

# LAND SURVEYING IN INDIA: PRESENT STATUS

Surveying has been traditionally defined as the science and art of determining the relative positions of points

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## BACK SIGHT

Humans have pondered over the 'shape of the earth' for more than a millenia. This led to some systematic processes and measurements which were later baptized as 'Geodetic Surveying'.

**Surveying** has been traditionally defined as the science and art of determining the relative positions of points above, on, or beneath the surface of the earth, or establishing such points. The purpose of which is to research the form and size of the earth and the geometrical shape and spatial position of the objects on the surface of the ground.

In other words, it is the science to collect, analyze, integrate, manage and apply the geographical data about above and under the ground surface or in the water with features of spatial contribution with all kinds of appropriate approaches and instruments, which aims to make the natural appearances known to the people.

**Historically**, it was as early as 1400BC that the Egyptians first used surveying to accurately divide land into plots for the purpose of taxation and sometime in 120BC the Greeks developed the science of geometry and used it for precise land division and also standardized the procedures for conducting surveys. They were also the first to develop an instrument (Diopter) for conducting surveys.

However, in 1800AD, during the industrial revolution, surveying became an important aspect for development of public

infrastructure, in terms of railroads, canals and roads. This led to the development of more sophisticated instruments and this was the time when science of Geodetic and Plane surveying was developed.

**Today**, surveying has become a part of our lives and irrespective of whether we realize it or not, it is affecting our daily lives. Whether it is the development or realignment of our neighbourhood road, development of a new shopping mall in the vicinity, the development of a new amusement park, the laying down of the optical fibre cables for more telecommunication lines or the development of a new line for metro rail in our neighbourhood, without surveying, all these would not have been possible.

Some of the common surveying applications have been,

- to map the earth above and below the sea,
- prepare navigational maps (land, air, sea),
- establish boundaries of public and private lands,
- develop data bases for natural resource management,
- development of engineering data for
  - bridge construction,
  - roads,
  - buildings and
  - land development etc.

**The methods of surveying** can be classified under major two headings, viz., Geodetic and Plane. Geodetic is one where the spherical shape of the earth is taken into account and it covers large areas and has high accuracy. Plane surveying is concentrated into smaller areas where accuracy requirement is not

that stringent and this method considers region as flat, instead of spherical. This is commonly used for most of the work, whereas geodetic surveying is employed for determining shape and size of earth and establishing control points.

Surveying has broadly been classified into the following categories (after <http://pasture.ecn.purdue.edu/~asm215/topics/history.html>), depending upon **the purpose** for which they are being used,

- Control surveys
- Topographic surveys
- Land, Boundary and Cadastral surveys
- Hydrographic or Marine surveys
- Route surveys
- Construction, Urban Planning or Engineering surveys
- ~~the~~ **the** surveys

Surveying can also be classified depending upon the **instruments used, type of measurement** and **depending upon the platform**, from where surveying is done.

### STAKE OUT

With development taking place in the field of surveying world over and also in India, we thought of conducting a study through questionnaire survey, to study the present status of land surveying in India. A questionnaire was designed where it was decided to study the different activities of companies engaged in the surveying field, their geographical reach, core land surveying companies vis-à-vis GIS companies where surveying is an associated task. The study was also intended to look into the different instruments being used and their feedback in terms of usability, user-friendliness, availability in their region, after-sales service and overall satisfaction level. The questionnaire also asked about the usage of GPS in the surveying work and also the Return on Investment.

Before the questionnaire was sent, a consent letter was sent to around 200 companies, the data for which was

obtained from our internal resources, web-search and websites of the companies. Once the consent was obtained, the questionnaire was sent to the concerned department or concerned person and/ or the CEO of companies, spread all over the country, engaged in surveying and GIS work. It was also sent to some freelancers/ retired professional, either who are currently engaged in surveying tasks or were engaged previously. The response was overwhelming and we are thankful to all those, who took their time and responded to the questionnaire.

### TRIANGULATION

The questionnaires were analysed on the basis of the location of the surveying company vis-à-vis the geographic area they cater to, their annual turnover as a percentage to their total business. The kind of instruments being used by these companies were also studied and also from where they are purchased. One important motive of this survey was to assess whether GPS was being used in land surveying or not, and if yes, its penetration. The Return on Investment for the surveying projects was also studied. All these were in addition to the different kinds of surveying, the companies are engaged in.

### PLOTTING

The entire analysis of the questionnaire was divided into two sections. First section (Pole A) covered the type of survey and the instruments being used in India by different companies, their locations vis-à-vis their turnover and Return on Investment. In the second section (Pole B), satisfaction level of different instruments was studied along with the service and support the vendors offer to them.

### POLE-A

The companies who participated in the survey, 43% of them were from South of India, with their head offices in Bangalore, Hyderabad or Chennai. There were only 14% response from the western part and almost similar response of approximately 22% from East and North. There was only one response from the NE region, catering to almost all the eight NE states.

The different activities, companies are engaged in, could be listed as,

- Topographic survey
- Cadastral survey
- Utility survey
- Engineering survey
- Natural Resource Management (NRM)
- Urban Mapping

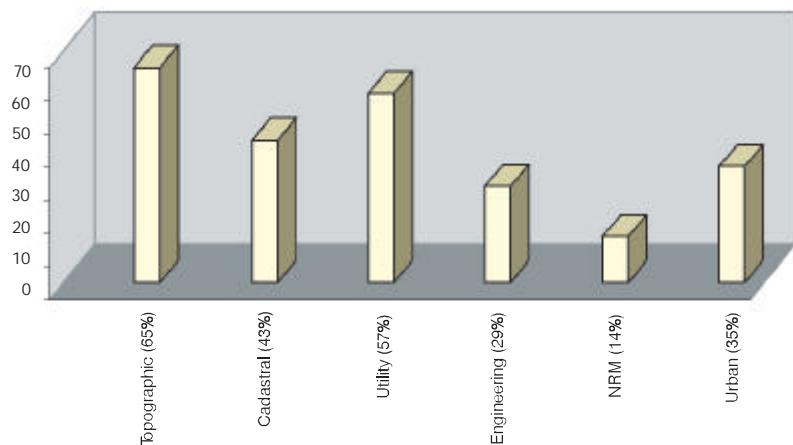


Fig.1 Bar diagram showing the different surveying activities, companies are engaged in

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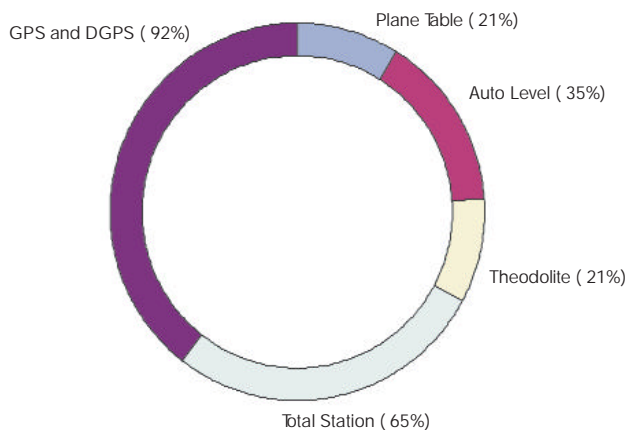


Fig.2 Usage of instruments for surveying tasks

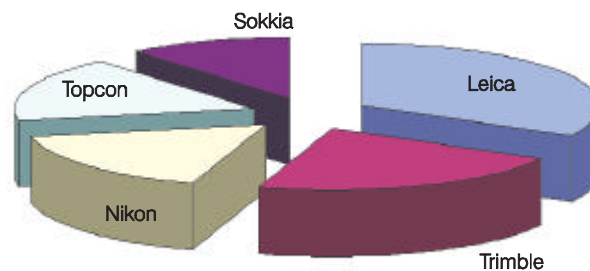


Fig.3 Distribution of make of surveying instruments (except GPS)

The percentages of these **activities** could be shown by Figure 1.

The instruments being used by different companies for conducting the above survey are,

- Plane Table
- Auto Level
- Theodolite
- Total Station
- GPS and DGPS

The distribution of these **instruments** in percentage is shown in Figure 2.

It could be seen from Figure 2, that most of the companies (more than 90%) have started using GPS and/ or DGPS for their survey work. For conventional surveying, still Total Station is a preferred choice with 65% users opting for this and 35% uses Auto Level. Other instruments are used almost uniformly. However, there have been few companies who have started using Laser Range Finders and also laser based levels, but the most important fact emerged was, a couple of companies have started LIDAR surveying as one of their important activities, viz., Genesys International of Bangalore and Geofiny Technologies of Chennai.

In almost all the cases, the **instruments have been obtained** through the local vendors and in exceptional cases, when it

is very specialized one, it has been ordered/ imported directly from the manufacturer. Also all the companies prefer to obtain the instruments locally through their local vendors because of their support and service, but how much do they get, is a concern. More on this is in the next section.

The **use of GPS** has really penetrated the land surveying arena, although 37% of the respondents still use hand-held GPS and mapping type, Geodetic type and DGPS are almost equally distributed. Another important aspect is that 80% of these companies, own the GPS they use and even some of them rent it out. There are only 20% such surveying companies, who rent the GPS instruments. Although most of them own the GPS instrument, but for specialized jobs, they hire. Another important conclusion arrived at was the use of post-processing software for better accuracy. Almost 85% of the companies using GPS survey, use some or the other GPS post-processing software. However, all are system specific, the most common being Leica Ski-Pro.

Although, no company gives an estimate of their earnings, still we tried to look at their **Return on Investment (ROI)**. It was found that the ROI for most of them (about 85%), in the range of 10-30%

profit and the rest between a profit margin of 30-50%.

#### **POLE-B**

This section of the survey was the trickiest one where it was intended to get an idea about the **satisfaction level in the usage of instrument** being used by different companies and also the **satisfaction level with the local vendors**. Since almost all of the companies preferred to purchase the instrument from the local vendors, due to their availability for support and service, it was to be seen, how much they satisfy their customers.

The main make of instruments being used were Leica and Trimble, with some of them preferring Topcon, Sokkia and Nikon instruments. As per the respondents, 33% are using Leica surveying products, 22% are using Trimble instruments and 17% each are using Nikon and Topcon. In this section, the surprise to me was the Sokkia surveying products which only 11% of respondents use. Surveying market share could be shown in Figure 3.

In the **GPS section** Leica was the leader with 45% of the respondents using their products, followed by Garmin with 35% and Trimble with the rest of 20%. Trimble might have lagged Garmin in

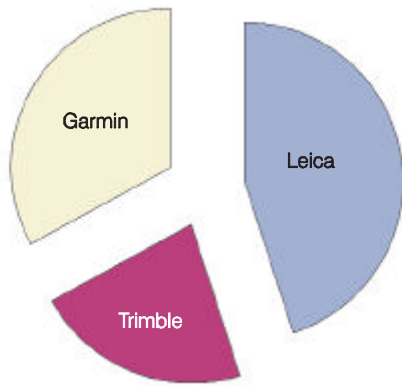


Fig.4 Market share of GPS instruments

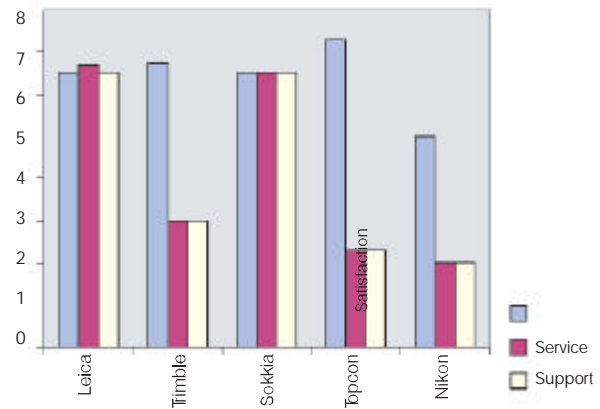


Fig.5 Make of the instruments vis-à-vis satisfaction level

the GPS section, because most of the companies are using hand-held instruments. But if we compare Leica and Trimble, there is a wide gap of 25% in the market share. GPS market share could be shown in Figure 4.

In the **Instrument satisfaction level** (ease of use and navigation) a scale of 10 was used with 1 being the least satisfied and 10, the most. In this part, Topcon scored the highest with 7.3 points while Trimble and Leica were neck to neck with 6.75 and 6.5, followed by Nikon with 5 points. However, in the **service and support** category, Leica scored 6.7 and 6.5 respectively whereas others scored in the range of 2-3 points, in both the categories, where a lot to be desired from the local vendors of these companies. Dr Sharma from EnGeo consultancy says, that the Leica has a very modern service centre and their service is prompt (considering the fact that his company is in the NE) and the support is good. Sunil Kokare of Monarch Surveyors, Pune has very bad experience with the local Trimble vendor and has rated them as poor in both service and support and has even rated Nikon local vendor to be very poor in terms of service and support. Comparison of the instrument satisfaction and service support are shown Figure 5.

The instrument satisfaction level for almost all make is the same but it is the service and support of the local vendors which decide companies to purchase which brand of the instrument.

The satisfaction level for the GPS of both Trimble and Leica are the same at 7.5 points but in service and support again, Leica has scored 8 and 7.75 over Trimble's score of 5 in both service and support. The satisfaction level of Garmin in this section of the product is much below.

**FORE SIGHT**

This is one of its kinds of study for the Indian market and users. An attempt was made through the present study to get an idea about the different applications, the companies are engaged into and the different instruments being used by them. Attempt was also made towards studying the market share of the different vendors, the satisfaction level of the instruments and service and support of the local vendors. Although the response of the companies was overwhelming, detail survey is needed to come to a definite conclusion.

Most of the respondents have voiced their opinion of better service and support from the local vendors. Another aspect highlighted was the lack of trained

staff and good training institutes. From the use of GPS point of view, the compatibility with Galileo and the prohibitive import duty was few of the concerns of the respondents.

There have been few responses, which I would like to quote verbatim:

"Surveying is the foundation of any infrastructure project so accuracy & integrity is the most important factor in surveying. There should be some registration on national level to this industry."  
 - **SunilKokare**, Director of Monarch Surveys and Contractors Ltd., Pune.

"Its time we had a national grid of GPS differential stations available for common use at no cost."  
 - **Col.JJacobVSM** (Retd.) of Genesys International, Bangalore.

"Import duty continues to be high. Some of the vendors do not have trained staff for aftersales support. Lack of awareness does not allow us to go for it. None of the vendors has taken initiative to provide free training with the instruments to non-users."  
 - **DineshSharma**, Topcon Surveying, Faridabad.

I thank all those who took part in the survey and provided their valuable inputs for the article.



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