# Engineering Geological Maps – A Ready Reckoner

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**Abstract**

*The Bureau of Indian Standards Recommendations for preparation of Geological and Geotechnical Maps for River Valley Projects emphasise uniformity in the preparation and presentation of geological maps and guide the field geologist in preparing geological drawings that may be readily understood by the user. In practice, however, the map products may be in variance with the BIS Code due to project and site specific objectives and, hence, such uniformity is conspicuous by its absence. The present day boom in hydro power development, with attendant diversification and outsourcing of geotechnical investigations, has added greater disparity in engineering geological maps. These maps, that form the backbone of any investigation, are found to defer from site to site, organization to organization and, surprisingly, even within the organizations.*

*Along with the guidelines, therefore, it may be prudent to adopt well defined check list of map components and sample Engineering Geological Maps. Besides the executing and designing agencies, this may be a great help to the outsourcing agencies and the new entrants as well.*

*The paper introduces a 'Check List' of map components that is well illustrated by a sample Engineering Geological Map.*

## Introduction

Detailed engineering geological maps form the backbone of any investigation. Lithology and geological structure, including joint data, have formed the basic data on these maps since the time engineering geology discipline got recognition. With the advent of Rockmass Classification approach, and introduction of mechanized tunneling, the maps became more and more advanced, particularly with respect to data on discontinuities. A detailed Engineering Geological Map, therefore, may have numerous components that may include lithological variation, structural details, physio-mechanical information, investigations carried out, surface/ subsurface water discharge data, physical features, etc. While some of these tend to be fairly common on all maps, others may or may not be needed depending upon the nature of the project.

While emphasising the uniformity in the preparation and presentation of Geological and Geotechnical Maps for River Valley Projects, the Bureau of Indian Standards recommends geological drawings that may be readily understood by the user (Anon, 2006). The Recommendations also highlight the following:

1. Accuracy, clarity and proper emphasis in the presentation of the data are important requirements.
2. A geological map should stand by itself. The user should not have to read the text of the report in order to interpret the map. The maps should be clear, symbols should be uniform, different types and weights of lines should be chosen to illustrate different geological data. To achieve this, major geological data should be most prominently displayed. Map explanations should be complete and comprehensive.

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3. Ingenuity and sound judgment are essential for presentation of the diverse details required in engineering geology studies.
4. In river valley projects, the geological surveys are usually undertaken in different stages and the engineering geological maps are prepared accordingly in order to meet the requirements of planning, design and construction on different scales varying from regional one in reconnaissance stage to large scale in construction stage.
5. It has been assumed in the formulation of this standard that the execution of its provisions is entrusted to appropriately qualified and experienced people, for whose guidance, it has been prepared.

In practice, however, it is found that the maps produced have a great deal of disparity for reasons that can be attributed to varying objectives and absence of standardisation. It is rather strange that the map products differ even within the organizations. With a sudden spurt in the outsourcing of engineering geological investigations following the hydro power development boom in the country has led to further complications. Along with the BIS guidelines, therefore, it may be prudent to adopt well defined check list of map components and sample Engineering Geological Maps that will help the executing and designing agencies, and new entrants, in outlining and verifying the outsourced jobs. In this context, one may also recall the well referred signature phrase of Ronald Reagon - "Trust, but Verify" - that is also a commonly practiced management mantra.

## Components Check List

The scrutiny of some of the existing Engineering Geological Maps – commonly referred to only as Geological Maps – reveals that the map components may be divided into four basic categories, viz "Common", "Desirable", "Need Based", and "Obligatory". While most of the components need no elaboration, others brings out certain fundamental concepts of data representation. The categorisation of components and their elaboration, wherever needed, are dealt with in the following text. Some working tips have also been incorporated for the beginners.

### 1.Common Components

Lithology (Arranged by upward younging in Legend)þ

Outcrop

Lithological Contact (Firm, Interpreted/ Concealed)þ

Bedding/ Foliation Attitude

Joint Attitude

Shear Zone

Fold Axis

Fault

Spring

RQD/ 'Q'/ RMR (Spot value)þ

Compressive Strength (Schmidt Hammer; Spot value)þ

Slide Zone

### 2. Desirable Components

Stereoplot

Joint set data with rock mass characteristics

Special Features (Creep affected, slumped, etc.)þ

Special Observationsþ

Photographs (Camera location/View Direction)

### 3. Need Based Components

Trace of Joint/ Shear

Geophysical Section Lines

Discontinuity Survey Lines

Summary Map

Isopach (Mostly for overburden deposits)þ

Stratum Contour

Piezometric Surface

Drill Holes (Completed/ In Progress/ Proposed)þ

Drifts (Completed/ In Progress/ Proposed)þ

Sample Location

In situ Test Location

## 4. Obligatory Components

Scale (Bar)þ

Direction (North upwards; or D/s to the right)þ

Project Layout (Tunnel Alignment)þ

Notes (mapping methodology, comments, etc.)þ

Source (Organisation's name; author name optional)þ

Date (Period of mapping, issuance date)þ

Contour

Reference Pillars (Permanent/ Temporary Bench Marks)þ

Coordinates

Section Lines

Road/Path/Mule Track/Ropeway/Bridge, etc.

The above list provides the basic components and the user is advised to expand the list by incorporating other desirable or need based components. He may also serve the cause by circulating such modifications in the list.

## Explanation and Working Tips

*Lithology:* Crowding the maps with symbols may be avoided that otherwise tend to mask other important details. Instead, reasonably spaced alpha-numeric characters may be used.

*Planar Features:* Traces of continuous planar features such as joints that run across the ground of differential relief do not follow the strike of the plane. Hence, the joint dip symbol becomes irrelevant and only the dip direction/amount, or joint set number of pre-defined sets, needs to be given.

*Surface Runoff:* The discharges of major drainage and springs may be shown adequately. This helps in assessing the subsurface water regime.

*Overburden Thickness:* Interpreted Isopach lines in thick overburden covered reaches like slide debris provide good information for the purpose of preliminary siting of the structures. As an alternative, Stratum Contour Maps are also used.

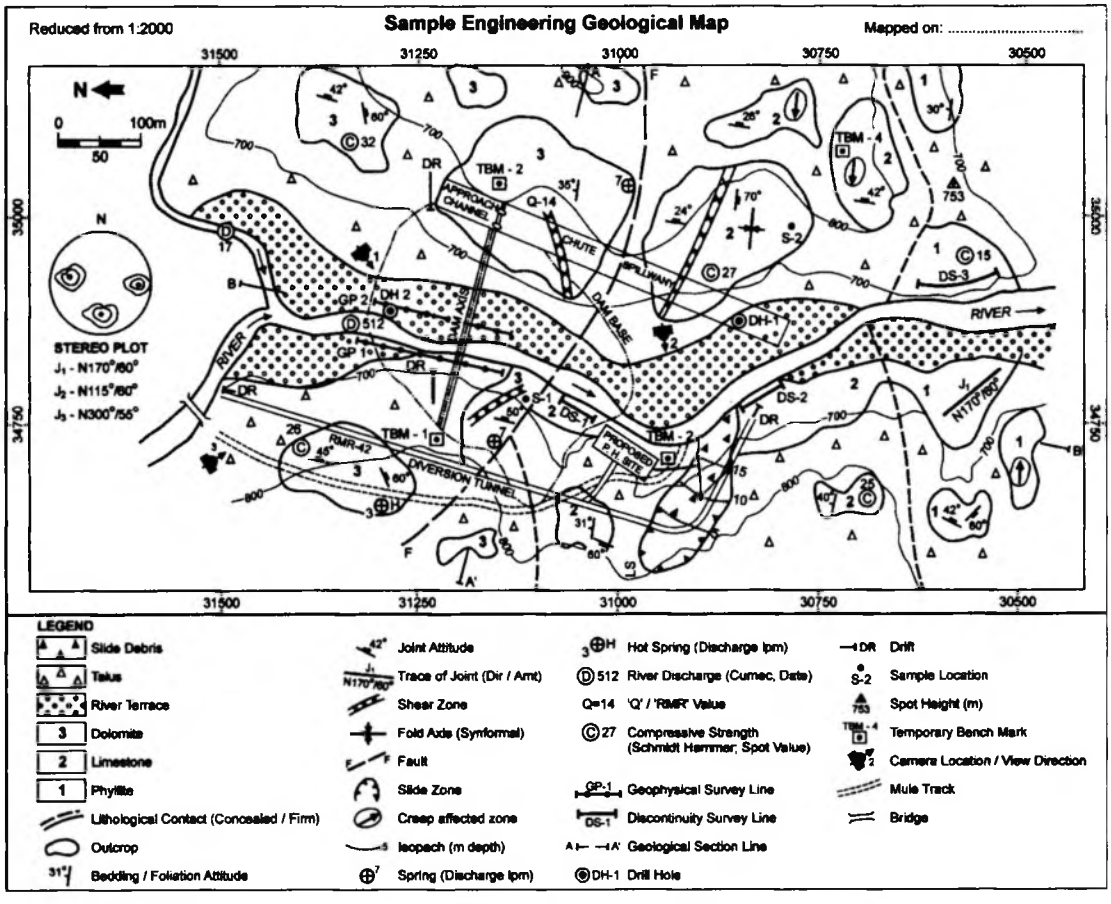
*Photographs:* Better comprehension of site features through photographs is accomplished by plotting camera location with view direction. For the same reason, an index plan of the site with camera location/ view direction is provided along with the photograph itself.

*Summary Map:* In case of large mapped areas, a summarised map on smaller scale is provided that carries the salient engineering geological information. It makes the document handling much easier.

*Notes:* It is obligatory to provide the period during which the mapping has been carried out. Other relevant information like the mapping methodology, constraints, etc. may be provided under this head.

## Conclusions

The Bureau of Indian Standards Recommendations on geotechnical Maps highlight uniformity that, however, is seldom followed for various reasons. It, therefore, becomes imperative to adopt well defined check list of map components and sample Engineering Geological Maps which have been introduced in the preceding paragraphs.




The subject matter of the paper is neither a complex conceptual aspect, nor highly technical, but, aims at bridging the disparity gaps in map products. It may be a useful tool when read with the Recommendations of the Bureau of Indian Standards in this regard.

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## References

Anon (2006): Recommendations for preparation of Geological and Geotechnical Maps for River Valley Projects. IS 15686:2006; Superseding IS 6065 (Part 1):1985. Bureau of Indian Standards.