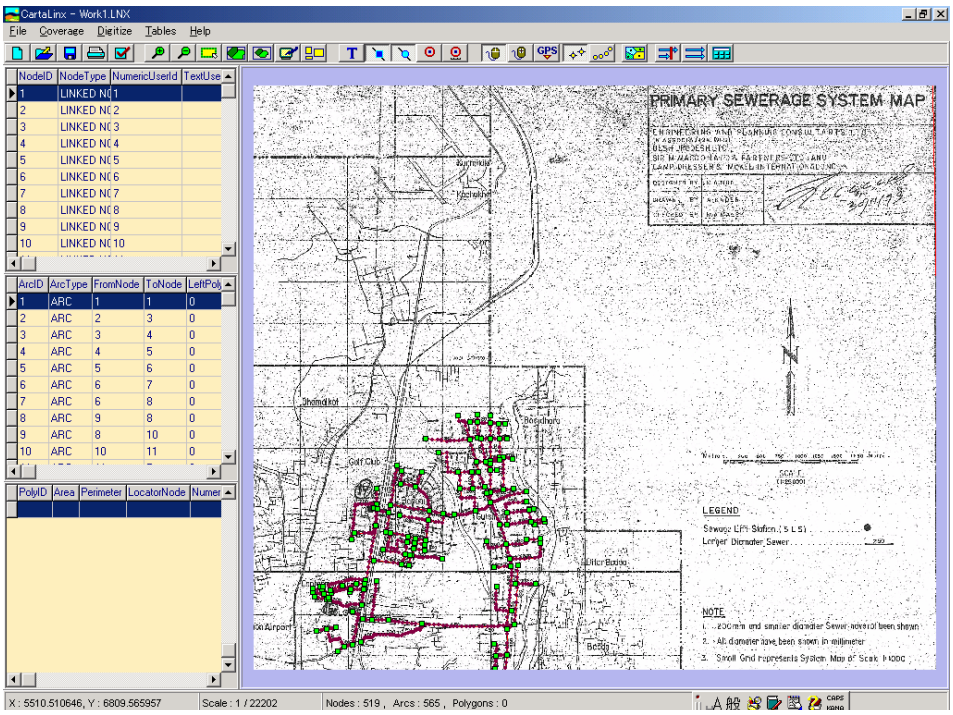
## Thematic Map of Main Pipe Line in Sewerage

The development of the sewerage is also an important theme in the social infrastructure as well as the water supply. In the sewerage management, it is the important themes of the operation about the drainage of the drainage and the water management to reduce water pollution.

In the point of view of facility management, it is also an important point about the rehabilitation relating to the maintenance including a water pollution countermeasure caused by decaying of the sewerage pipe and the leak, the improvement of the water management facilities in consideration of the environment and the improvement of the operation of the sewerage. As for the layout planning of the sewerage pipe, it is the information about topographic longitudinal.

As shown in the following figure, the distribution of main pipe of the sewerage in Dhaka city is compiled in the base map as a thematic map.

As for the present conditions, sewerage facilities are insufficient because the maintenance hasn't been catching up with the urban development, so the development is a pressing need urgent subject. A large-scale map is expected the advantage use of the geographic information as well as the management of the water supply and the rehabilitation.



# *Chapter 17 Recommendations for the Use and Application of Data produced by the Study*

In addition to bringing together the types of topographic maps and their features, and defining the relationship between SOB and the users of topographic maps and digital topographic data, specific examples of the recommendation of the Study team regarding how the digital topographic map data produced by the Study should be used and applied in future are summarized below.

These recommendations are being made assuming ordinary circumstances; before the data are put to specific use, it will be necessary to examine in detail the objectives of the project, how the data will be used, how the project will be implemented, etc., before drawing up a concrete working plan for the project.

## *17.1 Classification of Topographic Maps and Objectives of Production*

Although there are many approaches to the classification of topographic maps, the following two methods are commonly used:

1) Classification of topographic maps according to scales
2) Classification of topographic maps according to objectives

Definitions in the classification of topographic maps according to scales differ from country to country or person to person, but generally the classifications are as follows:

1) Small scale topographic maps: Topographic maps at a scale of 1:20,000 or smaller
2) Middle scale topographic maps: Topographic maps at scales of 1:10,000 to 1:2,500
3) Large scale topographic maps: Topographic maps at a scale of 1:2,500 or larger

The classification of topographic maps according to the objectives of production is generally as follows:

1) General maps: Also called “base maps”: maps on which various types of maps are based
2) Objective maps: Map produced for a particular objective such as thematic maps; often produced from a general map

This relation is shown in Figure 17.1.1 “Classification of Topographic Map”.

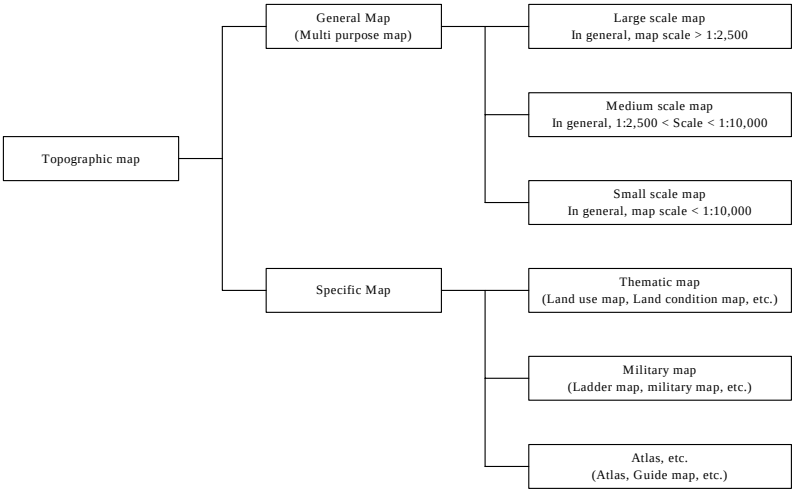



Figure 17.1.1 “Classification of Topographic Map”

Of the general maps, the 1:25,000 or 1:50,000 scale topographic maps (the scale is determined by the surveying agency of each country) are also called national base maps, and these basic topographic maps cover the entire land area of each country at the same scale and at the same level of accuracy. In Bangladesh, the national base maps are topographic maps at the scale of 1:50,000.

It is important that the national base maps cover the entire national territory at the same scale and at the same level of accuracy, and that they are always maintained, being modified and revised as necessary. This is one of the basic tasks the Government must undertake. Medium to large-scale general maps, on the other hand, necessitate a large number of map sheets to cover the entire territory of the country, and require a huge amount of time and expense to produce and maintain. Therefore, these medium- to large-scale maps are produced mainly to cover city areas where human economic activities are vigorous.

In short, with small-scale national base maps, emphasis is placed on the coverage of the entire national territory. However, the main purpose of producing medium to large-scale base maps is to be used as basic information for the drawing up of various plans and policies concerning mainly city areas. That is to say, the final objective is not the production of medium to large scale base maps; the final objective is to have the topographic maps produced put to effective use by various users.

The 1:5,000 scale digital topographic maps data produced by the Study, in terms of the above description, falls in the medium scale general map data category, and its final objective is naturally to be put to effective use by various users. It is when they are put to effective use by various users that the 1:5,000 scale digital topographic maps of the Dhaka Metropolitan Area produced by the Study will be worth to produce.

Some specific examples of usefulness in future of the 1:5,000 scale digital topographic maps and GIS basic data produced by the Study described above from the standpoint are discussed below.

## *17.2 Forms of Using Topographic Maps*

Seen from the relationship between the producer and the users of topographic maps, there are three forms of use as described below.

***1) Using topographic maps as such***

This is the use of the maps as the base maps described in Section 17.1, "Classification of Topographic Maps and objectives of Production", the topographic maps are used as they are, without any processing. Usually the maps are sold as printed maps.

In this case, the producer of the topographic maps provides them to the users as printed maps; and when using the maps in their present form, basically the users do not alter the actual contents of the maps.

***2) Use of topographic maps as basic maps for processing into objective maps***

This is the use of the map as the base map for the production of objective maps as described in Section 17.1 "Classification of Topographic Maps and Objectives of Production". Usually, the maps are sold as printed maps.

In this case, the producer of the topographic maps collects the data necessary for production of the objective maps, and the collected data is added or processed to produce, for example, land-use maps, land condition maps, guide maps, etc., which are usually provided as printed maps to the users. The users may process the provided topographic map data, but only to add necessary information.

***3) Processing of digital topographic maps by the user to produce the necessary original digital data***

The producer of topographic maps sells and distributes the digital topographic data to the users. The user collects the additional data needed for his own purpose and produce data to meet his own objectives, based on the data collected and using the digital topographic data provided by the map producer. Usually the contents of the data are processed, as the provided map data are processed as GIS data.

In this case, the producer of topographic maps is in the position of supplying digital topographic data, and in his role as map producer is required to amend and revise the digital topographic data and to supply the data without a hitch. At the same time, since the user is required to process and use the digital topographic data at his own expense and using his own skills, the user is required to maintain a certain level of technical ability, equipment, personnel and budget.

The producer of topographic maps as described in 1) and 2) above is in the position of both producing and supplying data, while the user is a passive user from the viewpoint of data production and processing, because the data provided is used as is.

The position of the map producer in 3) above is a data supplier rather than a data producer. What is required of this type of map producer is not to produce new data, but to make maintain and manage the data available. Meanwhile, the position of the user in 3) differs from that in 1) and 2) in. He processes the data himself and is recognized as an active user of the data. These points are summarized below in Table 17.2.1.

Table 17.2.1 "Forms of Use of Topographic Maps"

| Form of Use | Map Producer (SOB) | Map User |
|---|---|---|
| 1) Use of topographic maps as they are | ・Work done by SOB up to now<br>・Producer and supplier of data | ・No processing of data<br>・Passive use of data。 |
| 2) Use of topographic maps as base maps for processing to produce objective maps | ・Work done by SOB up to now<br>・Producer and supplier of data | ・No processing of data<br>・Passive use of data |
| 3) User process digital topographic data to produce necessary data。 | ・Supplier of digital topographic data。<br>・requires continuous data maintenance and management | ・Processing of digital data by user<br>・Requires a certain level of technical ability, equipment, personnel and budget<br>・Active use of data |

## *17.3 Relationship between the Producer and Users of Topographic Maps*

Of the forms of use as descried above, the "use of topographic maps as such" in 1) above is the most simple method, in which the main users are individuals, not organizations such as governmental agencies, universities and various kind of study team.

However, the "use as base maps for processing" in 2) above, in which the producer of the topographic maps is also at the same time a user processing the data, has a more complicated relationship between the topographic map producer and the user than in 1) because there are other users of the processed data, both individuals and organizations.

Depending on the circumstances, the topographic map producer may commission another agency to do the data processing, and that agency may provide or sell the processed data to users. In any case, the main users are individuals and not organizations such as governmental agencies, universities and various kinds of study team.

The main users in 3) "processing of digital topographic data by the user to create the original data needed" are not individuals, but organizations such as government organization, university, research institute and various kinds of study team.

A summary of these relations is shown below.

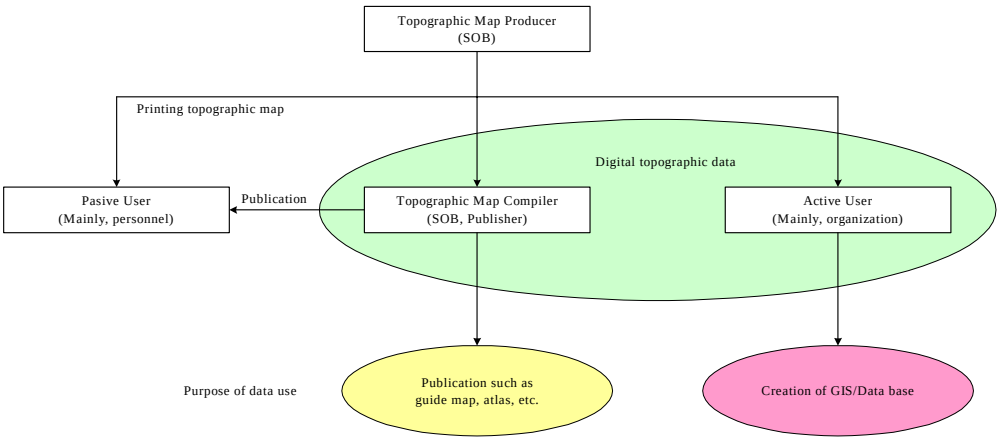



Figure 17.3.1 "Relationship between Topographic Map Producer and the User"

## *17.4 Assumed User Agencies*

From the relationship between the topographic map producer and the user, with the exception of passive users, the specific users agencies in Bangladesh in the other two forms of use are assumed as follows:

1) SOB produces guide maps, land-use maps etc., and supplied them to the users.

2) SOB provides digital topographic data as basic data to processors who produce and sell guide maps, land-use maps and other types of maps. At present, the Mappa Ltd. publishes guide maps etc., for Dhaka city, Chittagong City and so on.

3) Organizations receive digital topographic data from SOB and produce the GIS data based on the digital topographic data, as needed by each agency.

Of the above cases, here we will consider the users agencies in Bangladesh included in 3). From the results of the questionnaire survey held by SOB, the interview survey carried out by the Study team and the discussion held between the Study team and the other government agencies of Bangladesh during the period of the Study, it is clear that many agencies including the Dhaka City Cooperation, Road Bureau and so on that are responsible for the administration of the Dhaka Metropolitan Area want to use the products of the Study in their own work.

In order to use effectively the 1:5,000 scale digital topographic data and GIS basic data produced by the Study, it is necessary to examine the types of additional data needed for the purpose, how it is collected and how it is processed, based on the contents of the data produced in the Study.

The specific procedure is as follows:

1) Define the purpose of use in the project where the data to be used.
2) Define the data judged necessary for the purpose of the project
3) Examine the contents of the additional data considered necessary
4) Examine the method of collecting the additional data
5) Examine the data processing method, the thematic map to be produced, system etc.

## *17.5 Specific Use Plan*

An examination of the contents of data necessary to formulate various development projects, in general, shows that there is common data required for any project. With the exception of very specific projects, the following 4 types of data are deemed to be common data necessary for the formulation of various development projects. These 4 types of data form the basic information used in formulating the development projects, but many other types of data will be required for actual projects.

In using the products of the Study for various development projects, the first step is to collect the following types of data and process them as GIS data.

***1) Statistical data***

Statistical data, including the land area and number of residents in each administrative district, is widely used as the basic information for the drawing up of various development plans. GIS data linking the administrative boundaries, population statistics, physical areas etc., is the basic data used in the initial stage of all kinds of development project.

***2) Land use***

Actual land use conditions have to be understood in order to formulate all kinds of development project. However, it should be noted that land use categories differ depending on the development project.

***3) Land conditions***

As basic information, the land conditions of an area or region to be developed in a development project are also the minimum necessary data. In particular, land conditions are important data in formulating development projects for extremely flat areas such as Dhaka City, which suffers flooding every year and for mountainous area where landslide disasters occur frequently.

***4) Social conditions***

In formulating various development projects in the Metropolitan areas of developing countries, it is necessary to consider the social conditions unique to the country. In particular, the gap between rich and poor in each area is one of the factors to be considered in formulating various development projects.

The above 4 types of data are to some extent common to all kinds of development projects, so that such data should not be provided individually by the related agencies; instead the data provided by each agency should be disseminated to other related agencies in order to cut waste in spending. If we consider how the products of the Study other than the above 4 items can be put to effective use in a specific project, the following is a broad outline.

### *17.5.1 Use in waste disposal projects*

Probably, there have been few examples of the use of GIS in waste disposal projects. However, if we consider its use in the waste disposal project of the Dhaka metropolitan Area the following GIS data will be useful.

***1) Land use***

Naturally, the types of waste and the quantity of discharge are different in resident districts and industrial districts. It is necessary to separate the types of rubbish generated according to the land use. If another agency has already prepared land use data that can be used, but it should be noted that land use categories differ somewhat depending upon the purpose of land use.

***2) Social conditions***

In the Dhaka Metropolitan Area, it is thought that the quantity of rubbish is greater in economically affluent districts. Therefore, the quantity of rubbish discharge should be estimated from the category of the economic condition of the residents. A field survey based on the GIS basic data as one of the products of the Study should be made if necessary, in order to produce the social condition category maps reflecting the economic conditions of residents.

***3) Population***

If the economic and land use conditions are the same, the quantity of rubbish discharged should be proportional to the number of residents. Thus, the population in any unit (administrative unit or rubbish collection unit) is needed in order to estimate the quantity of rubbish discharged.

The basic population statistics are issued by the statistics Bureau, but these statistics cannot be deemed to be absolutely accurate. Therefore, it is necessary to estimate the population of each district basically by the counting the number of houses and house types, which will be multiplied by a given coefficient in order to compare the product with the statistical data.

***4) Rubbish collection points and routes***

In considering effective rubbish collection, it is necessary to examine the rubbish collection routes. For this purpose, present rubbish collection points and routes, data on road width enough for the rubbish trucks to pass along and on which traffic regulations are enforced should be collected and processed to produce GIS data.

### *17.5.2 Use in sewerage projects and facility maintenance*

In Japan, GIS has been used in many aspects of the sewerage project and facility maintenance and the necessary systems for those have been completed. Basically, if the existing systems are used it will not be difficult to build up the GIS for the sewerage project and facility maintenance in Dhaka City, as far as the systems are concerned.

For building the GIS, data on the sewerage pipe network is needed, but the reliability and accuracy of the existing data on the sewerage pipe network may cause a problem. If it is necessary for sewerage pipe network to be verified section by section in the field, the amount of work involved might be enormous.

### *17.5.3 Use in water supply projects and facility maintenance*

In Japan, GIS has been used in many aspects of the water supply projects and the facility maintenance and the necessary systems for those have been completed. Basically, if the systems existing in Japan are used it will not be difficult to build the GIS for the water service project and facility maintenance in Dhaka City, as far as the system is concerned.

Similarly to the sewerage project, data on the existing water supply pipe network is also needed, but the reliability on location accuracy for the pipe network to be verified section by section in the field, the amount of wok involved might be enormous.

### *17.5.4 Use in urban planning*

The minimum necessary data to formulate city planning are the 4 types of data described in Section 17.5, which should be provided first.

Other necessary data includes social infrastructure data (hospitals, schools, mosques, water service and sewerage pipe networks, gas pipeline network, power transmission lines, etc). It may well be expected that some of this data has already been produced or will be provided from other projects in the near future.

In considering the use of data in city planning, therefore, a wider range of data is required than in other development projects and it is not easy to screen the necessary data contents. Thus, it is necessary to implement a study of data if the necessary GIS data is produced for drawing up the city plans for the Dhaka Metropolitan Area.

### *17.5.5 Use in land management*

The land management is based on the preparation of a land ledger, for which the dimensions of the land of each owner are measured by a ground survey known as cadastral survey to calculate the area and produce the land data.

Recently, the land data of each landowner is produced by computer also in the developing countries. To arrange the land data of all the landowners, it is necessary to prepare a digital topographic map that indicates

all the data and the location of the land of each owner. By indicating the boundary of the land of each owner on this digital topographic map, the cadastral survey data is attached to the cell of each landowner's land as attribute data.

As to the scale of this topographic map, scales of 1:1,000 to 1:2,000 are adequate to indicate each house definitely. For this purpose, the height data (or accuracy) in the topographic map is not needed and the accuracy of horizontal position that is the usual accuracy of 1:1,000 to 1:2,000 scales topographic maps are also unnecessary. Symbols and annotations are also basically unnecessary information.

The digital topographic maps produced by the Study are at the scale of 1:5,000, which is a little smaller for the purpose of this discussion. Although the digital map data can be enlarged, it is important in using the enlarged map data to understand that the accuracy of the topographic maps is not enhanced.

Therefore, it will be rather difficult to use the 1:5,000 scale digital topographic maps produced in the Study for preparation of the land ledger. If the Government of Bangladesh prepares a full-scale land ledger, it will be necessary to produce new digital topographic maps at the scales of 1:1,000 to 1:2,000, and the 1:5,000 scale digital topographic maps produced in the Study will be used in drawing up the plan for producing the 1:1,000 to 1:2,000 scales digital topographic maps.

### *17.5.6 Use in anti-flooding measures*

The most important problem in making use of the products by the Study for anti-flooding measures is height accuracy. In the 1:5,000 scale digital topographic maps produced by the Study, the contour intervals are 2.0 m, but the specialists in planning anti-flooding measures would probably request that the contour lines should be 0.5 m or less.

Observing the topography of the Dhaka Metropolitan Area, the request for the contour interval of 0.5 m or less can be understood, but if the accurate contour lines in the interval of 0.5 m or less are depicted in photogrammetric method, it is necessary to substantially change the parameters of the Study (scale of aerial photos, scale of maps to be produced, number of control points, density of leveling points and routes, etc). However, the Study could not handle such changes.

For applying the products by the Study to anti-flooding measures, the first step is to substantially enhance the height accuracy of the 1:5,000 scale digital topographic maps by additional surveys as follows:

1) Execute a leveling survey using the existing benchmarks

2) Acquire as many leveling points as possible during the leveling survey, if possible, at the rate of about one point to every 100 square meters. It is important to acquire leveling points not only roads but also outside the road.

3) Prick the acquired leveling points on the 1:5,000 scale digital topographic maps.

4) Indicate the elevation values of the pricked leveling points in the 1:5,000 scale digital topographic maps, and correct the contour lines based on these elevation values. However, it may be physically difficult to depict the contour lines with the accuracy of 0.5 m on the scale of 1:5,000 topographic maps because the Dhaka Metropolitan Area has an extremely flat terrain.

5) Implement a field survey in parallel to these works in order to determine the elevation values of the maximum flood water surface through the hearing survey of the flooded areas and the leveling survey from the existing benchmark to flood marks and show these results on the 1:5,000 scale digital topographic maps.

In taking countermeasures against floods, it is also effective to make the following surveys using the 1:5,000 scale digital topographic maps produced by the Study.

1) Acquire the satellite image data in case of flood disaster and input the flooded areas from the satellite images on the 1:5,000 scale digital topographic maps to predict the future flooding areas.

2) Implement hearing survey to learn the water levels at a flood disaster from local residents, determine the water levels from the benchmarks in the vicinity by leveling survey and determine the absolute elevation values of the flood, and at the same time, predict the future flooding areas by inputting the elevation values and their positions on the 1:5,000 scale digital topographic maps. These results should be compared with the results in 1) above in order to ensure the more accurate flooding areas to be predicted.

3) By using the DTMs produced in the process to produce the digital topographic map data or contours and photogrammetric height points, it is possible to simulate how a flooding area expands as the water level rises. In using the DTMs, the DTM data of the points at which buildings and houses exist should be eliminated in advance because the rooftop heights of these buildings and houses may be acquired.

4) As the Dhaka Metropolitan Area lies in the sedimentary plain that extends in the mouth of a large river, the elevation difference is very small and the water discharge conditions depend upon natural and artificial dikes, roads and discharge pumps. It will be useful for the anti-flood project to prepare a land condition map taking these into account. Dhaka City is located approximately 220 km up the mouth of the Padma River, but it is affected by the tide levels because its elevation is so low that discharge pumps are used to drain water. Thus, the land condition map incorporating the data such as positions, quantity and performance of discharge pumps will be useful for a water discharge plan.

5) If data such as rainfall, river flow, evaporation quantities, penetration quantities, inflows, basin areas, sewerage or drainage routes are available, it may be possible to simulate the water level changes in flooding because there are accurate 1:5,000 scale digital topographic maps. However, the water level changes cannot be simulated with simple models because the floods in the Dhaka Metropolitan Area are caused by three factors; the rise of the river water level due to the melting snow in the Himalayan Mountains, flooding due to poor drainage of rainfall in the rainy season and high tide caused by hurricane at Bengal Bay.

### *17.5.7 Use in road and traffic measures*

The 1:5,000 scale digital topographic maps can be applied to the planning of construction such as the flyover project to reduce traffic congestion and the new road construction project.

On the other hand, it is necessary to review the transport system in Dhaka city including the bus stops near intersections in order to reduce the traffic congestion. For this purpose, plans to change the positions of bus stops and rickshaw pools that have caused the present traffic regulations and congestions should be drawn up and implemented.

Dhaka Transport Co-ordination Board (DTCB) has planned a project for the transport infrastructure in Dhaka Metropolitan Area and pointed out the necessity of detailed medium to large-scale digital topographic maps and GIS data. The area under the control of DTCB is 1,542 $km^2$ in total covering Dhaka City and its surrounding areas, including the area covered by the 1:5,000 scale digital topographic maps produced in the Study.

For DTCB, the first step is to create GIS data on the roads, including information on road width, road length, road type, bridge and culverts, as well as information on bus stop positions and traffic regulations, based on the 1:5,000 scale digital topographic maps produced by the Study.

### *17.5.8 Use in police administration*

The products of the Study can be used by the police administration in the following way:

***1) Production of police precinct map***

There are cases in which a dispute on the precinct of a police station may arise in an event of traffic accident or crime because the precinct of each police station is not clearly defined. The first task is to prepare each police station's precinct map using the 1:5,000 scale digital topographic maps produced by the Study.

***2) Traffic regulation database***

Inadequate traffic regulation (right-turn, left-turn, U-turn, etc) is the cause of traffic congestion. Therefore, the next task will be develop a database containing information on various traffic regulations using 1:5,000 scale digital topographic maps produced in the Study, and to review the

present traffic regulations in order to establish more appropriate traffic regulations.

# *Chapter 18 Conclusion*

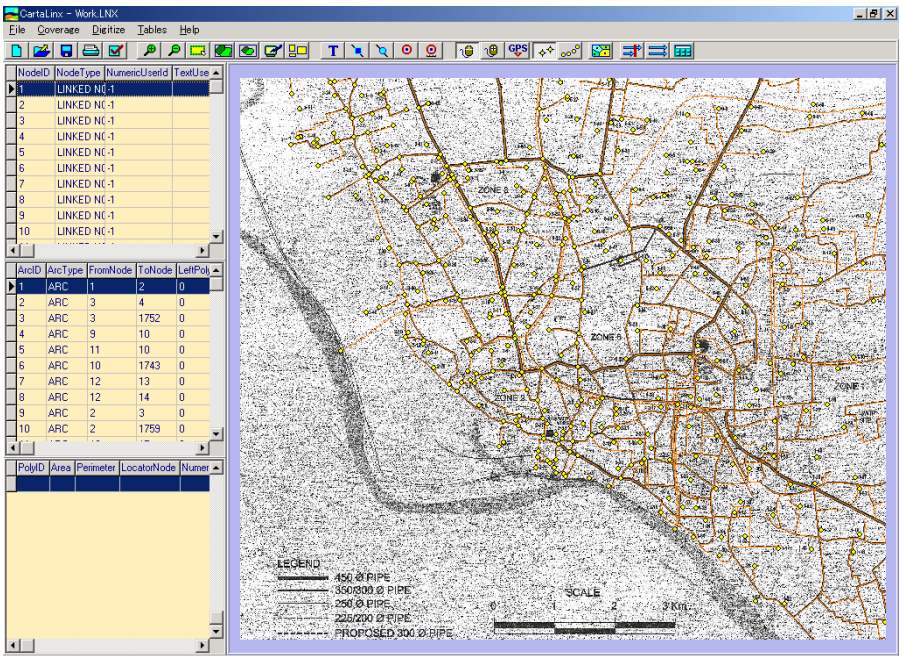
## Thematic Map of Main Pipe Line about Water Supply

The development of the water supply is an important theme in the social infrastructure. In the urban water supply, it is the important themes of the stable supply of the drinking water and those operations in consideration of the future water demand prediction.

In the point of view of facility management, it is also an important point about the rehabilitation relating to the maintenance including the improvement of water quality and correspondence to the leak of water caused by decaying of the water pipe, and the improvement of the operation of watering.

As shown in the following figure, the main pipe network of the water supply in Dhaka city which attribute uses pipe diameter is compiled in the base map as a thematic map.

As for the facility management of the water supply and the rehabilitation as well, a large-scale map is expected the advantage use of the geographic information.



# *Chapter 18 Conclusions*

The Study was implemented in the joint work by the Study team and SOB counterparts over a period of approximately 21 months from the end of November 2002 to the beginning of July 2004. With respect to the ground control point survey and the field identification in particular, SOB counterparts took the initiative in actual implementation. In the second half of the 2nd year's Study, technology transfer in the production of 1:5,000 scale digital topographic maps by digital photogrammetric method and in the creation of GIS basic data was carried out using the equipment provided by JICA.

SOB had no experience in producing medium to large-scale digital topographic maps by digital photogrammetric method, and the Study was the first experience in such a work for SOB. For this reason, it took time for SOB counterparts to understand that the production of small scale topographic maps that SOB had undertaken so far is different in content from that of the medium to large scale topographic maps in the Study.

In particular, SOB counterparts may need to understand that the production of the medium to large-scale topographic maps involves subtle problems that were problematic in the production of the small-scale topographic maps. In particular, with regard to the administrative boundaries and names that were the map compilation data, the accuracy of their horizontal positions had not been so important in the small scale topographic maps; but in the medium to large scale topographic maps the accuracy of the horizontal positions is quite important.

In the 1:5,000 scale digital topographic maps produced in the Study, roads were basically shown according to actual dimensions and houses were depicted individually as much as possible, so that therefore, great care was needed in depicting administrative boundaries on the 1:5,000 scale digital topographic maps.

The 1:5,000 scale digital topographic maps produced in the Study were the first medium to large scale topographic maps that SOB had ever produced, and it goes without saying that it is difficult to expect the perfection on the first try. Therefore, the 1:5,000 scale topographic maps produced in the Study should be regarded by SOB as prototype medium to large-scale topographic maps.

The 1:5,000 scale topographic maps produced are in the form of digital data, so that they can be easily revised. In the future, SOB will need to update the 1:5,000 scale digital topographic maps, taking into consideration the contents and methods of work better suited for actual conditions in Bangladesh, and also drawing on their experiences in the production of the digital topographic maps. In this way, it will be possible for SOB to maintain and enhance SOB's technical capabilities in the production of medium to large-scale topographic maps.

In Japanese culture, technology and traditional art, a process has long been in effect made up of the three steps, namely, "SHU (protect)", "HA (destroy) and "RI (break away)". "SHU (protect)" means to study in

earnest, to learn adhering strictly to the basic techniques. The next step is "HA (destroy)" in which the basic techniques (that can also be expressed as "tradition") are broken down. Through the destruction of old forms and techniques we arrive at last at the final step of "RI (break away)" in which we move away from what we have learned and establish something original.

Since old times, Japan has developed its own technology based on technology imported from overseas, through the process of these three steps, "SHU (protect), HA (destroy) and RI (break away)".

The method used in the production of the 1:5,000 scale digital topographic maps that the Study team employed in the Study is basically Japanese system modified by engineers of the Study team who have experience in topographic mapping in a variety countries.

Basically, the method the Study team employed has its foundation in Japan. Although there is no basic difference in the mapping technology, there is a need to alter actual method of execution depending upon the conditions of the country such as local conditions, equipment owned, technical capabilities, etc., of country in question.

It is important for SOB now to review the working method used in the Study by considering local conditions of Bangladesh, local qualities, equipment owned, technical capabilities, available budget, etc., in order to establish within Bangladesh a specific working method suited to the actual conditions of SOB. In other words, the Study was the "SHU (protect)" step for SOB, and now SOB needs to move on to the "HA (destroy)" step.

Through the implementation of the Study, SOB was able to experience the chain of work for the production of medium to large scale digital topographic maps by photogrammetric method, and was able to equip itself with the equipment and software necessary to produce medium to large scale topographic maps. As we have mentioned several times through the execution of the Study, the ground control point survey and aerial triangulation have been completed in the Study for the entire area covered by aerial photography (960 $km^2$), and SOB is in the position to be able to produce by itself its own digital topographic maps to cover the area (approximately 389 $km^2$) not covered by the 1:5,000 scale digital topographic maps, using the products of the Study.

After the completion of the Study, the Study team expects that SOB will establish a working method suited to the actual conditions of Bangladesh, based on the experience obtained through the implementation of the Study, and will by its own efforts produce 1:5,000 scale digital topographic maps to cover the remaining area.

The reason why medium to large scale topographic maps are produced mainly for city area is that the huge effect of human economic activities in city areas causes all kinds of problems, such as environmental problems and urban problems, and, the small scale topographic maps covering the entire national land are insufficient as basic material for solving these problems. The medium to large-scale topographic maps,

therefore, are produced because there is a need for them. It can be said that the topographic maps have no value until they are actually used by the users.

SOB needs to make efforts to ensure that the 1:5,000 scale digital topographic maps produced in the Study are put to effective use by many users; and the study team firmly believes that by having many users make use of the maps the reputation and value of SOB as an agency producing and supplying topographic maps are enhanced.

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