

3.1 ■ HIGHWAY SURVEY

Before any highway alignment is finalized, various engineering surveys are required to be carried out. The survey work may be carried out in four stages. All the possible alternative routes are considered, in the first three stages, keeping in view the various requirements of highway alignment. In the fourth stage the detailed survey of the selected route is carried out.

Following are various types of surveys :

- (a) Map study
- (b) Reconnaissance survey
- (c) Preliminary survey
- (d) Location survey.

3.2 ■ MAP STUDY

In this topographical maps of the concerned area are studied. These maps are available from the survey of India department. The main features like rivers, hills, valleys etc. along with contour lines at 15 to 30 m interval are shown on these maps. By careful study of such maps in the office one or more possible alignment can be marked keeping in view the topographical features and obligatory points. It is possible to drop certain alignments because of unavoidable obstructions and undesirable ground conditions. In map study it should be ensured that proposed alignment do not exceed ruling gradient anywhere. Thus map study gives a rough general idea about various possible alignments.

3.3 ■ RECONNAISSANCE SURVEY

After map study and marking various possible alternative routes, the second set of surveys for highway location is the reconnaissance survey. In this type of survey fairly wide stretch of land along the proposed routes is studied. Very simple instruments like Tangent

DO YOU KNOW?

Topographical maps are drawn to a scale of 1 : 50,000.

Clinometer, Abney level, Barometer compass etc. are used in this survey to collect details not available in the map.

3.3.1 Object of Reconnaissance Survey

- (i) To locate positions of hills, valleys, lakes, ponds, marshy land, permanent structures and other obstructions along the routes which are not available in the map.
- (ii) To collect information regarding maximum flood level, underground water level, number and type of cross drainage structures along the probable route.
- (iii) To determine the value of gradient, length of gradient and radius of curves of alternate alignment.
- (iv) To obtain information regarding type of soil along the routes.
- (v) To obtain information regarding climatic conditions in the area of the route.
- (vi) To locate the sources of construction materials and water.
- (vii) To collect data regarding the geological formation, type of rocks, seepage flow etc., when the road passes through hilly terrain.

3.2.2 Method of Conducting Reconnaissance Survey

The reconnaissance survey is conducted in two steps :

(i) **Area Reconnaissance :** This is carried out from the existing maps and aerial photographs obtained from the survey of India. In the absence of maps or aerial photographs, a basic map for reconnaissance is prepared. The latest technique to prepare the basic map is to take aerial photographs of the site and then through study of the photographs taken.

DO YOU KNOW?

A list of points on which data may be collected during ground reconnaissance survey is given in IRC-SP19.

(ii) **Route Reconnaissance :** This is carried out to check the practicability of each alternative route selected during area reconnaissance. This is done either by walking or by a helicopter. After working out the alternative routes the areas are restricted to small stretches of land and the required informations are then collected.

3.3.3 Preparation of Reconnaissance Report

After collecting the various informations, a reconnaissance report is prepared in the following format :

(a) **Introduction :** This includes the following :

- (i) Purposes of reconnaissance survey
- (ii) Study methods
- (iii) Design criteria

(b) **General Alignment details :** In this following informations must be provided :

- (i) Choice of routes, including advantages and disadvantages of various routes.
- (ii) Interchange locations.
- (iii) Service to communities.
- (iv) Safety considerations.
- (v) Drainage.

(c) **Project Cost Estimate :** This includes the estimate of the following :

- (i) Roadway

- (ii) Right-of-way
- (iii) Structures
- (iv) Utility re-location

(d) **Summary** : This includes conclusions and recommendations.

Finally a plan drawn to a scale 1 : 50,000 showing the alternative alignment is attached.

3.4 ■ PRELIMINARY SURVEY

Preliminary survey is a large scale investigation of the alternative routes marked during reconnaissance survey.

3.4.1 Object of Preliminary Survey

- (i) To survey the alternate alignments proposed during reconnaissance survey and to collect details of topography, soil and drainage.
- (ii) To compare the various proposals in view of the requirements of a good alignment.
- (iii) To estimate quantity of earthwork, materials etc. required for road construction along each alternative alignment of the road.
- (iv) To finalize the best suited alignment from all considerations.

DO YOU KNOW?
In preliminary survey, an accurate traverse line along the route already recommended during reconnaissance survey, is drawn. This line is called P-line.

3.4.2 Method of Conducting Preliminary Survey

The preliminary survey is carried out by one of the following methods :

- (i) Conventional Method
- (ii) Aerial photogrammetry method

(i) **Conventional Method** : This method of preliminary survey is carried out in following steps :

(a) **Primary Traverse** : This is the first step in the preliminary survey. In this primary traverse is established along the route recommended in the reconnaissance survey. The angles and length of centre line should be measured very accurately as these traverses are open traverses and no adjustment of errors is possible later on.

(b) **Topographical Features** : After establishing the centre lines of preliminary survey, the topographical features are recorded. Physical features such as buildings, trees, monuments, ports, railway lines, drainage channels etc. are surveyed and plotted. The width to be covered for such detailing should be about the land width proposed to be acquired.

(c) **Levelling Work** : The levelling along with plane tabling is also carried out side-by-side to give centre line profile and typical cross-section. In the preliminary survey the levelling work is kept to a minimum, just sufficient to get the approximate earth work in the alternate alignments.

(d) **Hydrological Data** : The hydrological data are collected to get information on highest flood level, rainfall intensity, catchment areas of streams and to estimate the type, number and size of cross drainage structures. The grade line of the alignment is also decided based on the hydrological and drainage data.

(e) **Soil Survey** : After collecting the hydrological data, soil survey is conducted to work out details of earth work, slopes, sub-soil and surface drainage requirements. This also helps in deciding the pavement type and approximate thickness required.

(ii) **Aerial Photogrammetry Method** : This is the most modern and quick method of preliminary survey. This survey is very much suited when the distance and area to be covered are vast. Aerial photographs of the strips of land are taken and are examined by using photo-interpretation method to decide the geological feature, soil conditions, drainage requirements etc.

After collecting the various data from the preliminary survey of various alternate route, a comparative study is done to decide the best possible and economical route for location survey.

3.5 LOCATION SURVEY

The purpose of the final location survey is to fix the centre-line of the selected alignment in the field and to collect additional data for the preparation of the drawings.

3.5.1 Method of Conducting Location Survey

The location survey is carried out in two steps :

(a) **Location of Centre Line** : The centre line of the proposed road is transferred from the basic map to the ground. The centre line should touch all the major and minor control points. Pegs are driven at 30 m intervals with the help of theodolite and steel tape while locating the centre line. Depending upon the sharpness of the curve, stakes may be put at closer intervals in the horizontal curves. All curve points, namely beginning of transition, beginning of circular curve, end of circular curve and end of transition should be marked and referenced.

(b) **Detailed Survey** : First bench marks should be established at intervals of 250 m and then precise levelling is done. A single datum should be used for the entire level works. Longitudinal section and cross-sections are taken at close intervals to assess quantities correctly. Where there is major change in level, additional cross-sections are taken. All river crossings, valleys etc. should be surveyed in detail upto considerable greater distances on either side of the route.

All topographical details like town, valley, hill, river, railway lines etc. are noted and plotted using conventional signs. Sufficient hydrological data are also collected and recorded.

A detailed soil investigation is carried out to draw the soil profile and also to get the bearing capacity of soil.

3.6 HIGHWAY PLANS

Highway plans are the drawings prepared from the collected data during highway survey. The following highway plans/drawings are generally prepared in a highway project :

- (a) Locality map-cum-site plan
- (b) Land acquisition plans
- (c) Detailed plan and longitudinal section
- (d) Detailed cross-section
- (e) Drawings for cross-drainage
- (f) Drawings of masonry works

(a) Locality map-cum-site Plan

This is a combination of the key map drawn to a scale of 1 : 2,50,000 and the index map to a scale of 1 : 50,000. This map should show the location of the project in state and indicate the names of towns and cities.

(b) Land Acquisition Plans

This is prepared from the survey drawings for land acquisition details. Scales of 1 : 2000 to 1 : 8000 are suitable. These plans should show wells, land boundaries, trees, nature of land and the nature of crops.

(c) Detailed Plan and Longitudinal Sections

Detailed plan should show the final centreline, right-of-way boundaries, cross-roads, railway lines, positions of points of transit, location of cross-sections, contours etc. The longitudinal section should show the final road profile, existing road profile, superelevation, cross-fall etc. The normal practice is to show both the plan and profile together in one sheet. These are drawn by using scale of 1 : 2500 for horizontal and 1 : 250 for vertical.

(d) Detailed Cross-section

Cross-sections should be drawn at every 50-100 m in plain terrain, 50-75 m in rolling terrain and 20 m in hilly terrain. It is drawn to a scale of 1 : 100. The cross-sections should show the existing ground profile, are of cut and fill, proposed road levels etc.

(e) Drawings for Cross-drainage

This is drawn to scale of 1 : 50.

(f) Drawing of Masonry Work

This is usually drawn to scale of 1 : 100. For details of any complicated portion of structure scale of 1 : 10 may be used.