

M.Sc. Remote Sensing and GIS

RT-204

Remote Sensing in Mineral Exploration and Geotechnical Engineering

Unit-IV

4.2 Site Selection Studies –Dam

MS: Monika Sharma

Introduction

- Sites selection is not a new idea. The important is to utilize technology and techniques for site selection, there are many traditional methods they are costly and time consumable. Nowadays advancement in technologies, in present of space technology, we can utilize maximum resources at optimum cost.
- Satellite Remote Sensing provides the synoptic view of the earth. We can use this imaging technology for updating of our maps in possible time frame as well as acquire information about the landuse and landcover.
- Geographical Information system is computer based systems that handle the attribute data as well as spatial data where geographical information is an important characteristic. Use GIS in this study as a decision support system regarding the site selection.

SELECTION CRITERIA FOR RESERVOIR LOCATION CONSTRAINTS

- Factors influencing reservoir site selection includes
 - topography (slope/aspect),
 - hydrology (rainfall, drainage network),
 - geology (mineral), soil, land use/cover (agriculture, forestry),
 - road network and development plan.
- However, increasingly socio-economic and environmental factors are also being considered . It is more viable and humane to locate a reservoir site near to demand points as well as minimizing settlement relocation or flooding areas with historical archeological value.
- The constraint criteria indicate that reservoir sites should not be in the vicinity of densely populated areas, and must have water accumulated areas, any slope failure, and slopes up to 11 deg are recommended in the literatures.

Multi-criteria evaluation (MCE) approaches

- Using GIS will require creating information layers corresponding to each constraint. The relevant information obtained for the study area was converted into the required constraint layers as in using ArcGIS software spatial analyst. The necessary constraint layers for the study area were derived from various sources.
- Remote sensing satellite data of SPOT-5 and Shuttle Radar Topographic Mission (*SRTM*) are used to extract information and construct layers of information for constraints , i.e. to identify settlements areas, calculate slope and drainage network respectively. Topography was derived from a *SRTM*. This process is usually followed by allocation of weights to each constraint layer, multiplying each layer by its weight and then successively multiplying the result by each of the constraints to combine all the layers. These operations are labeled as a Multi-Criteria Evaluation (*MCE*) (*Heywood et al., 1998*).

- Whenever it is decided to construct a dam, the first question that one face is which type of dam will be most suitable and most economical? Following are the factors affecting selection of dam site by dam type.
 - Topography
 - Geology and Foundation Conditions
 - Availability of materials
 - Spillway size and location
 - Earthquake zone
 - Height of the Dam
 - Other factors such as cost of construction and maintenance, life of dam, aesthetics etc.

Topography

- Topography dictates the first choice of the type of dam.
- A narrow U-shaped valley, i.e. a narrow stream flowing between high rocky walls, would suggest a concrete overflow dam.
- A low plain country, would suggest an earth fill dam with separate spillways.
- A narrow V-shaped valley indicates the choice of an Arch dam

Geological and Foundation Conditions

- Geological and Foundation conditions should be thoroughly surveyed because the foundations have to carry the weight of the dam. Various kind of foundations generally encountered are
- Solid rock foundations such as granite have strong bearing power and almost every kind of dam can be built on such foundations.
- Gravel foundations are suitable for earthen and rock fill dams.
- Silt and fine sand foundations suggest construction of earth dams or very low gravity dams.
- Clay foundations are likely to cause enormous settlement of the dam. Constructions of gravity dams or rock fill dams are not suitable on such foundations. Earthen dams after special treatments can be built.

Availability of Materials

- Availability of materials is another important factor in selecting the type of dam. In order to achieve economy in dam construction, the materials required must be available locally or at short distances from the construction site.

Spillway Size and Location

- spillway disposes the surplus river discharge. The capacity of the spillway will depend on the magnitude of the floods to be by-passed. The spillway is therefore much more important on rivers and streams with large flood potential.
- The availability of spillway site is very important in selection of a particular type of dam.

Earthquake Zone

- If dam is situated in an earthquake zone, its design must include earthquake forces. The type of structure best suited to resist earthquake shocks without danger are earthen dams and concrete gravity dams.

Height of Dam

- Earthen dams are usually not provided for heights more than 30 m or so. For greater heights, gravity dams are generally preferred.

Conclusion

- The main considerations are being safety, economy and the environment. the criteria for locating reservoir are sensitive to the physical, environmental and economical settings, GIS and remote sensing can be useful tools for generating, manipulating and handling relevant data, leading eventually to identifying a number of optimum sites for locating reservoir and ultimately providing options and, assisting with the planning process and decision making. Remote sensing being demonstrated the effectiveness of using remotely sensed data in providing the necessary spectral and spatial information for generating information layers for reservoir site selection criteria. The GIS as a decision-making tool, being facilitated combining various information layers as well as implementing the necessary analysis on the data.