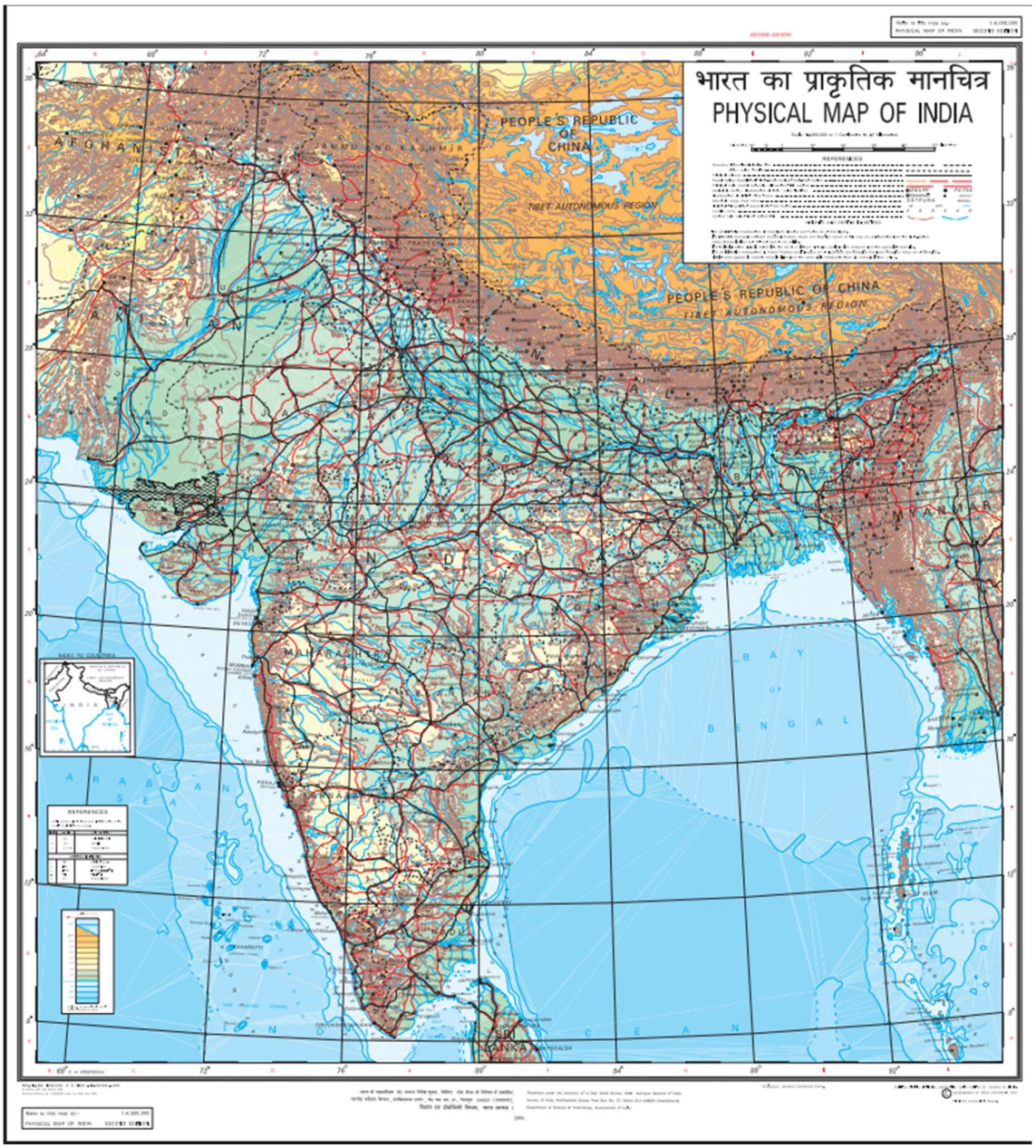
Topographical Maps
Map Reading

1. TYPES OF MAPS

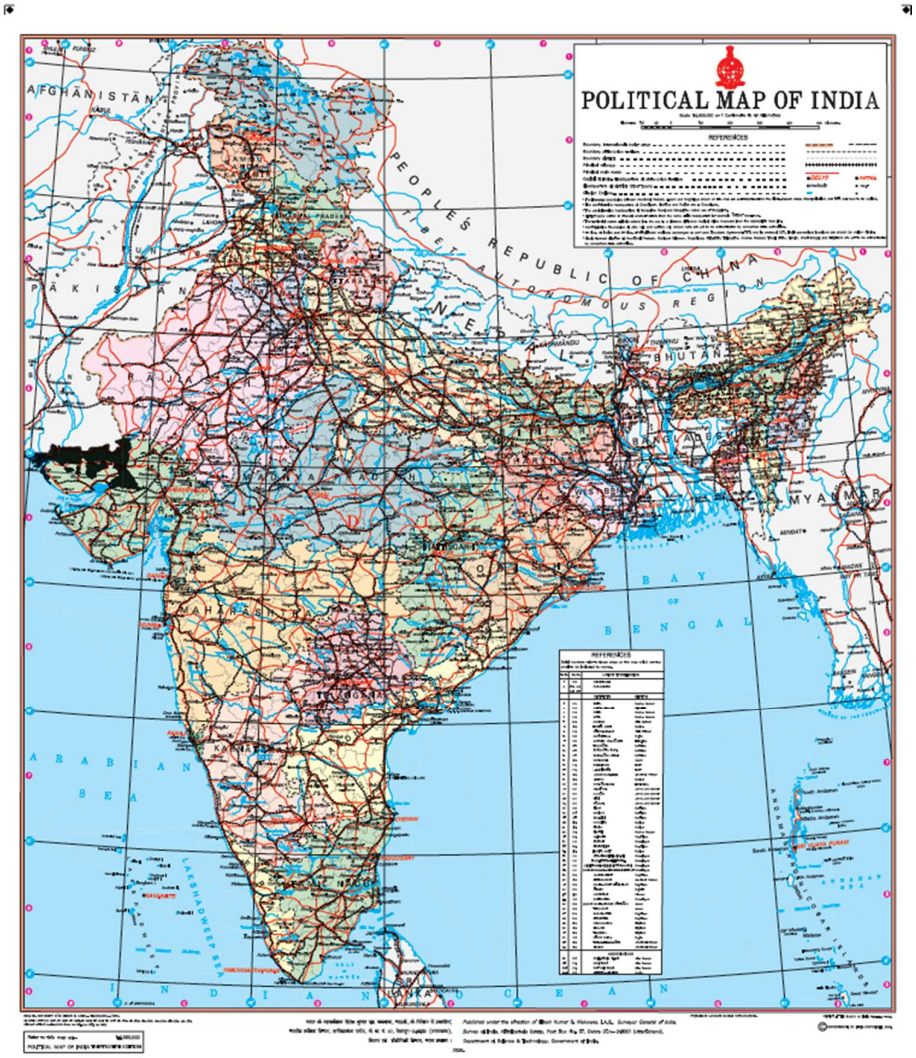
1.1 Physical Maps

- Show natural features such as mountains, rivers, plains, oceans
- Help in understanding relief and physical landscape



1.2 Political Maps

- Show administrative boundaries
- Indicate capitals, cities, and towns

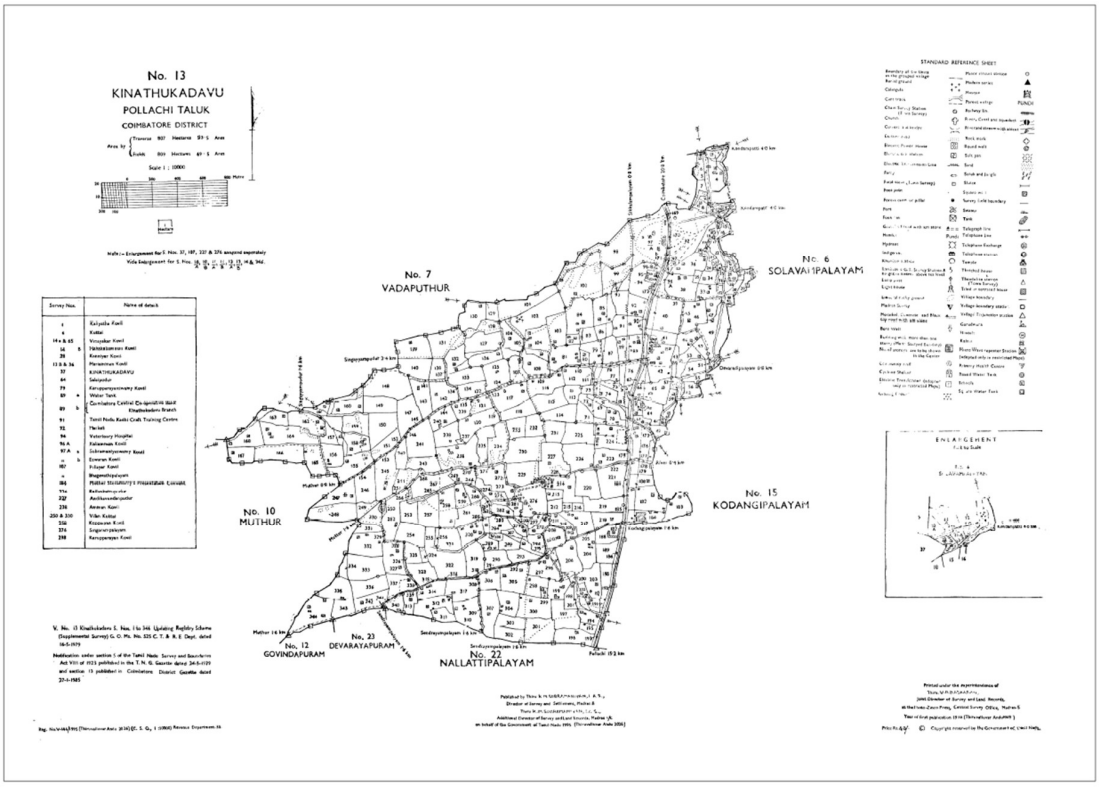


1.3 Thematic Maps

- Focus on specific themes
- Examples: population density, rainfall, soil, vegetation, transport

1.4 Cadastral Maps

- Show land ownership and property boundaries
- Used for land records, revenue, and urban planning



1.5 Navigational Maps / Charts

- Nautical charts for sea navigation
- Aeronautical charts for air navigation

1.6 Weather Maps

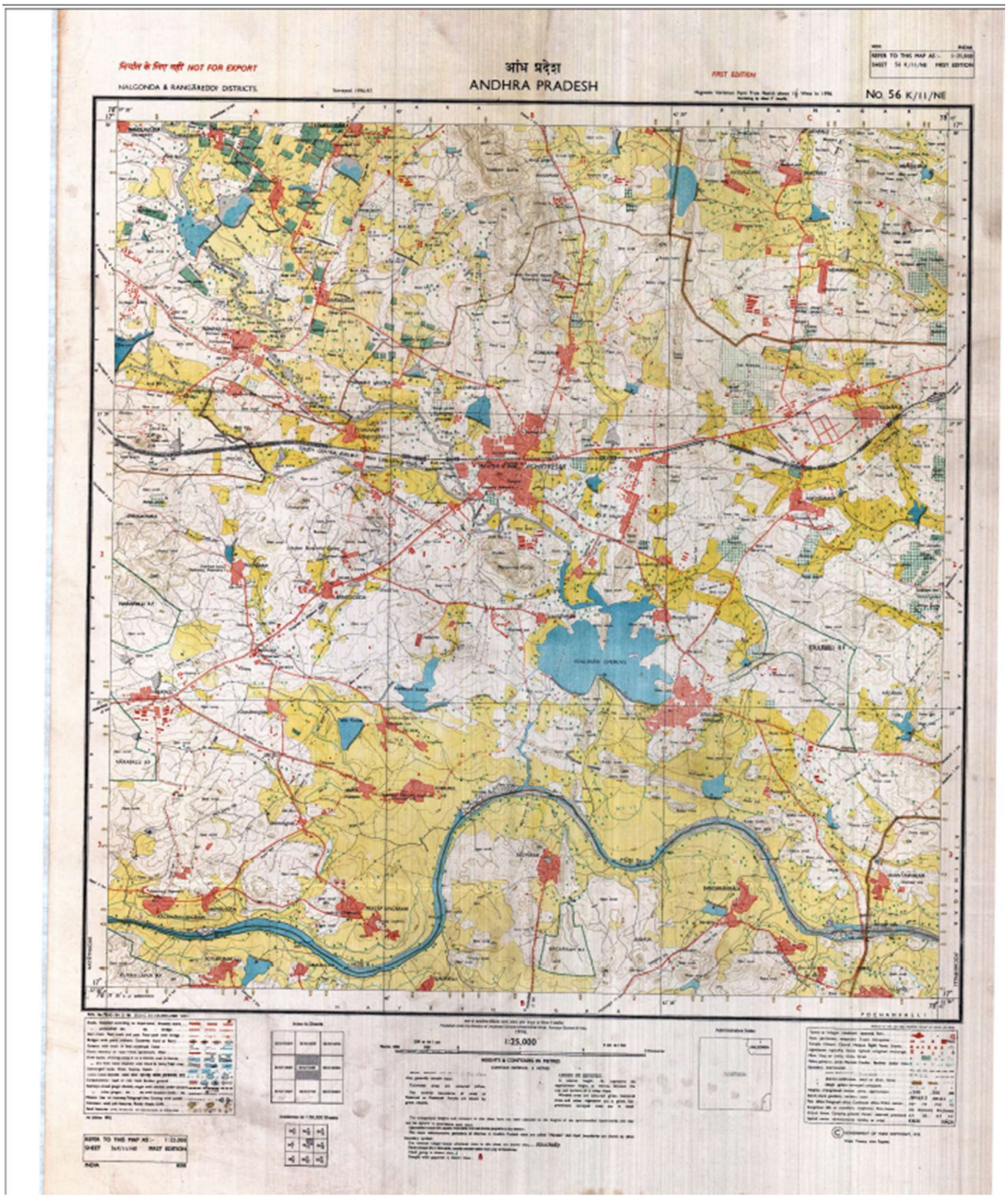
- Show rainfall, temperature, wind, pressure
- Used for weather forecasting

1.7 Tourist Maps

- Highlight tourist locations, routes, facilities

1.8 Topographical Maps

- Show natural and man-made features in detail
- Represent relief using contour lines
- Used for engineering, planning and military operations



2. Map Making Agencies in India

2.1 Survey of India (SoI)

- The National mapping agency of India (established in 1767).
- Prepares Topographical maps, geodetic surveys, digital cartography, and special purpose maps.
- Provides base maps for development, defence, research& analysis.
- Survey of India maps can be accessed vide their Online Maps Portal https://onlinemaps.surveyofindia.gov.in

2.2 National Atlas and Thematic Mapping Organisation (NATMO)

- Located in Kolkata.
- Specialises in **thematic maps and atlases** (economic, social, cultural, and environmental maps).

2.3 National Remote Sensing Centre (NRSC)

- Produces satellite imagery–based maps through Bhuvan portal.
- Used for natural resource management, disaster management, and urban planning.

2.4 Other Agencies also produces various type of Thematic Maps

- Meteorological Department (weather maps).
- Forest Survey of India (Forest Cover Maps)
- Geological Survey of India (Geological Maps)
- Census of India (demographic maps).
- Zoological & Botanical Survey of India (Ecological Maps)
- State Remote Sensing Application Centres (state-level thematic maps).

3. Detailed Study of Topographical Maps

3.1 Definition of Topographical Map

A Topographical Map is a detailed and accurate representation of natural and man-made features of the Earth's surface, prepared on a specific scale and showing relief through contours, spot heights and other elevation methods.

3.2 Classification Based on Scale

- **Large Scale Maps:** 1:2,000, 1:5,000, 1:10,000 – detailed urban surveys
- **Medium Scale Maps:** 1:25,000 & 1:50,000 – regional planning (SoI standard)
- **Small Scale Maps:** 1:250,000 & 1:1M – state and national studies

3.3 Map Elements (Marginal Information)

A Topographical Map is a detailed and accurate representation of both natural and man-made features of the Earth's surface. To understand and interpret such maps effectively, it is important to be familiar with the marginal information and elements of map provided on every map sheet.

A topo map includes the following essential elements:

1. Title
2. Sheet Number (e.g., E43W11)
3. Scale (RF & Graphic)
4. Administrative & Sheet Index
5. Map Edition & Price
6. Conventional Symbols
7. Notes
8. References
9. Compilation Index
10. Projection & Datum (UTM, WGS-84)
11. Magnetic Declination
12. Contour Interval
13. Publication Office Details
14. Grid Reference System
15. Website Information
16. Copyright Information
17. Printing Registration Details

18. Grid Reference Reading Example
19. Surveyor General's Imprint

3.3.1. Title:

- Indicates the name of the map "Open Series Map"
- Description of the map "Education Sheet with UTM Grid"

3.3.2. Sheet Number

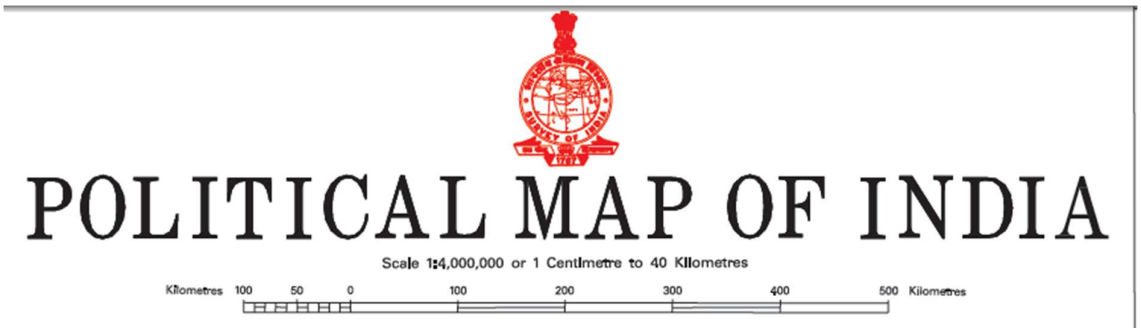
The whole country is sub-divided into grids and each grid has labelled with specific number serially. Every topographical map sheet represents the part of a whole are for easy identification.

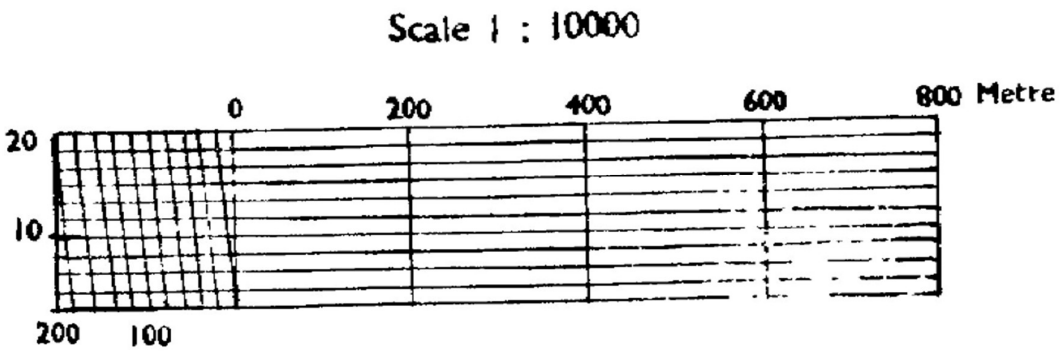
For example, the Sheet number ***"E44M11NE"***

3.3.3. Scale:

Indicates the Scale of Map. Eg: "1:50000" scale indicated by refraction

Scale also shown as graphical representation.

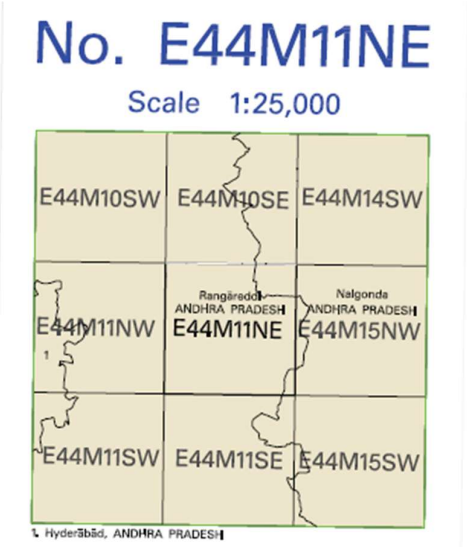




3.3.4. Administrative Index& Sheet Index

Shows the administrative divisions such as state, district boundaries fall in the sheet.

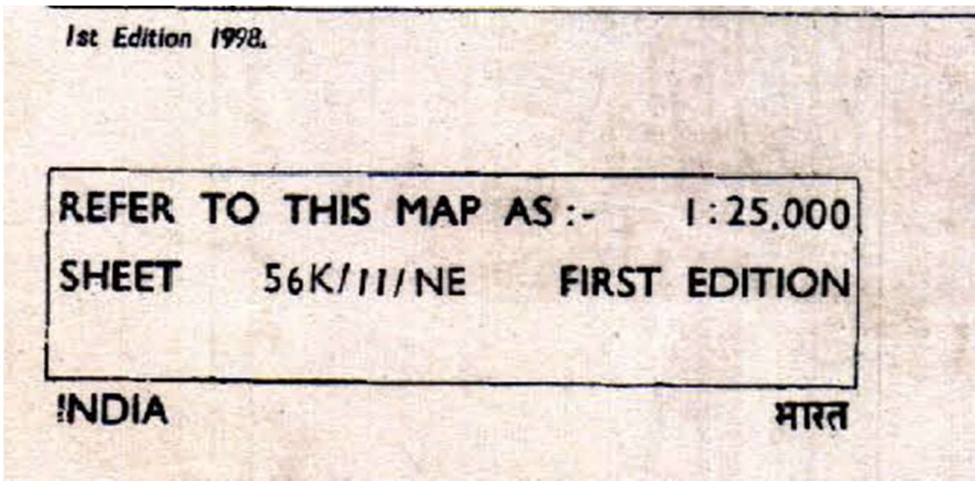
Also Shows the Index of adjoining sheet numbers.



3.3.5. Map Edition & Price of the Map

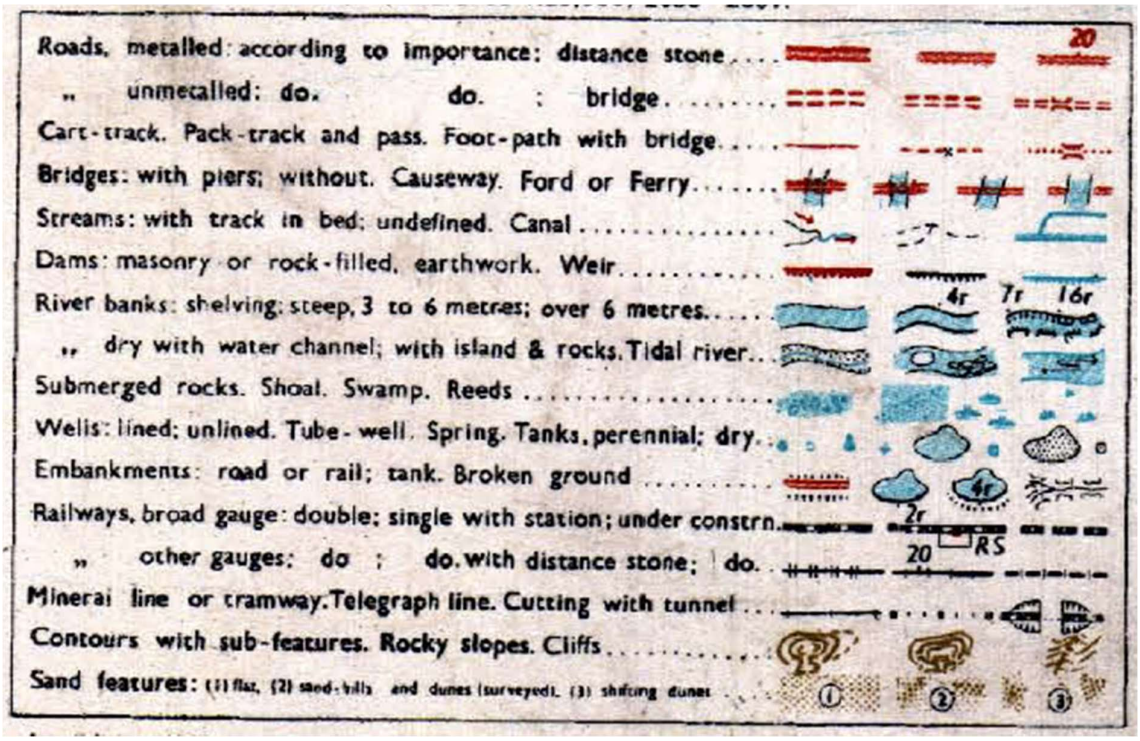
Shows the Map Edition & year of Edition – Eg: " 2nd Edition 2019"

Indicate the Price of Physical print of the Map'



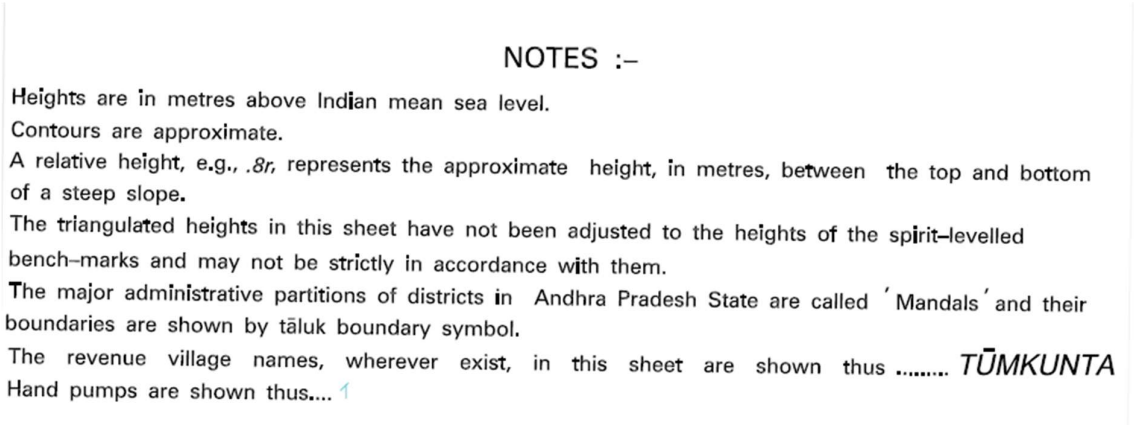
3.3.6. Conventional Symbols

All the Convention Symbols used to represent the natural & manmade feature explained in the list of Conventional Symbols.



3.3.7. Notes

Additional instructions or explanations provided for proper interpretation of the map symbols like clarifications on contour intervals, Height reference etc..



NOTES :–

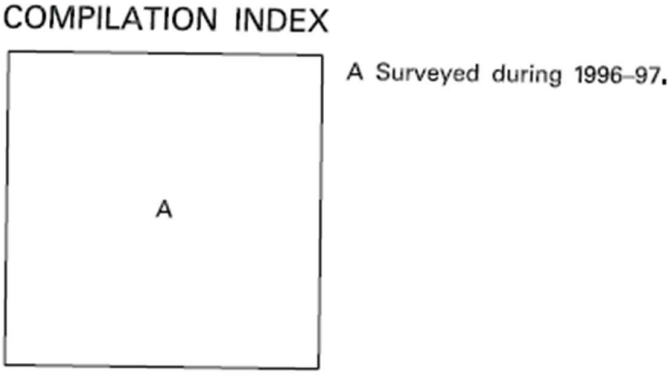
Heights are in metres above Indian mean sea level.
Contours are approximate.
A relative height, e.g., *.8r,* represents the approximate height, in metres, between the top and bottom of a steep slope.
The triangulated heights in this sheet have not been adjusted to the heights of the spirit–levelled bench–marks and may not be strictly in accordance with them.
The major administrative partitions of districts in Andhra Pradesh State are called 'Mandals' and their boundaries are shown by tāluk boundary symbol.
The revenue village names, wherever exist, in this sheet are shown thus ..... *TŪMKUNTA*
Hand pumps are shown thus....

3.3.8. References

Explanation of important features used in the map*. (Eg NH-14 National Highway 14)*

3.3.9. Compilation Index

Shows the information regarding Surveyed year and updated for major details during subsequent years

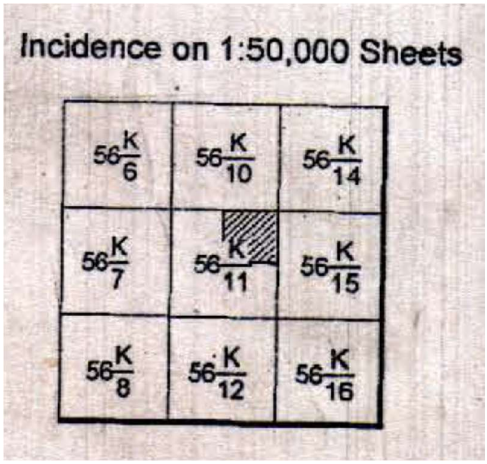


COMPILATION INDEX

A

A Surveyed during 1996–97.

.



Incidence on 1:50,000 Sheets

$56\frac{K}{6}$ $56\frac{K}{10}$ $56\frac{K}{14}$
$56\frac{K}{7}$ $56\frac{K}{11}$ $56\frac{K}{15}$
$56\frac{K}{8}$ $56\frac{K}{12}$ $56\frac{K}{16}$

3.3.10. Projection and Datum

Shows Projection and Datum Information's of the map

Projection – UTM *Datum – WGS 84*

3.3.11. Magnetic Declination

Shows Magnetic variation of the area in a particular year and variation of the annual declination.

Eg: *"Magnetic variation from the True North about 1° West in 2015"*

(Decreasing by about 2'annually)

3.3.12. Contour Interval

Shows Information of Contour intervals in metres.

3.3.13. Information of Publication Office Details

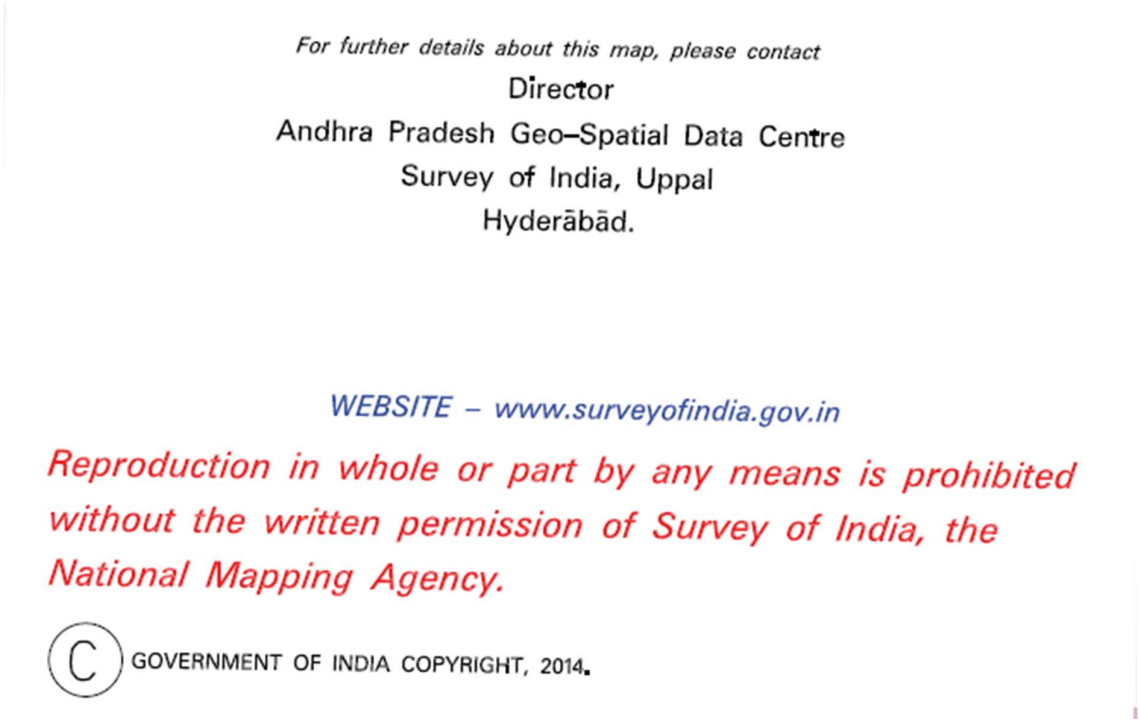
Shows the Information pertaining to office of the Geospatial Directorate responsible for the area of the Map.

3.3.14. Grid Reference

Shows the Information pertaining to Grid projection, its units, symbolization of Grids and Grid North variation.

3.3.15. Website Details

Provide the url of Survey of India's Website details from where these maps can be downloaded. *i.e* www.surveyofindia.gov.in

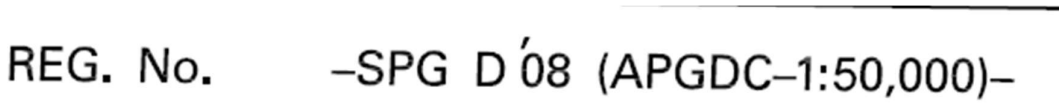


3.3.16. Copy Right information

Shows the copy right information and reproduction permissions.

3.3.17. Printing Registration Number & printing office details

Provides the register number of the map printed details and printed office details of published map.

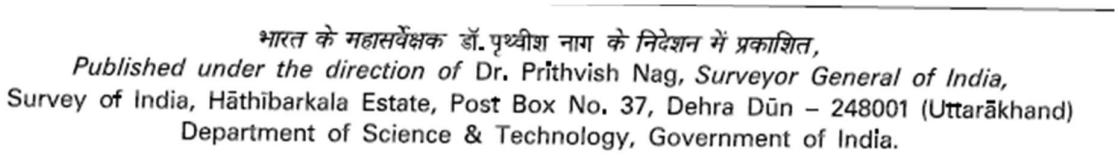


3.3.18. Grid Reference reading with example:

An example of reading of grid values for a particular location of the feature.

3.3.19. Surveyor General's Imprint

Provide the name of the Surveyor General of India and the address of the office at the time the map was published.


भारत के महासर्वेक्षक डॉ. पृथ्वीश नाग के निदेशन में प्रकाशित,
Published under the direction of Dr. Prithvish Nag, *Surveyor General of India,*
Survey of India, Hāthībarkala Estate, Post Box No. 37, Dehra Dūn – 248001 (Uttarākhand)
Department of Science & Technology, Government of India.

4. Advanced Uses & Digital Mapping:

Digital Tools for Map access and analysis:

With modern technology, maps are no longer limited to paper. Digital tools help access, view, analyze and interpret maps **efficiently.**

4.1. Geographic Information System (GIS)

- A computer-based system to **store, manage, and analyze spatial data**.
- Layers of data (like roads, rivers, settlements, soil, crops) can be **overlaid and analyzed**.
- Example Tools: **QGIS (Free/Open Source), ESRI ArcGIS**.

4.2. Drone Photogrammetry & Remote Sensing

- Uses **satellite images or aerial photos** to study the Earth's surface.
- Helps in analyzing **land use, vegetation, water bodies, urban growth**, and disaster management.

4.3. GNSS (Global Navigation Satellite System)/ GPS (Global Positioning System)

- Continuously Operating Reference Systems (CORS) are networks of permanent GNSS (Global Navigation Satellite System) receivers that provide real-time or post-processed positioning data with high accuracy. They serve as fixed reference points for surveying, mapping, geodesy, and precise navigation, enabling users to correct their GNSS measurements and achieve centimeter level accuracy.
- Handheld GPS devices or mobile apps give **real-time location coordinates**.
- Helps in **field surveys, navigation, and locating features on digital maps**.

4.4 . Online Topographic Map Portals

- Many countries provide **digital topographical maps**.
- Features include data downloads, visualisation tools like zoom**, layer selection, contour view, and measurement tools**.
- Example: **Survey of India Map Portal**, **Open Street Map**.

4.5 . Spatial Analysis Tools

- Allow measurement of **distance, area, slope, drainage patterns**, and **population distribution** digitally.
- Can combine **thematic maps with topographical data** for planning and research.

Case Studies on Topographical maps in real scenarios:

Topographical maps are **used extensively** in planning, development, and research because they show both **natural and man-made features** with elevation details.

1. Urban Planning

- **Scenario:** Planning a new township or city expansion.
- **Application:**
    - Use topo maps to locate suitable land, avoiding flood-prone areas.
    - Identify existing roads, railways, and settlements for connectivity.
    - Example: Development of smart cities in India

2. Road and Railway Construction

- **Scenario:** Designing highways, railways, or tunnels.
- **Application:**
    - Analyze **elevation and slope** using contour lines.
    - Plan routes with **minimum cutting of hills or filling of valleys**.
    - Example: Delhi-Chandigarh highway construction using topo maps for route alignment.
    - PM Gati Shakti

3. Disaster Management

- **Scenario:** Floods, landslides, or earthquake-prone zones.
- **Application:**
    - Identify **low-lying areas** likely to flood.
    - Determine **safe locations for shelters or evacuation routes**.
    - Example: Uttarakhand floods – topo maps helped in planning relief operations.
    -

4. Agriculture and Irrigation Planning

- **Scenario:** Irrigation canal construction or crop planning.
- **Application:**
  - Use topo maps to locate **rivers, streams, and tanks**.
  - Plan **efficient water distribution** avoiding steep slopes.
  - Example: Irrigation projects in Punjab and Haryana using Survey of India maps.

5. Military and Defence Applications

- **Scenario:** Army troop movement or battlefield strategy.
- **Application:**
  - Use topo maps to understand **terrain, elevation, and approach routes**.
  - Identify **strategic high points and obstacles**.
  - Example: Himalayan border surveillance requires topo maps for route planning.

6. Environmental and Forest Management

- **Scenario:** Managing forests, wildlife sanctuaries, and national parks.
- **Application:**
  - Identify forest cover, water bodies, and terrain.
  - Plan **fire lines, trekking paths, or protected zones**.
  - Example: Jim Corbett National Park – topo maps used for conservation planning.

शीटों का विन्यास
LAYOUT OF SHEETS

अनुबंध 'क'
Annexure 'A'

आधार : विश्व ज्योडीय पद्धति – 84
DATUM: WORLD GEODETIC SYSTEM (WGS)- 84

प्रक्षेप : यूनिवर्सल ट्रान्सवर्स मर्केटर
PROJECTION : UNIVERSAL TRANSVERSE MERCATOR (UTM)