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RECOMMENDATIONS FOR
THE PREPARATION OF GEOLOGICAL AND
GEOTECHNICAL MAPS FOR
RIVER VALLEY PROJECT

PART 1 SCALES

(First Revision)

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(Continued from page 1)

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PART 1 SCALES

(First Revision)

0. FOREWORD

0.1 This Indian Standard (Part 1) (First Revision) was adopted by the Indian Standards Institution on 16 August 1985, after the draft finalized by the Geological Investigations and Subsurface Exploration Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Geological surveys and exploration for river valley projects are usually undertaken in four different stages: (a) Reconnaissance stage, (b) Preliminary investigation stage, (c) Detailed geological investigation stage, and (d) Construction stage. In some cases, the detailed geological investigations may be taken up just prior to construction, when these would also be termed as pre-construction stage investigations. In order to meet the requirements of planning, design and construction engineers at various stages of the project, geological surveys are undertaken on different scales.

0.3 This standard was first published in 1971. This revision has been prepared based on experience gained since then by the use of this standard and to reflect the current practice in the field. Important changes in the revision include the addition of recommended scale for surface mapping of preliminary investigation stage and modifications in the recommended scales/contour intervals for preparation of maps concerning concrete dams, earth and rockfill dams at preliminary investigation stage and for final foundation grade mapping.

0.4 This standard is being published in two parts as under:

Part 1 Scales

Part 2 Format and method of presentation of geological and geotechnical maps

0.5 In the formulation of this standard due weightage has been given to international coordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

1. SCOPE

1.1 This standard (Part 1) gives the recommendations for the selection of scales for geological maps for river valley projects required for various stages of investigation, namely, reconnaissance, preliminary investigation, detailed geological investigation and construction.

2. RECONNAISSANCE STAGE

2.1 In the reconnaissance stage, the objective of the geological investigation is to bring out the over-all geological features of the area so as to act as guide lines for the proper planning of the project. Therefore, the scale of mapping for such work need not be very large and the available geological maps may be made use of. In case fresh mapping is required 1 : 50 000 scale may be adopted for all types of projects, namely, multi-purpose storage dam, hydel projects consisting of tunnels and channels, etc (see Table 1).

2.2 Aerial photographic studies should be done on scales varying from 1 : 65 000 to 1 : 40 000 depending on terrain conditions and availability of air photos along the tunnel and hydel channel alignments for a choice of the alignment best suited on geological considerations. These studies are also helpful for the selection of dam sites and bringing out the over-all geological and structural features of the reservoir area.

3. PRELIMINARY INVESTIGATION STAGE

3.1 The object of preliminary geological investigation stage of the river valley projects is to collect further detailed information about the surface and subsurface geological conditions around the probable sites selected in the reconnaissance stage. This is gathered by mean of surface mapping on a scale of 1 : 15 000 and preliminary subsurface explorations. The interpretation of aerial photographs, on scales varying from 1 : 40 000 to 1 : 25 000, depending on terrain conditions, availability and ability to pick out details of geology on photos, would be useful adjunct to the afore-mentioned mapping and subsurface exploration. The data obtained from these is utilized in the preparation of the preliminary project report (see Table 1).

3.2 Concrete Dams and Power Houses — Geological mapping of concrete dam sites and appurtenant features should be done in 1:5 000 or nearest available scale topo-maps having 2 m contour interval covering the area of the main dam and its appurtenant structures, such as coffer dam, diversion tunnels, spillway, power house and intake area. It should cover at least an area equal to twice the height of the dam towards the upstream and downstream direction of the area covered by the main dam foundation. This mapping should be extended up to 100 m above the top of dam in areas of immature topography and 25 m above the top of dam in mature topography. At the dam sites involving special geological problems, such as the problem of the stability of hill slopes, the mapping should be extended to cover such areas also.

3.3 Earth and Rock Fill Dam — For earth and rock fill dams, the engineering geology mapping should be done on 1:5 000 or nearest available scale topo-maps having contour interval of 4 m. Mapping should extend from about four times the height of dam in the upstream to a similar distance downstream of the proposed dam axis along the river. These surveys should be extended up to 100 m above the top of dam in areas of immature topography and 25 m areas of mature topography and as detailed in the case of concrete dams (*see also* Table 1).

3.4 Hydroelectric Projects — Geological mapping of hydel channel alignments, tunnel alignments, and reservoir area should be done on 1:15 000 scale topo-maps having contour interval of 10 m. Geological mapping of areas of special landslide problems and mineral deposits to be submerged by the reservoir should be done on 1:5 000 scale topographic map having contour interval at 10 m. The geological mapping of power house sites, surface as well as underground including the sites of appurtenant structures, for example, surge tank, penstock tunnel area and expansion chamber, should be done on 1:1 000 scale topo-maps having contour interval at 2 m (*see also* Table 1).

3.5 Exploratory Works and Construction Material Sites — The logging of exploratory drill holes, pits and trenches should be done on 1:100 scale (*see* IS : 4453-1980*). Geological mapping of construction material sites should be done on 1:15 000 scale, preceded by the interpretation of air-photos on 1:40 000 to 1:25 000 scale, which will help to locate the types and characteristics of construction materials.

4. DETAILED INVESTIGATION STAGE (PRE-CONSTRUCTION STAGE INVESTIGATIONS)

4.1 In the detailed design and estimation stage, the object of the geological investigation is to provide detailed geological information of

*Code of practice for subsurface exploration by pits, trenches, drifts and shafts (*first revision*).

the appurtenant structure sites, such as spillway, intake and power house sites, tunnel inlet and outlet portals, for the final design of the structures and, therefore, these areas should be surveyed on 1 : 1 000 topo-maps having contour interval at 2 m.

4.2 Geological mapping of access roads to various construction sites and the mapping of plant sites may be done on 1 : 3 000 scale having contour interval of 5 m. The quarry sites and borrow areas should be surveyed on 1 : 2 000 scale topo-maps with contour interval at 4 m.

4.3 The maps prepared during detailed investigation could be termed as geotechnical maps, because, besides showing the boundaries of geologically different units of overburden and rock at the dam site and construction material sites the legend to the different units should show the expected variation in soil properties, such as grain size, penetration resistance, cohesion and angle of internal friction values, plasticity, permeability, etc, as gathered from tested samples of the overburden. Wherever possible classification of soils according to IS : 1498-1971* with soil properties should be indicated. This map should also show the results of geophysical studies in different rock and overburden formational units, like longitudinal wave velocity, Poisson's ratio, Young's modulus and electrical resistivity.

5. CONSTRUCTION STAGE

5.1 The object of geological investigations during the construction stage is to keep a record of geological features exposed during the construction of the project, and to apprise the construction and design engineers regarding any special geological feature revealed in the excavation which could not be inferred in the pre-construction stage explorations so that the new geological features are taken care of in the design and construction. Also such record is helpful if additions or modifications are made to the engineering works later on end in solving post construction problems. Therefore, the final foundation grade mapping is recommended to be done on 1 : 100 scale for concrete dams, power house sites; 1 : 500 scale for earth and rock fill dams, and 1 : 1 000 scale for hydel channel area. For underground power house excavation, the scale of mapping is recommended to be 1 : 100, where as for three dimensional logging of tunnels 1 : 200 scale is recommended (see Table 1 for contour intervals). Surface geological mapping of critical areas in tunnel alignment (for example, depression shown or drainage crossing) should be done locally or at least 1 : 1 000 scale.

*Classification and identification of soils for general engineering purposes (*first revision*).

**TABLE 1 RECOMMENDED SCALES FOR GEOLOGICAL AND GEOTECHNICAL MAPPING FOR
RIVER VALLEY PROJECTS**

(Clauses 2.1, 3.1, 3.4 and 5.1)

SCALE OF MAPPING	CONTOUR INTERVAL OF TOPOGRAPHIC MAPS	RECONNAISSANCE STAGE	PRELIMINARY INVESTIGATION STAGE	DETAILED INVESTIGATION STAGE (PRE-CONSTRUCTION STAGE INVESTIGATIONS)	CONSTRUCTION STAGE
(1)	(2)	(3)	(4)	(5)	(6)
1 : 65 000 to 1 : 40 000	—	Aerial photographic studies :	—	—	—
		(a) For selection of dam sites, (b) For choice of tunnel and hydel channel align- ments, (c) For reservoir area geo- logical and struc- tural features			
1 : 50 000	20 m	Regional geological studies of dam sites tunnel and hydel channel alignment, power house sites, construction material sites	—	—	—
1 : 40 000 to 1 : 25 000	—	—	Interpretation of aerial photographic studies would be a useful adjunct to surface mapping to collect further infor- mation about surface conditions around the probable sites select- ed. Will help to locate		

(Continued)

TABLE 1 RECOMMENDED SCALES FOR GEOLOGICAL AND GEOTECHNICAL MAPPING FOR RIVER VALLEY PROJECTS — *Contd*

SCALE OF MAPPING	CONTOUR INTERVAL OF TOPOGRAPHIC MAPS	RECONNAISSANCE STAGE	PRELIMINARY INVESTIGATION STAGE	DETAILED INVESTIGATION STAGE (PRE-CONSTRUCTION STAGE INVESTIGATIONS)	CONSTRUCTION STAGE
(1)	(2)	(3)	(4)	(5)	(6)
			the types and characteristics of construction materials		
1 : 15 000	10 m	—	Geological mapping of channel alignment, tunnel alignment, construction material sites and reservoir area	—	—
1 : 5 000	10 m	—	Geological mapping of areas of special geological and economical importance in the reservoir area, for example, landslide, mineral deposit	—	—
1 : 5 000	4 m	—	Geophysical and geological mapping of earth and rock fill dam sites, appurtenant features	—	—
1 : 5 000	2 m	—	Geophysical and geological mapping of concrete dams sites and appurtenant features geological	—	—

			mapping of house sites	power		
1 : 3 000	5 m	—	—	Access roads and plant sides	—	
1 : 2 000	4 m	—	—	Quarry sites, borrow areas	—	
1 : 1 000	2 m	—	—	Geotechnical map- ping of special structure sites of dams, for example, spillway intake and power house sites, tunnel inlet and outlet portals	Geological mapping hydel channel area	
1 : 500	2 m	—	—	—	Final foundation grade geotechnical mapping of earth and rockfill dam sites	
1 : 200	—	—	—	—	Three dimensional log- ging of hydel, access and other tunnels	
1 : 100	—	—	Logging of explora- tory drifts, drill holes pits and trenches	—	Foundation grade geo- technical mapping of concrete dam blocks, surface and under- ground power house excavations	



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