

# **Planning Guidelines for Rural Road Master Plan**

**(Guideline on GIS Application  
for Rural Road Development)**

Strengthening of Activities in Rural Development Engineering Center Project  
(RDEC-2)

Local Government Engineering Department (LGED)

**GIS Unit**

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# **1. Planning Guideline for Rural Road Master Plan**

## **1.1 Introduction**

Bangladesh is a very densely populated and low lying country with around 150 million inhabitants living in an area of 144,000 sq.km. A majority portion of the population lives in rural areas. It is estimated that about 76% of its population live in rural areas. Rural connectivity is a key component of Rural Development in Bangladesh. Rural roads contribute significantly to generating increased agricultural incomes and productive employment opportunities, alongside promoting access to economic and social services. Rural Roads are the virtual lifelines for the vast multitude residing in rural areas.

Bangladesh is having high density of roads predominantly earthen in nature. However the paved road network in the country has increased steadily since independence in 1971 from 3600 km to 65000 km currently. It is evident that the improvement of rural road network has underpinned the economic growth, business and employment opportunities and agricultural production of the country. Keeping in view the socio-economic benefits accruing from providing road connectivity to the rural level, there is a need to impart greater thrust to providing road connectivity.

The main purpose of this Manual is to assist in preparation of Rural Road Master Plan. This Manual is intended to facilitate collection and collation of various types of information required for preparation of Master Plans at the District levels and its vetting at the center level. It is also intended to bring about a basic uniformity of approach and transparency in the Planning process for the roads to be developed under LGED.

## **1.2 History of Rural Development and Involvement of LGED**

### **1.2.1 Comilla Model of Early 1960s**

The rural development programmes of the Government, which has originated in the early 1960s was conceptualized essentially as an instrument for providing support for increased agricultural production. The rural development model known as the "Comilla Model" emphasized the formation of cooperatives and the integration of support services provided by the Government departments. The model had four major elements and three elements of the Comilla Model were related to development of rural infrastructure as indicated below:

- Two tire cooperatives - Krishak Samabaya Samity (KSS) and Thana Central Cooperative Association (TCCA)
- Rural works programme (RWP)
- Thana Irrigation Programme (TIP)
- Thana Training and Development Centre (TTDC).

Thus the Comilla Model paved the way for development of the rural roads in the country under the RWP and LGED started implementing rural road improvement projects with support from the donors and GoB.

### **1.2.2 Strategy for Rural Development (RD) 1984**

In 1984, the Government of Bangladesh formulated the strategy for Rural Development Projects with the broad objective of improving the quality of life of the rural people. The strategy adopted an integrated approach for formulating Rural development projects that contained the three elements as follows:

- Physical infrastructure including roads, storage and markets
- Irrigated agriculture, minor drainage and flood control work
- Production and employment programmes for the rural poor

For construction of the roads, the strategy considered the Growth Centre and Union Parishad connecting roads.

### **1.2.3 Bangladesh Rural Infrastructure Strategy Study, 1996**

Later in 1996, Bangladesh Rural Infrastructure Strategy Study was jointly conducted by GoB and the World Bank to check the validity of 1984 strategy. The main conclusions of the study were:

- The strategy of Growth Centre based approach (which focuses public investments on selected Growth Centres, where selections were made based on some well defined criteria to indicate their socio-economic importance) remains valid
- No major changes are required, only some readjustment or "fine tuning" may be justified in light of the experience acquired from the implementation of different RD Projects
- Targets will have to be reset after the recent increase from 1400 to 2100 Growth Centres and regional priorities will have to be redefined in view of the national potentials of the region
- Some minor readjustment will be needed in the spatial distribution of infrastructure development project investments to be in line with agriculture production and potential
- More emphasis on user/community participation in planning, implementation and monitoring phases
- More use of local resources, such as, local materials, and the continued use of labour intensive techniques with appropriate equipment
- Increasing the role of private sector and further strengthening of the capacity of contractors operating at the rural areas, who provide cost effective, labour

intensive skills and resources to enhance the future sustainability of the rural infrastructure system.

- Institutional strengthening of LGED and its wide network at local levels with a great orientation towards community participation
- Greater priority based investment programmes and highest emphasis on establishment of sustainable maintenance system for already built infrastructure.

#### **1.2.4 Rural Road Improvement Components**

Based on the rural development and rural infrastructure development strategies as stated above, the rural road improvement projects have included the following components during different five-year plan periods:

- Development of rural hats and bazaars identified as Growth Center
- Construction/Improvement of Upazila Roads connecting Upazila HQs with Growth Centers and Union Roads connecting Union HQs with Upazila HQs, Growth Centers or local rural markets
- Construction of bridges/culverts on the above roads

The components of rural road and Growth Center/Market improvement as a package were included in such rural infrastructure development projects to increase agricultural production, ensure better availability of agricultural inputs and facilitate transportation and marketing of agricultural produces and generation of employment opportunities in the farm and non-farm sectors.

In addition, promoting local governance is an added dimension in the process of rural development in Bangladesh. For better service delivery and local development activities by the Union Parishad and ensuring community participation including transparency and accountability, improvement of Union Roads and construction of Union Parishad complexes have assumed much greater importance than before.

#### **1.2.5 Responsibilities of LGED**

The local Government Engineering Department (LGED) under the Local Government Division of the Ministry of Local Government, Rural Development and Cooperatives is responsible for construction and maintenance of Upazila Road, Union Road and Village Road along with the Local Government Institutions (LGIs) to improve transport network, development of Growth Centers and rural markets infrastructure and thereby contributing towards employment generation and poverty reduction. LGED is also responsible for providing technical support to LGIs both in rural and urban areas of the country.

### **1.3 Issues of Development of Master Plan for Rural Road Network**

In view of the needed investment prioritization, it is necessary for LGED to prepare a master plan for Upazila roads, union roads and Village Roads along with Growth Centers/Rural Markets, Union Parishad Complex etc. the objectives of Rural Road Master Plan will be as follows:

- To identify/prioritise a most useful and effective rural road network through out the country to ease the rural life as a whole
- To provide all weather access to all Growth Centers, all Union Parishads Complexes, most of the rural markets and other service delivery centers of the rural areas
- To improve rural accessibility for facilitating agricultural production and marketing of different products
- To reduce poverty through employment generation and accelerating economic activities in rural areas
- To strengthen the Local Government Institutions and promoting local governance

## 2. Classification of Road System in Bangladesh

The road network of Bangladesh has been classified and the responsibilities of construction, development and maintenance of these roads have been entrusted to Roads and Highways Department (RHD) and Local Government Engineering Department (LGED) respectively. The Planning Commission of Bangladesh during April 2003 approved this classification and fixed up the definition, ownership and responsibilities of the total road network of the country. According to the classification LGED will be responsible for construction, development and maintenance of three classes of roads, which has been named as Upazila Road, Union Road and Village Road in collaboration with Local Government Institution (LGI). Road type with definition and the ownership and responsibility are furnished in Table 2.1 below:

Table 2.1 Road Network Classification with Definition

Sl. No	Type	Definition	Ownership and Responsibility
1.	National Highway	Highways connecting National capital with Divisional HQs or sea ports or land ports or Asian Highway	RHD
2.	Regional Highway	Highways connecting District HQs or main river or land ports or with each other not connected by national Highways.	RHD
3.	Zila Road	Roads connecting District HQ/s with Upazila HQ/s or connecting one Upazila HQ to another Upazila HQ by a single main	RHD

		connection with National/Regional Highway, through shortest distance/ route.	
4.	Upazila Road (UZR)	Roads connecting Upazila HQ/s with Growth Center/s or one Growth Center with another Growth Center by a single main connection or connecting Growth Center to Higher Road System,* through shortest distance/route. (Former Feeder Road Type-B)	LGED/LGI**
5.	Union Road (UNR)	Roads connecting union HQ/s with Upazila HQs, Growth Centers or local markets or with each other. (Former Rural Road Class-1 (R1))	LGED/LGI
6.	Village Road (VR)	a) Roads connecting Villages with Union HQs, local markets, farms and ghats or with each other. (Former Rural Road Class-2 (R2)) b) Roads within a Village. (Former Rural Road Class-3 (R3))	LGED/LGI

\* Higher Road System- National Highway, Regional Highway, and Zila Roads;

\*\* LGI- Local Government Institutions.

The roads belonging to the Pourashava and the City Corporation have not been included in the above table. The responsibility for development and maintenance of such roads will lie with the Pourashavas and the City Corporations respectively. Recently the government has further re-organised the road categories and the responsibilities of Upazila road and Union road has been entrusted to LGED and the responsibilities of Village road is entrusted to Local Government Institution (LGI). Accordingly gazette notifications have been issued by the government stating the name of these roads along with ID Number, Length, etc. against the concerned agency.

The design standards relate the width of the road (geometric design) and thickness of various layers (pavement) to the classification of the road. It has been recommended that there should be 6 basic geometric design types for Zila, Upazila and Union Roads all based on traffic criteria. Design types 5 - 8 have been based primarily on forecasts/survey of commercial vehicles (applicable for LGED). Design types 3 and 4 are based primarily on forecasts of peak hour passenger car units (pcu's). The approved geometric design for each type of road is summarised in Table 2.2

Table 2.2 Approved Geometric Design Standards

Road Class	Design Type	Carriageway (m)/(ft)	Hard Shoulder (m)/(ft)	Verge (m)/(ft)	Crest Width (m)/(ft)
Union Road	8	3.0/10	0/0	1.25/4	5.5/18
	7	3.7/12	0/0	0.90/3	5.5/18
Upazila Road	6	3.7/12	0/0	1.8/6	7.3/24
	5	3.7/12	0.9/3	0.9/3	7.3/24
	4	5.5/18	0/0	2.15/7	9.8/32
Zila Road	5	3.7/12	0.9/3	0.9/3	7.3/24
	4	5.5/18	0/0	2.15/7	9.8/32
	3	5.5/18	1.2/4	0.95/3	9.8/32

For Types 8, 7, 6 and 5 the criterion should be daily commercial vehicles. For Types 4 and 3 the criterion should be peak hour pcu's. Traffic criteria for each design type are shown in Table 2.3 below:

Table 2.3 Traffic Criteria for Design Purposes

Design Type	Daily Commercial Vehicles (CVD)
8	Up to 50
7	51-100
6	101-200
5	201-300
4	301-600

### 3. Development of Road Inventory Database

#### 3.1 Road and Structure Inventory

A comprehensive and reliable road inventory database is a basic requirement to develop a rural road master plan road for effective and efficient construction and

maintenance management system. It should contain detailed information about the physical features of the roads along with identification number, geometric features, Present Condition, Annual Average Daily Traffic (AADT), International Roughness Index (IRI), Chronological History of Construction and Maintenance, location of Bridges/ Culverts, Growth centres, Rural Market, UP Complex, Other Social Infrastructures (School, College, Madrasa, Community Clinic, Health Centre, Cyclone Shelter, etc.) on the road in detailed form chainage-wise. A great amount of work has been done by the Upazila Engineers and concern technical staff to create inventory of all Upazila Roads, Union Roads and Village Roads under LGED through out the country. These data have been compiled and managed through computer based software named as - Road and Structure Database Management System (RSDMS) installed in each Upazila, District and in the RIMMU at LGED HQ Dhaka. During this year, the existing features have been improved and some new features have been added with the system to accommodate the growing needs. The purpose of all this improvement is to fulfil the requirement of proper planning and management for construction, maintenance, rehabilitation and improvement of road network under LGED through out the country.

A large number of roads including its appurtenant structures are being constructed in every year under various development projects of LGED. Deterioration of road and structures is a common phenomenon with time, virtually; road deterioration start immediately after its construction and it is progressive. It is therefore very important to maintain a reliable database of the roads and structures with their physical condition through introducing regular surveys/ inspections system and there by up-dating the database of roads and structures at a regular interval systematically.

### **3.2 Up-dating Upazila Road Map and Inventory**

The Upazila Road Map is a vital tool for physical planning and that must be available in the offices of all Upazila Engineers. It will enable them to see at a glance the relationships between different roads and support them to plan their annual maintenance program. The Upazila Engineer should update the road map of his Upazila as per necessity and sent the version of the updated map to GIS Unit at LGED HQ for maintaining the updated GIS database at central level.

The Upazila Engineer will up-date and maintain a reliable physical inventory and condition database through the RSDMS-VI software, primarily for their own purposes, and also having them available to furnish to the Executive Engineers of their respective districts on a regular basis. At the district level, after receiving updated data from the upazila, the concerned Assistant Engineer of the district XEN office will verify and check the submission and finally compile these data through RSDMS-VI after proper validation. The district XEN will then sent them to the Rural Infrastructure Maintenance Management Unit (RIMMU) at LGED HQ, Dhaka.

Upazila Engineers will have a key role in ensuring that inventory and condition data are accurate by establishing system of regular surveys through trained staff. This

information will be used as basis for assessing annual maintenance need and preparation of annual maintenance program of the district with ranking priority of schemes. All Upazila roads should normally be inspected once in every six months and other roads (Union and Village) at yearly intervals to update their condition. Additional inspections should be carried out after serious flooding or after other extreme weather conditions or disasters have been experienced.

Side by side, union-wise break-up of the road as well as location of UP complex, Growth Centre, Rural Market, Other Social Infrastructures (School, College, Madrasa, Community Clinic, Health Centre, Cyclone Shelter, etc.) shall also have to be recorded in detailed chainage-wise. Detailed description of shoulder and slope, cost of construction, year of construction, source of funding, last maintenance operation, etc. shall have to be recorded in the database using RSDMS-VI software. Chainage-wise detailed information of the road structures (bridges/ culverts) will also be recorded. All these data/ information will form the basis for assessment of physical and financial need including prioritization of development and maintenance work of the Upazila/ District

Steps must be taken to prevent frequent amendments of the database by adding new road or by changing road classes from one category to other (e.g, from UNR to UZR, VR to UNR, etc). If any road is required to be added in the database for some obvious reason, the XEN of the concerned district has to explain the reasons and will ask approval of the chief engineer for inclusion of the road in the road inventory under the particular upazila of the district. Subsequently the Chief Engineer will send the proposal to the committee constituted by the Planning Commission for necessary examination. Any addition/ change in the road class would be acceptable only after obtaining due approval from the said committee. When any addition/ change is approved the road database as well the Upazila road map shall have to be updated and will be sent to RIMMU at LGED HQ through a special messenger of the concern Upazila/ district for necessary inclusion in the central database at LGED HQ.

### **3.3 Preparation of Disaster Damage Inventory**

#### **3.3.1 Disaster Damage database preparation**

GIS Unit developed a disaster information database using Disaster Damage Database Software. Rural Infrastructure Disaster Damage Map , Submerge Level Map of Damage Road, Submerge Duration Map of Damage Road and damaged infrastructure photo will be collected with the help of Upazila engineer. Using disaster database and GIS Software, Disaster Damage Map will be prepared to add information for rural road master plan.

The following data is collected and inputted using Disaster Damage Database software.

- Flood Affected Road Segment Information
- Road Embankment Damaged Information
- Structure Damaged Information

Road Wise Damage Information									
District : MOULVIBAZAR					Upazila : KULaura				
A. Basic Information									
Flood		Road Code	Road Name			Total Length (km)	Duration of Flood (days)		
Year	Month								
2010	May	658653027	Pushainagar-Nowabgonj			8.55	90		
B. Flood Affected Road Segment Information									
From			To			Flood Water Overflowed	Road Submerged Duration (days)	Height Diff. between HFL & Road Surface (m)	
Chainage	X	Y	Chainage	X	Y				
4800	24.5780	92.0548	4950	24.5780	92.0548	Yes	45	0.60	
5900	24.5799	92.0466	6200	24.5809	92.0438	Yes	45	0.20	
6300	24.5811	92.0432	6570	24.5831	92.0421	Yes	45	0.20	
6700	24.5834	92.0417	7000	24.5844	92.0391	Yes	45	0.20	
7070	24.5853	92.0384	7150	24.5836	92.0380	Yes	45	0.30	
7550	24.5868	92.0358	7750	24.5871	92.0330	Yes	45	0.30	
7805	24.5871	92.0330	8430	24.5890	92.0290	Yes	45	0.20	
C. Road Embankment Damaged Information									
Damage Type	Chainage	Length (m)	Volume (cum)						
Washed out	4800	150.00	900.000						
Washed out	5900	300.00	1800.000						
Washed out	6300	270.00	1890.000						
Washed out	6700	300.00	2100.000						
Washed out	7070	80.00	560.000						
Washed out	7550	200.00	700.000						
Washed out	7805	625.00	3125.000						
D. Structure Damaged Information									
Structure Type	Chainage	Span (m)	Damaged Components						
			Wing Wall	Top Slab	Bottom Slab	Abutment	Scouring	Whole Structure	
Slab Culvert	8400	3.00	No	No	No	No	No	Yes	

### 3.3.2 Disaster Damage Database software

Data collected in the field will be inputted into computer using “Disaster Damage Database” software. Expected information is Flood Affected Road Segment Information, Road Embankment Damaged Information and Structure Damaged Information.

The screenshot shows three windows from the 'MOULVIBAZAR : KULAURA : Disaster Damage Database' software:

- MOULVIBAZAR : KULAURA : Disaster Damaged Road List**: A table with columns 'Road Code', 'Road Name', and 'Road Length'. It lists two roads: 658652003 (Kulaura-Pekurbazar-Nawabgonj-Baramchal Road, 16.48) and 658653027 (Pushainagar-Nawabgonj, 8.55).
- MOULVIBAZAR : KULAURA : Road Segment, Embankment & Structure Info**: A detailed view for Road Code 658652003. It includes:
  - Flood Affected Road Segment Information**: A table with columns 'Chainage', 'X', 'Y', 'Chainage', 'X', 'Y', 'Flood Water Overflowed?', 'Road Submerged Duration', and 'Height Diff. HFL & Road Surface'. A row with Chainage 7502 is highlighted and labeled 'Data'.
  - Road Embankment Damaged Information**: A table with columns 'Damage Type', 'Chainage', 'Length', 'Volume', and 'Photo'. A row with 'Washed out' damage at Chainage 7552 and Length 50.00 is highlighted and labeled 'Data'.
  - Structure Damaged Information**: A table with columns 'Structure Type', 'Chainage', 'Span', 'Wing Wall', 'Top Slab', 'Bottom Slab', 'Abutment', 'Scouring', 'Whole Structure', and 'Photo'. A row is highlighted and labeled 'Data'.

After all the data are inputted, data is transformed to GIS software (ArcGIS) compatible format.

### 3.3.3 Disaster Damage Database

Until user understand the software operation, following preparations are necessary.

- Preparation of Disaster Damage Database software manual
- Conduct a training for Disaster Damage Database software for beginners is necessary
- Cooperation of Maintenance Unit is indispensable in order to update soft

improvement.

### 3.3.4 Data collection in the field

- Location and photo of damage condition must be collected
- Collected data must be data input using Disaster Damage Database software
- Cooperation of Maintenance Unit is indispensable in data collection

### 3.3.5 Data feedback

- Upazila level Disaster Location map should be arrange as an Annual report and distribute in a printed paper. Attach a printed map could be more user friendly. Therefore Upazila engineer can use Disaster Location Map as planning, monitoring and maintenance information.
- In the future, Disaster Location map should be distributed in a printed map and in digital form according to their request. The flexibility of data use comes out more. Also for preparation, it is necessary to overcome many difficulties.
- Disaster Location map is not only for Upazila office but it should be useful for Maintenance Unit order to have a good cooperation.

## 3.4 Update river data

(1) Selection of spectral band for river interpretation

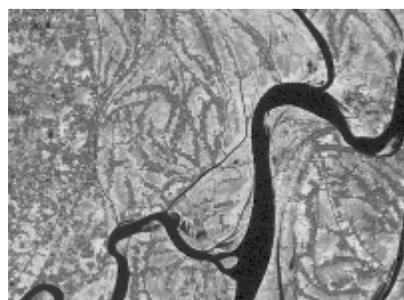
- Band 7 or Band 5 for Red, Band 4 for Green Band 3 for Blue to make color composite for river interpretation



- Single Band such as Band 7 or Band 5 is also use for river interpretation



Band TM7

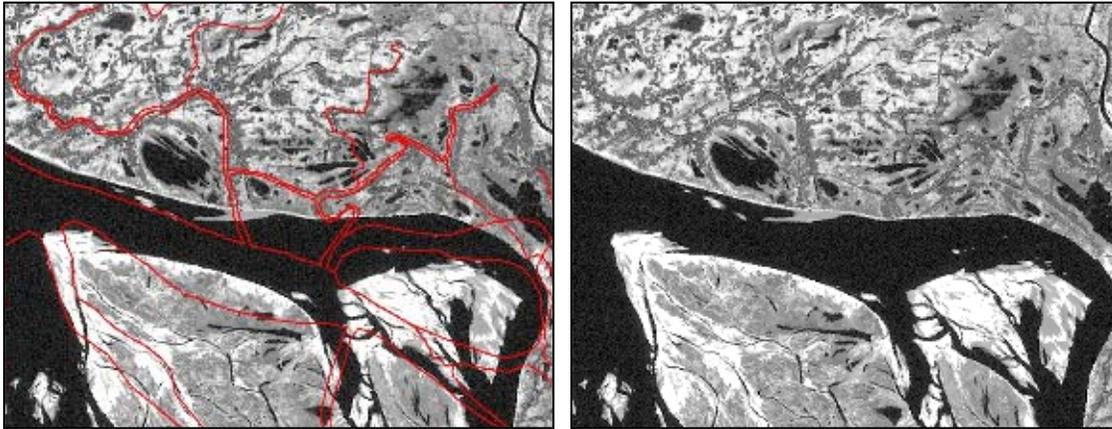


Band TM5

In general, adding near infrared wavelengths (band) will make easier to identify water body. Because most distinctive characteristic of water is the energy absorption at the near infrared wavelengths and because of this phenomenon, interpretation of a river becomes easy.

(2) Super impose GIS data (river) on Satellite image

Super impose GIS data (river) on Satellite image and check the movement of river.

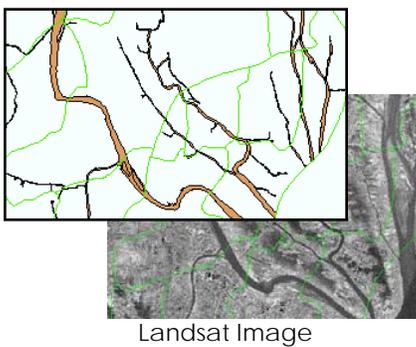


Super impose river data on LANDSAT image

LANDSAT image

Super impose GIS data (river) on Satellite image

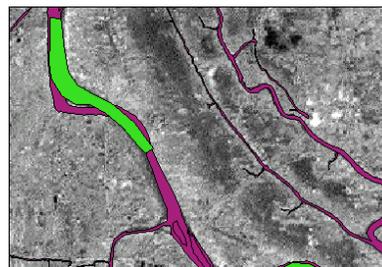
DUBM (Before updating)



Landsat Image



Getting outline of change area



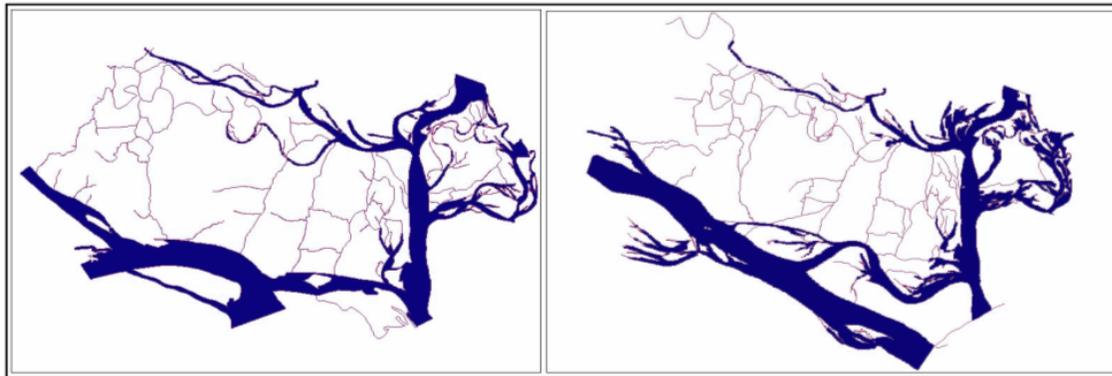
### Criterion of judgment of correction

When super impose the GIS data on a satellite image, and if it does not come on the same position, then edit and update the data.

[ Update ]

GIS software such as ArcGIS is used for updating river information. Overlay DUBM with a satellite image and modify the data.

Result of river data updated



Before update

After update

### 3.5 Update settlement data

(1) Selection of spectral band for settlement updating

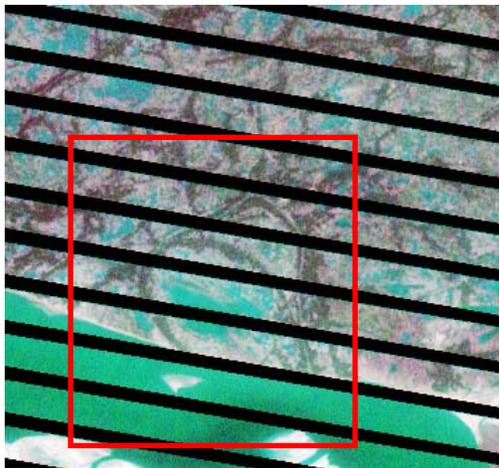
Use 6 bands (LANDSAT Band 1 through Band 7) for classification of land use.

(2). Settlement information from satellite image

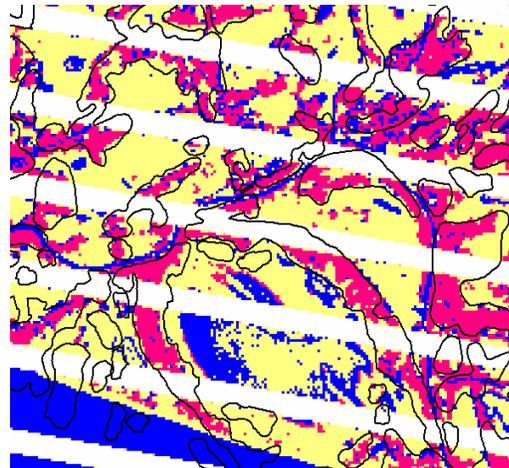
(2-1) Settlement information will be collected from satellite image analysis.

(2-2) Update

GIS software such as ArcGIS is used for updating settlement information. Overlay settlement data with a satellite image and modify the old data.

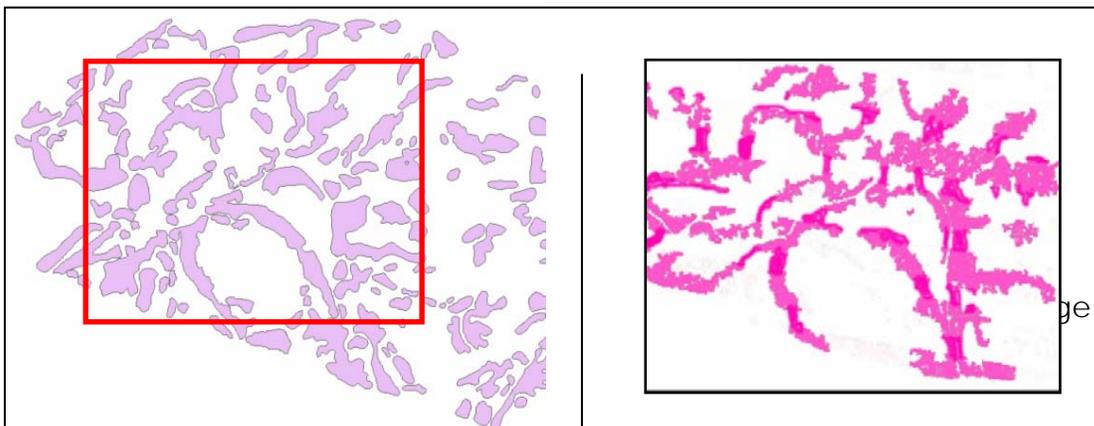


LANDSAT 7 (2008.12.09)



Unsupervised classification result

(Settlement data super imposed)



Before update

After update

## **4. GIS Application for Planning and Management of Rural Roads**

### **4.1 Background on GIS**

Geographical Information System (GIS) is an information system designed to work with data referenced by spatial/ geographical coordinates. In other words 'GIS' is both a database system with specific capabilities for spatially referenced data as well as a set of operations for working with the data. It may also be considered as a higher order map data management system. GIS tools can be used effectively for planning, progress monitoring and as an effective tool for construction and maintenance management of the road system. The database development under planning purposes can be easily used for maintaining and up keeping of the road system. It can also be used as an advanced online management system, which accommodates multi access data users.

### **4.2 Potential use of GIS in rural roads**

The major components of rural roads are planning, project preparation, construction, monitoring and maintenance. Planning includes preparation of district rural road plans and state network plan which is helpful for identification of the links to be developed, and a broad estimation that is required for allocation of funds, since each selected link of rural roads is considered as a project. The detailed project report includes the survey information such as detailed design and drawings, cost estimates for various road works, etc., which are required for execution of the road works. The same information will be highly useful during construction monitoring, quality control and maintenance activities. Thus the district rural road plan with the state network prepared in GIS platform can be extended as a road information system for each project by incorporating the detailed project report data and drawings. This in turn then will be the basis for award of work, monitoring the progress of the work and quantity control in the field.

### **4.3 GIS Application in planning and management**

GIS technology is useful in network as well as geographic analysis in the field of rural road planning and measurement of rural accessibility. To avoid any duplication in planning of rural roads it is suggested that a master plan for rural roads is to be prepared. Similarly, guidelines for preparation of Rural Road Plan for implementation also suggest the master plan based prioritised rural road links for implementation. The master plan for rural roads prepared at upazila level is convenient both from the point of map preparation & data collection and also for obtaining approval, under the District level. All the upazila level information sets in a district can be combined easily to form a District Rural Road Plan. Normally, 1:50,000 scale is convenient and easy to handle at the upazial level. Therefore, the base map for a upazila is prepared at the 1:50,000 scale. In the first instance, if the base map for road network is being prepared in GIS environment, it will be easy for preparation of District Rural Road Plan (DRRP) and State Network Plan. The relevant attribute data collected for preparation of the DRRP can also be incorporated easily in the GIS base map to generate the state network on

population size criteria of habitations for connectivity as well as to do prioritization of the links for implementation.

And GIS technology is useful in the field of rural road master plan. As the number of rural roads increases, it is difficult and hard to manage all these rural roads using traditional methods because as these methods are not only time consuming but also difficult to get the desired information. To overcome these difficulties GIS technology is useful. But to use GIS base map database is necessary.

### (1) Base map

Base map show basic information, such as road and infrastructure information to meet majority's requirements. The Upazila map (1:50,000) prepared by GIS Unit is a base map to show the up to date of administrative boundary, social-infrastructure, road networks and water networks etc. User can add additional data to prepare the specialized information map which is call thematic map.

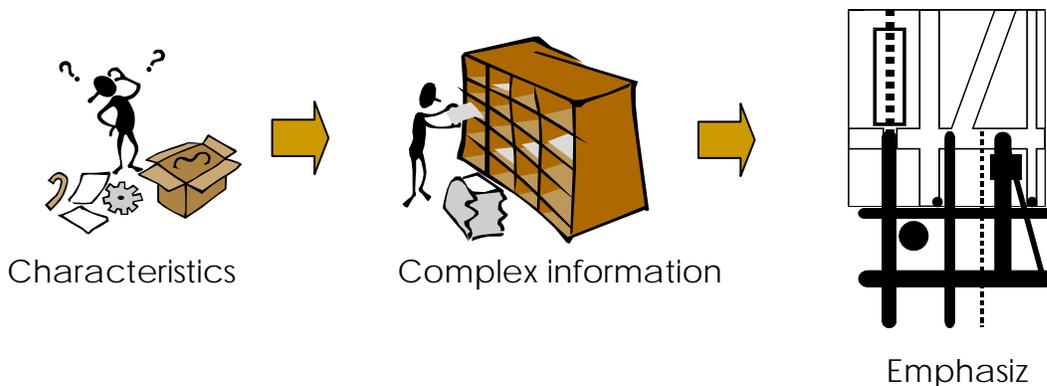
### (2) Thematic map

A thematic map is a type of map especially designed to emphasize specific characteristics connected with a given geographic area. Thematic maps are particularly well suited for presenting complex information in an understandable format.

Thematic map use the base data such as boundaries, settlements and rivers only for point of reference for the phenomenon being mapped.

Thematic maps serve primary following purposes.

- First, they provide specific information about particular locations.
- Second, they provide general information about spatial patterns.



GIS Unit is preparing a disaster location map to provide information for Maintenance Unit and for Upazila office. In order to disseminate and to maintain stability of

distributing this information, it is important to arranged standard form for disaster location map.

### Necessary information for map:

- Legend
- Title, scale, north arrow
- Data source
- Etc.

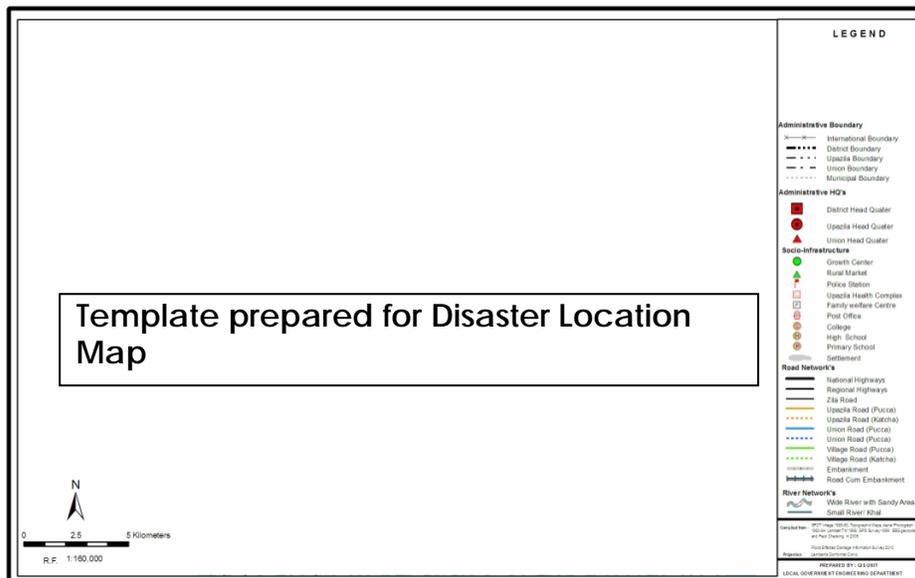
For each items font, font size, font color, etc. also must be decided.



- Select minimum information to put on the map
- Important information must be illuminate
- Remove information which are not important



Preparation of standard format (template) for



### (3) Preparation of thematic map

The database preparation is very important and time consuming for GIS. The following steps are involved in preparation of thematic map to minimize the loss and damages for road maintenance in LGED activity which is connected with planning, decision making and/or maintenance planning (Figure 1).

#### Step 1 Data preparation

- Data input
  - Input the data
  - Link the attribute data
- Data correction and verification

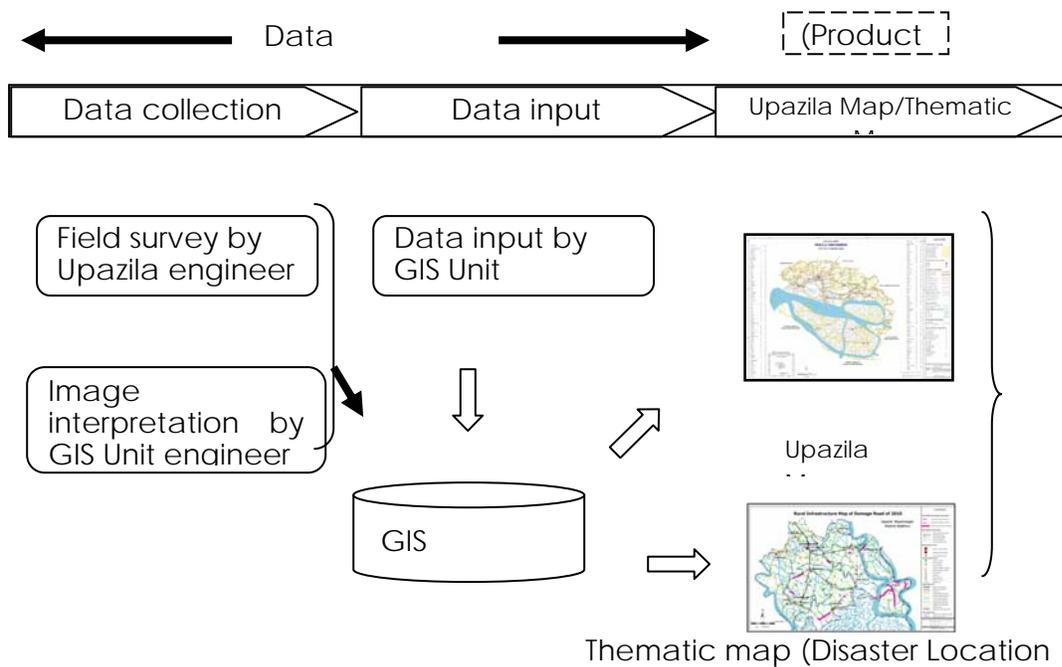


Figure 1 Data preparation for Rural Road Master plan using GIS

#### Step 2 Determination of requirements and the Area

- The request of a thematic map to prepare is determined.
- The target area (Upazila) is determined.

#### Step 3 Preparation of Upazila digital base map data

- Preparation of the road network data
- Preparation of additional information

Administrative Boundary

Administrative HQ's

Socio-Infrastructure

Etc.

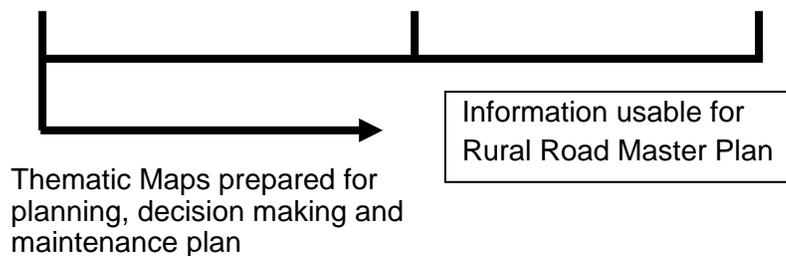
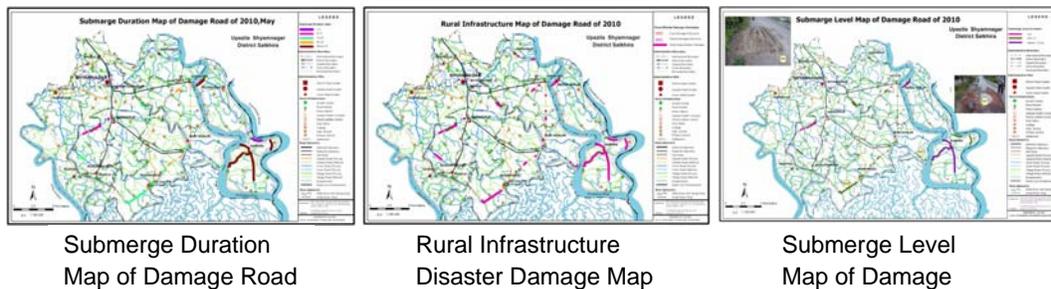
#### Step 4 Selection of a thematic map type

Choose the thematic map

- Road Type map
- Disaster location map
  - Rural Infrastructure Disaster Damage Map
  - Submerge Level Map of Damage Road
  - Submerge Duration Map of Damage Road

#### Step 5 Preparation of a thematic map (Plural requirements map)

Thematic map showing the existing road network with the disaster location of damage.



#### Step 6 Data updating

The quality of data depends on the updating of data and it requires continuous updating. The data updating requires field survey. Global Positioning System (GPS) is an advance method of location data collection/updating of information (maps). The

accuracy of this positioning system varies depending on the type of the receiver and the processing of data. The Differential processing (DGPS) can provide very accurate spatial coordinate and can be used for updating of maps in an efficient and cost effective manner.

- Road networks . . . Update road network information every year conducting field survey by Upazila engineer.
- River networks . . . Update river network information every five years. If there is any big flood during this period, additional update must be conducted. For updating, satellite image interpretation is recommended.
- Settlement . . . Update settlement information every five year. For updating, satellite image interpretation is recommended.
- Landuse (Forest) . . . Update information every five years. For updating, satellite image interpretation is recommended.

To obtain satellite image, download from the following web site.

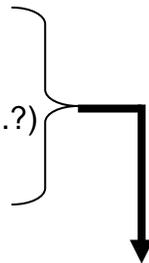
<http://www.glovis.usgs.gov/> (LANDSAT data can be downloaded free of charge)

GIS Unit now has an internet environment to download satellite image by them selves.

### **Step 7 Applications of Thematic maps for Rural Road Master Plan**

The database prepared through above mentioned steps is used for planning, decision making and maintenance. GIS can answer following questions and thus helps in Rural Road Master Plan.

- Where (Location is ...?)
- Condition (How is it....?)
- Trends (Comparison with the past...?)
- Range (Affected area...?)

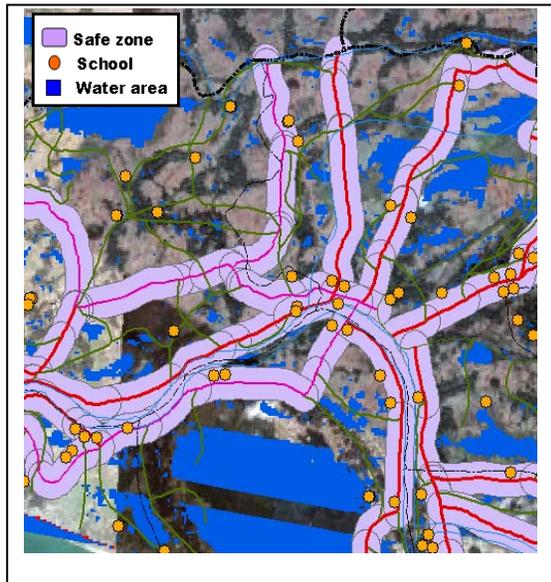


Flood analysis to find out which part of the road is likely to fall under submerge in case of flood

### **Some application samples:**

Creation of the thematic maps from the database of disaster damage to rural infrastructure.

## Safety-level evaluation of schools from flood



- Select satellite image to interpret the inundation area.
- Prepare inundation map
- Superimpose school location on the map
- change the color of school symbol according to the safety-level

### 4.4 Policy of data sharing

The effective planning, decision making and maintenance of any road concerning activity mainly depends on the reliable and updated data. Database is prepared this way but time consuming. So the data sharing among different government which will reduce the cost of duplication should be considered.

### 4.5 Limitations risk associated with this study

Since GIS has generally been used by an expert technology, a number of risks have been associated.

- Planning decisions will be made by experts and technocrats with access to GIS technology without reference to those directly affected user.
- GIS is relatively costly and the costs are unlikely to be matched with the benefits.

# Piloting Project Area for Disaster Damage Mapping

