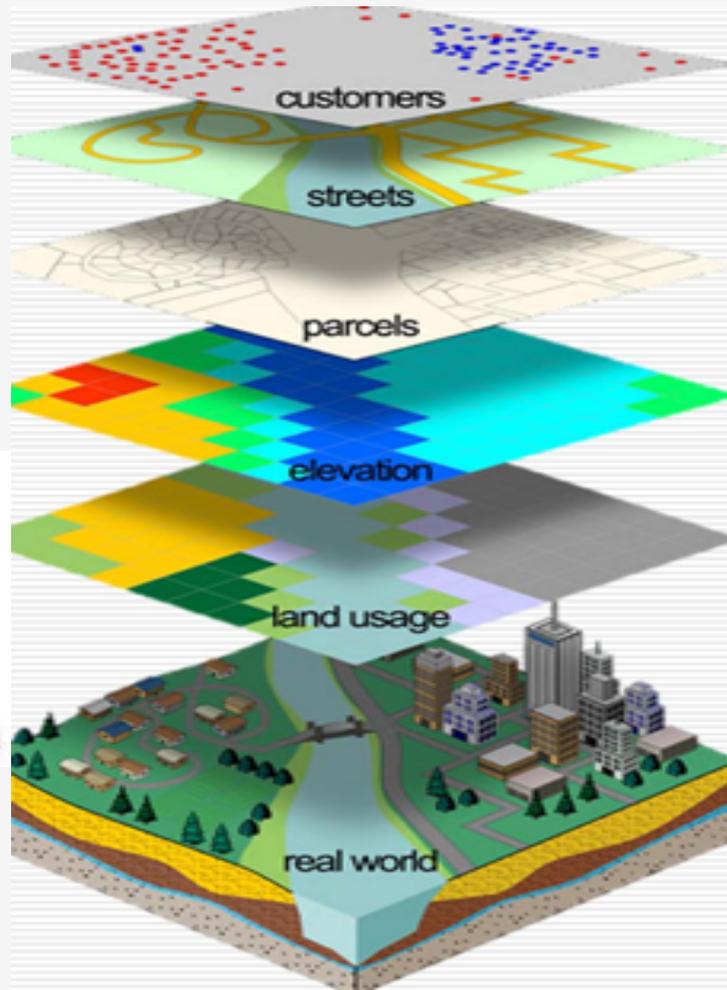


Aiding Surveying and Mapping with the Help of Global Navigation Satellite System (GNSS) in Bangladesh



Sanjeev Delwar
Assistant Director
Survey of Bangladesh

Map of Bangladesh



Bangladesh



The Peoples Republic of Bangladesh

- **Population-**156.7 Million
- **Area-** 147,570 Sq Km
- **Border-**
India (West & North),
India & Myanmar (East),
Bay of Bengal(South)
- **Economic Growth-** over 6%

Introduction

- ❖ Survey of Bangladesh is the National Mapping Organization (NMO) of Bangladesh.
- ❖ It produces and issues Maps, Charts & Geospatial data to Armed Forces and other users for various development activities.
- ❖ All stakeholders are beneficiaries of its products.
- ❖ SOB is the custodian of Aerial Photographs/ Satellite Images of Bangladesh.

Outline

- 1. Main Functions of Survey of Bangladesh (SOB).**
- 2. Background of GNSS Application in SOB.**
- 3. Establishment of National Horizontal Datum.**
- 4. Major GNSS Works Done by SOB.**
- 5. Establishment of 1st Order Horizontal Points by GNSS**
- 6. Establishment of 2nd Order Horizontal Points by GNSS.**
- 7. Establishment of Permanent GNSS CORS.**
- 8. Use of GNSS CORS in RTK Survey.**
- 9. Digital Mapping in Bangladesh**
- 10. Use of GNSS for Making & Updating Topographic Map**
- 11. GNSS Equipment Used in Survey Of Bangladesh.**
- 12. Future works.**

1. Main Functions of Survey of Bangladesh

- ❖ Trigonometrical and Geodetic Control Survey
- ❖ Topographical Survey for 1:25k and 1: 50k scale map
- ❖ Preparation of 1:250k Scale Topographical Map series
- ❖ Preparation of 1: 500k and 1: M scale Topographical Maps
- ❖ Custodian of Aerial Photographs/ Images of Bangladesh
- ❖ International Boundary Demarcation (Hilly Dist)
- ❖ Large Scale Contour Survey
- ❖ Publication of Geographical & Administrative Maps
- ❖ Publication of Thematic Maps

2. Background of GNSS Application in SOB

- ❖ Survey of Bangladesh (SOB) deals with topographic mapping on various scales and establishing geodetic control points all over the country.
- ❖ GNSS technology was first introduced at SOB in 1992 for establishing a new geodetic network of the country.
- ❖ It was a project implemented by SOB with the cooperation of the Government of Japan through Japan International Cooperation Agency (JICA).
- ❖ Under the project, 140 ,1st Order Control Points along with a National Horizontal Datum were established in 1992-1994.

3. Establishment of National Horizontal Datum

- ❖ The National Horizontal Datum was established in 1994 at Gulshan, Dhaka
- ❖ Continuously seven days GNSS observations were carried out to determine the geographical position of the datum
- ❖ The coordinate of the datum was fixed in WGS 1984 Ellipsoid with respect to four IGS stations located in Australia, Germany, Japan and South Africa

Establishment of Horizontal Datum

**Wettzell
(Germany)**

6,787,514.1944m

4,805,509.9497m

Tsukuba (Japan)

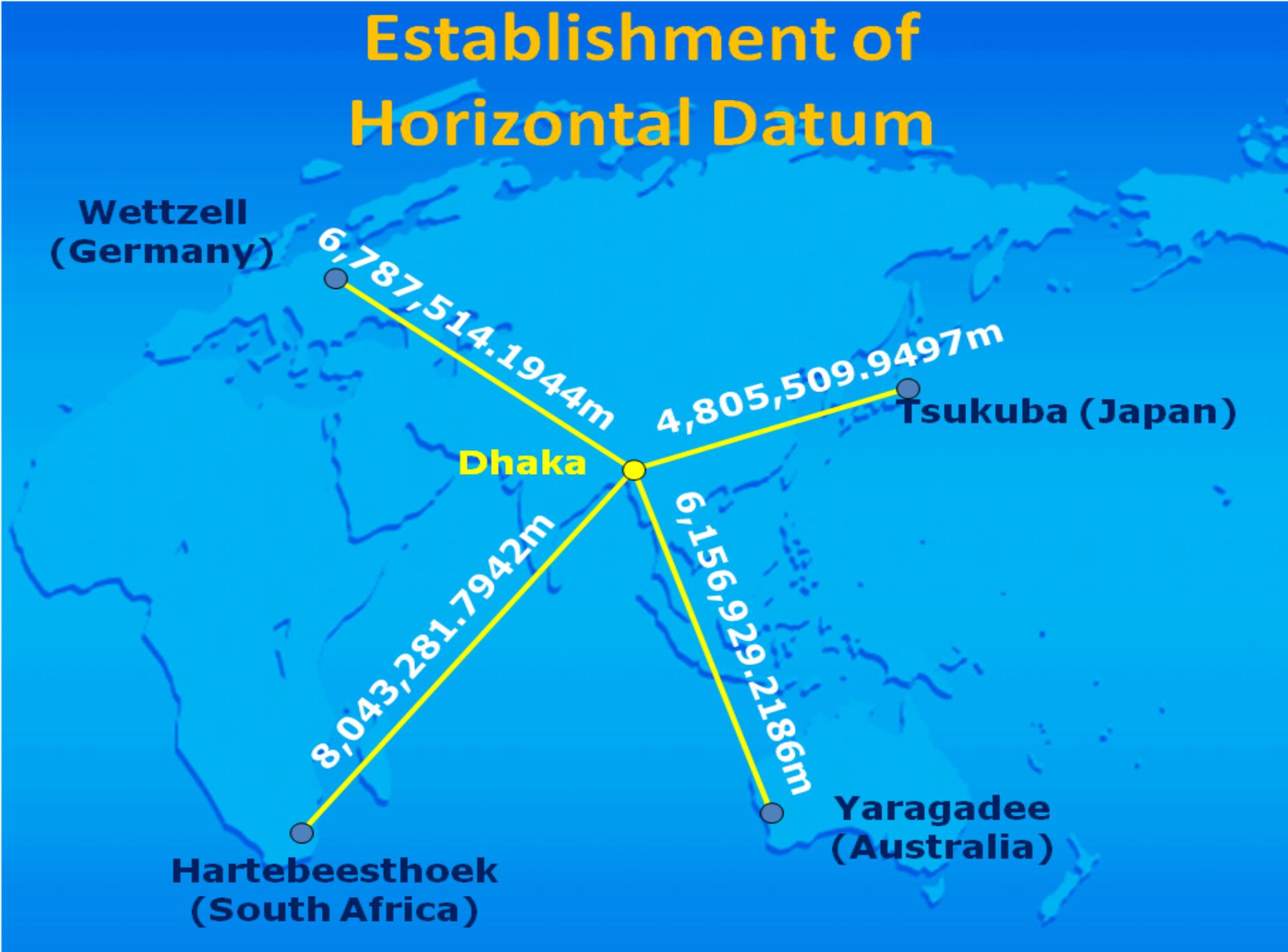
Dhaka

8,043,281.7942m

6,156,929.2186m

**Hartebeesthoek
(South Africa)**

**Yaragadee
(Australia)**



National Datum Yard

Established: 1994



Gulshan, Dhaka



Horizontal Datum



Vertical Datum

4. Major GNSS Works Done by Survey of Bangladesh

- Established 278 First Order and 797 Second Order Control Points all over Bangladesh



- Participated in the Asia Pacific Regional Geodetic Project (APRGP) GNSS Campaign in the year 2006, 2012, 2013 and 2014

4. Major GNSS Works Done by Survey of Bangladesh



□ Fixed up coordinates on 96 points in different airports of Civil Aviation Authority of Bangladesh



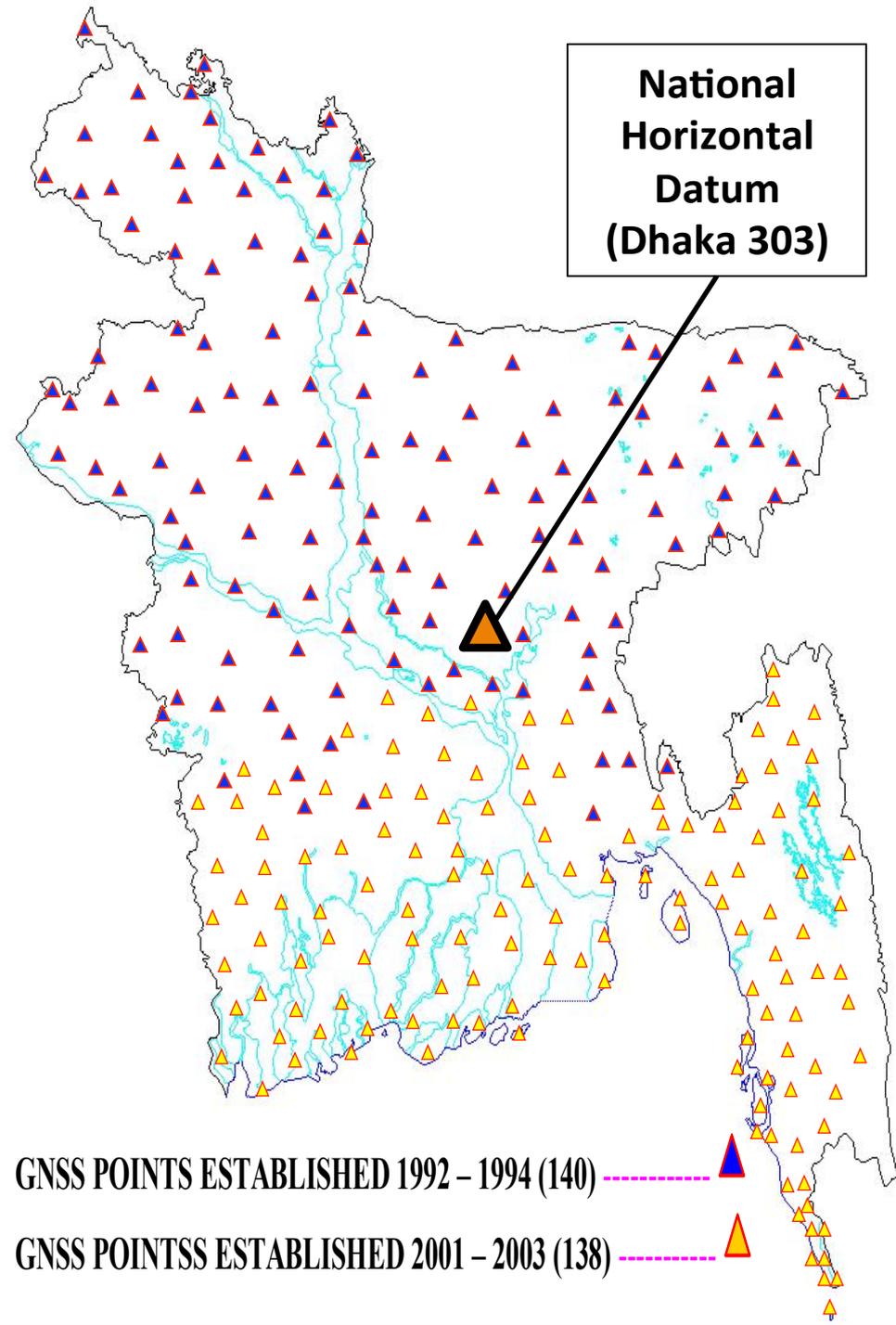
4. Major GNSS Works Done by Survey of Bangladesh



□ Fixed up coordinates on 115 points along the Karnaphuli river for Chittagong Port Authority

5. Establishment of First Order Horizontal Control Points by GNSS

□ The first order horizontal control points of Bangladesh were established by GNSS survey in two phases

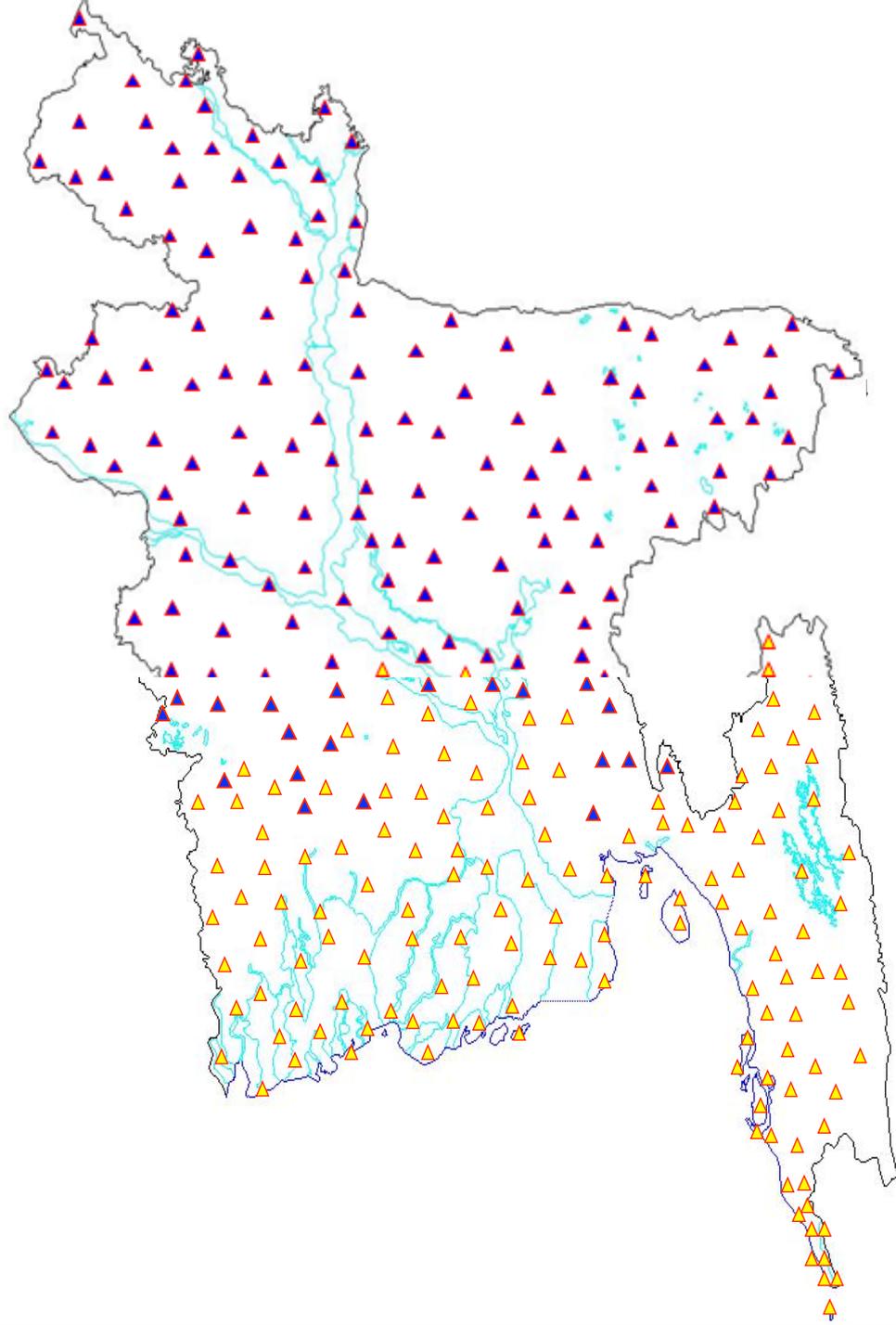


GNSS POINTS ESTABLISHED 1992 - 1994 (140)

GNSS POINTS ESTABLISHED 2001 - 2003 (138)

5. Establishment of First Order Horizontal Control Points by GNSS

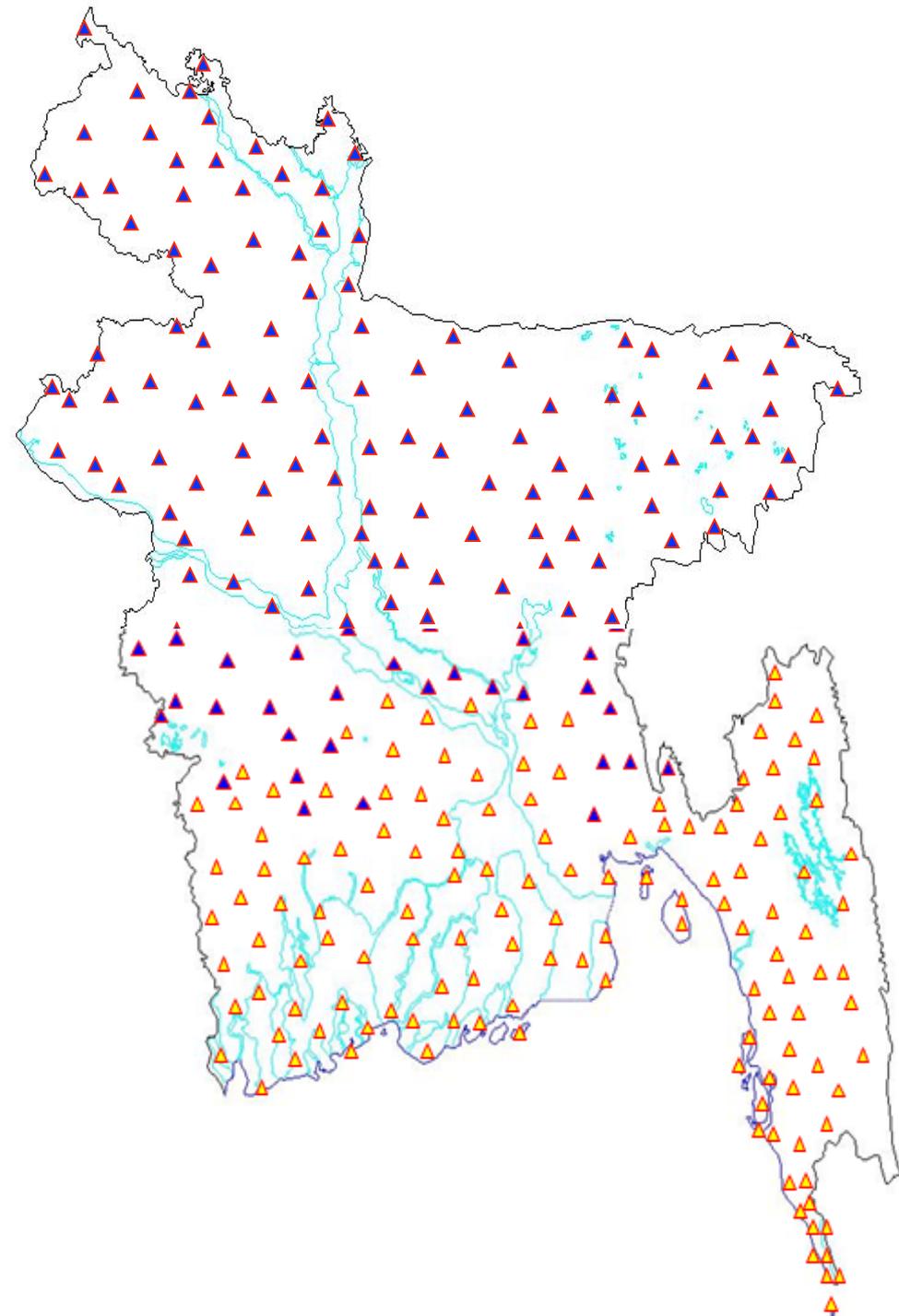
- The first phase was done in 1992-1994 by establishing 140 GNSS points in the upper part (northern part) of the country



5. Establishment of First Order Horizontal Control Points by GNSS

□ The second phase was done in 2001-2003 establishing 138 GNSS points in the lower part (southern part) of the country including Chittagong Hill Tract area

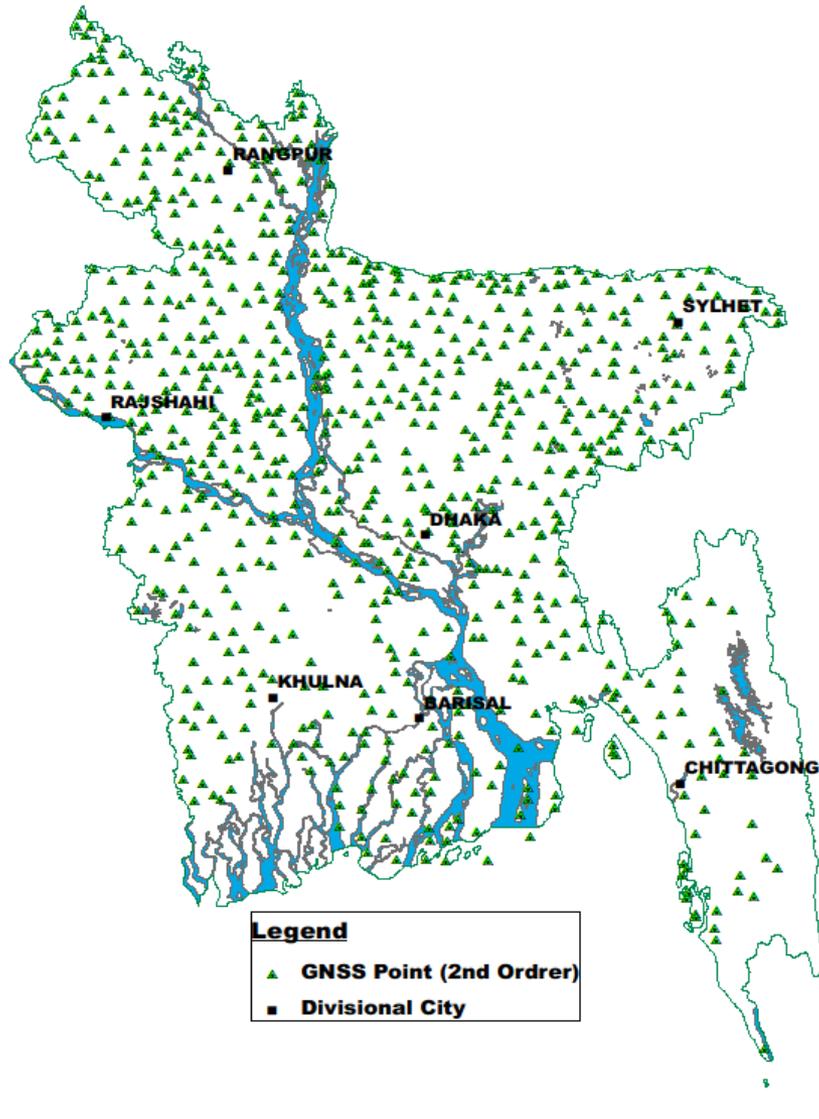
□ The average base line length of the First Order GNSS Network is 30 kms





GNSS Data Collection for First Order Network

6. Establishment of Second Order Horizontal Control Points by GNSS



□ Establishment of Second Order Horizontal Control Points by GNSS survey were started in 2009 and is till continued

6. Establishment of Second Order Horizontal Control Points by GNSS

- ❑ The number of Second Order GNSS Points were established as of Dec 2014 are 797
- ❑ The average base line length of the Second Order GNSS Network is 12 kms



6. Establishment of Second Order Horizontal Control Points by GNSS



□ Dual frequency Geodetic Grade GNSS Receiver were used for both 1st Order and 2nd Order observations

Distribution of GNSS Points

(1st Order & 2nd Order)

Horizontal Control Points (X,Y)

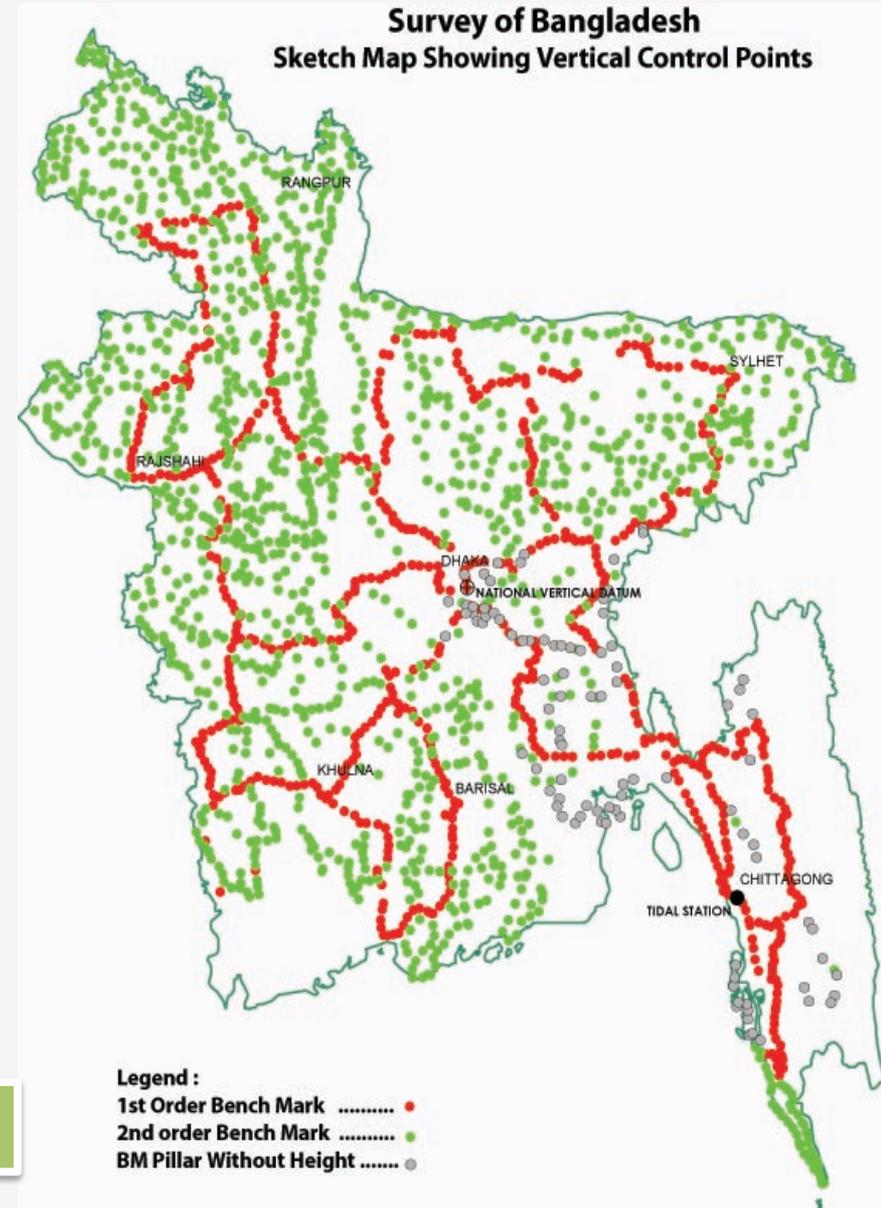
- 1st Order Horizontal GCP.. 278
- 2nd Order Horizontal GCP... 797

Vertical Control Points (Z)

- 1st Order Vertical GCP ... 662
- 2nd Order Vertical GCP ... 1450

3D Control Points (X,Y,Z) ...731

Total Control Points: 2438

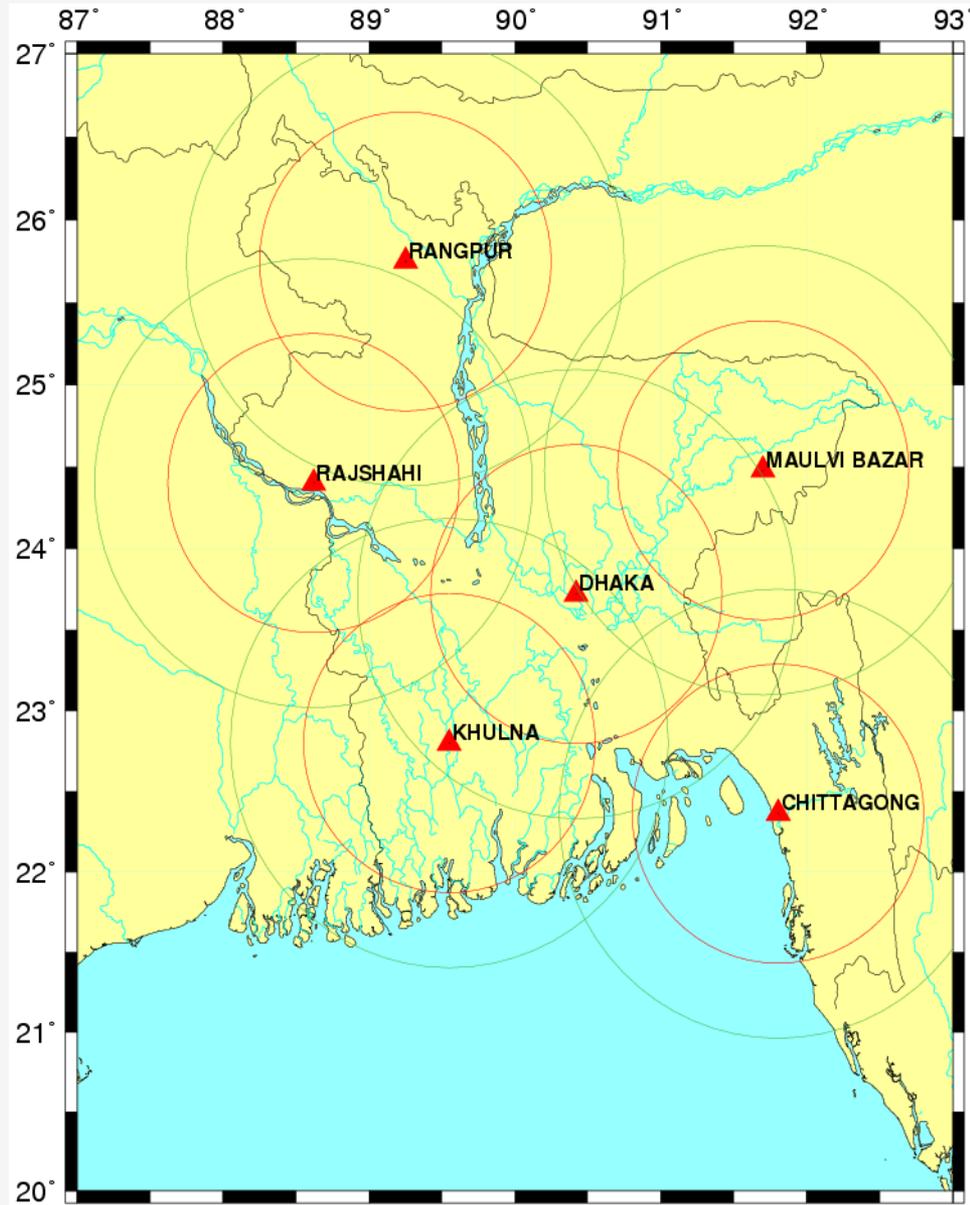


7. Establishment of Permanent GNSS CORS

- Established in: 2011
- Number of Stations: 6
- Data Acquisition Rate: 1 Second
- Type of Receiver: Trimble Net R9
- Data Transfer from Receiver to Server: GPRS
- RTK Correction: GPRS



Location of Permanent GNSS Station



Pictorial View of GNSS CORS



8. Use of GNSS CORS in Real Time Kinematic (RTK) Survey



Data Transfer by GPRS

GNSS SERVER

Data Transfer by GPRS



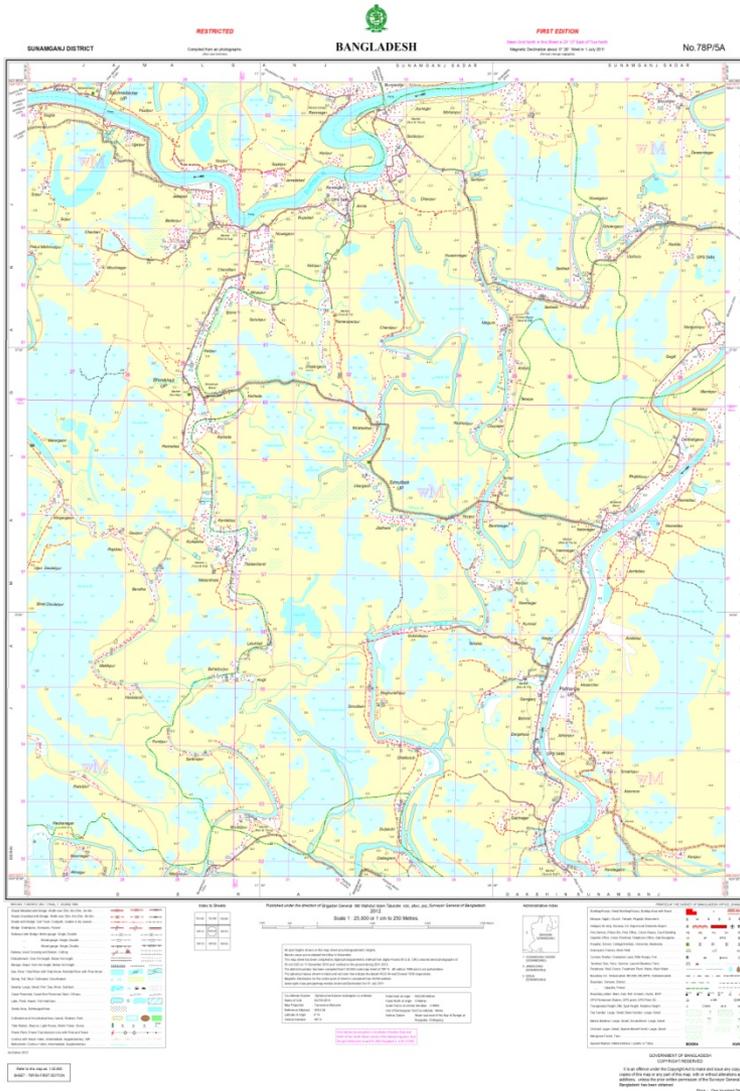
GNSS Station (CORS)

GNSS Station (CORS)

Emitting Correction & position of nearest reference station

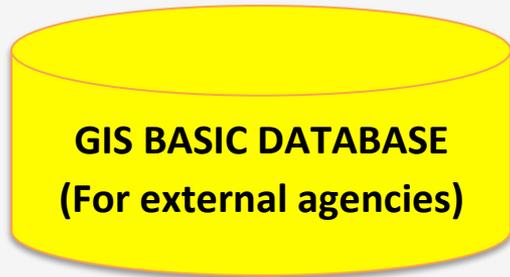


9. Digital Mapping in Bangladesh

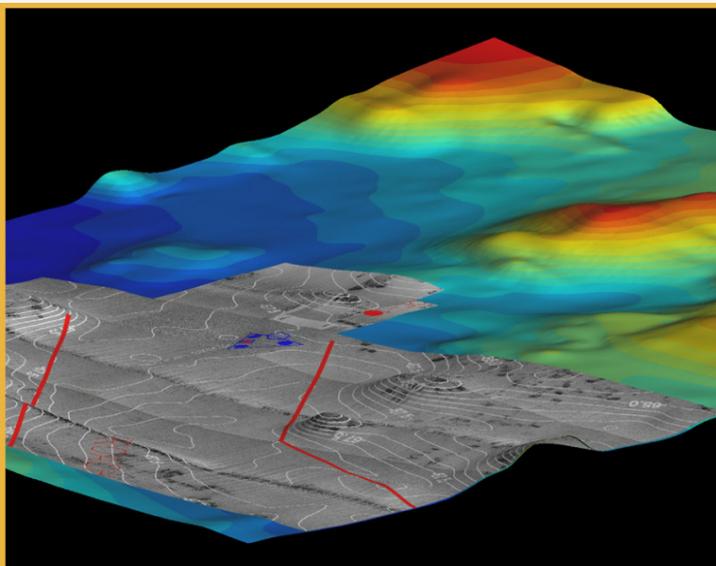


- Preparation of 1:25,000 scale map of the whole country.
- Preparation of 1:5000 scale map of the divisional cities.

9. Digital Mapping in Bangladesh

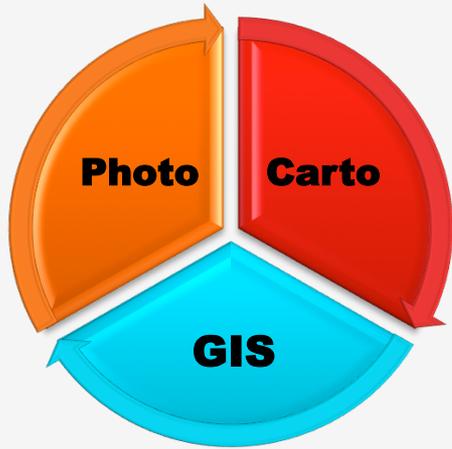


Preparation of GIS database of the whole country.



Generation of orthophoto and DTM of the whole country

Steps of Digital Mapping



Sources

- Aerial Photographs
- Satellite Images

PHOTO

- Aerial Triangulation
- Stereo Plotting

GIS

- **Cartographic Database**
- GIS Database

Carto

- **Simplification and Smoothing**
- **Generalization**
- **Symbolization**

Print

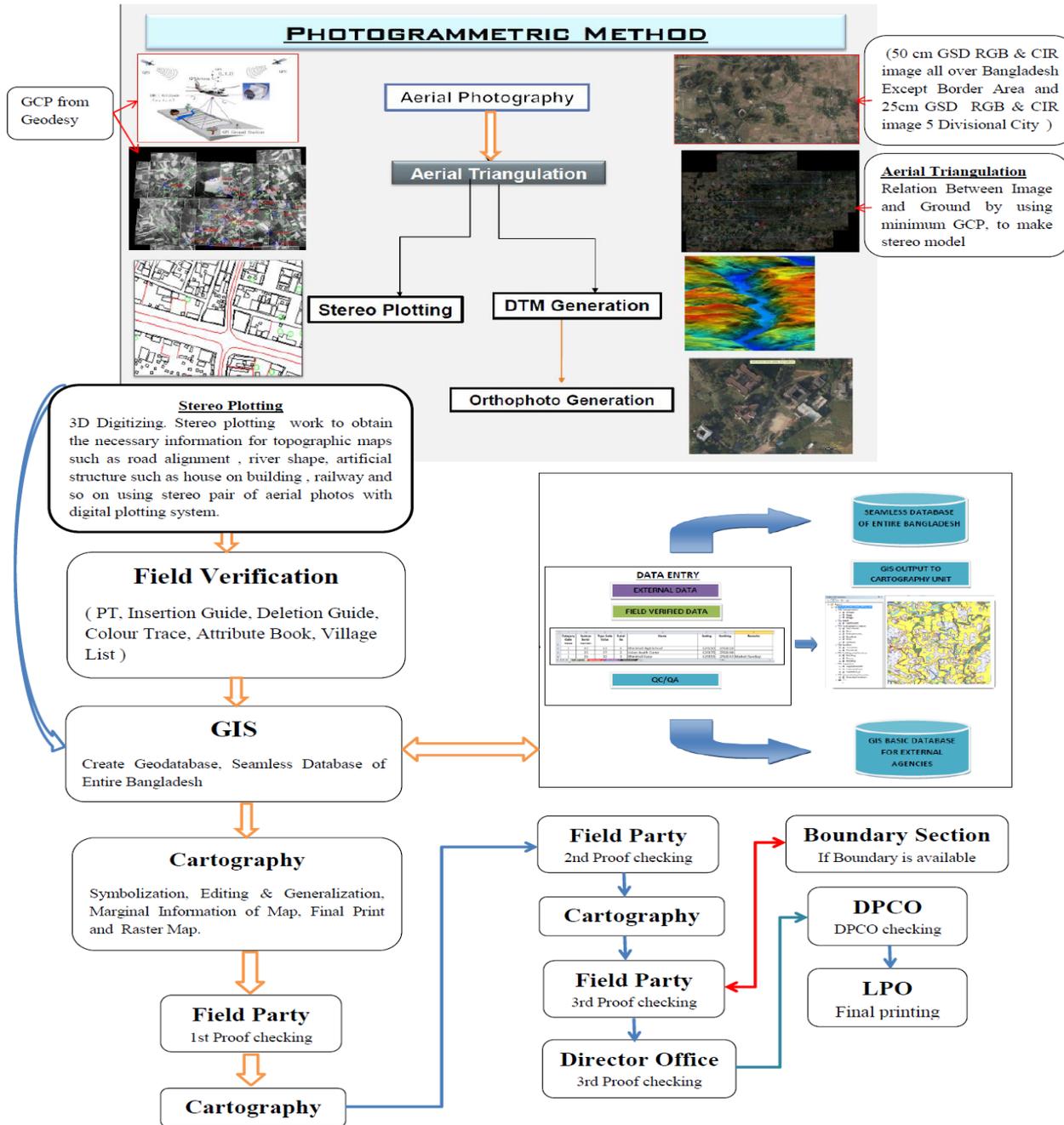
- Printing of Hard Copy Map



10. Use of GNSS for Making and Updating Topographic Map

- ❖ SOB produced different kinds of topographic maps on various scales.
- ❖ At present, we are changing our base map scale through a digital mapping project.
- ❖ Digital map of 1:25000 scale is under process of production with the help of GNSS in its different stages of preparation.
- ❖ Mobile Mapper and portable GNSS Receiver are used for collecting topographic data to update maps.

SOB WORK FLOW CHART OF DIGITAL MAP



11. GNSS Equipment Used in Survey of Bangladesh

- Dual Frequency Geodetic Grade GNSS Receiver (Leica GX-1220 + GNSS).30
- RTK GNSS Receiver (Leica Viva GS-15).10
- GNSS CORS Receiver (Trimble Net R9).06
- Mobile Mapper (Magellan ProMark-3).05
- Hand Held GNSS Receiver100+



12. Way Forward

- ❖ Procurement of latest technology based equipments and softwares related to surveying and mapping.
- ❖ Densification of second order points to have strong geodetic network.
- ❖ Densification of permanent CORS to establish a strong network throughout the country.

THANK YOU