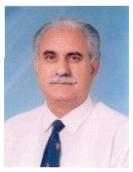
ROLE OF GEOMATICS & MODERN ELECTRINIC SURVEYING INSTRUMENTS IN DEVELOPMENT PROJECTS



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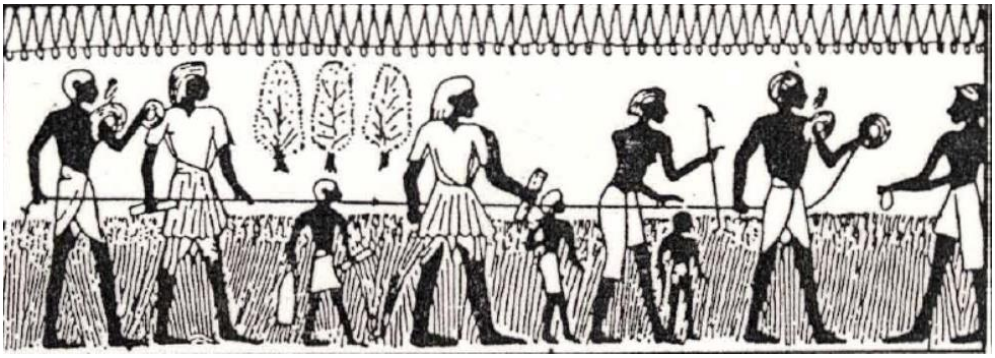
Introduction

Geomatics is the new terminology of the old profession of surveying and mapping which has been around for more than two thousand years. The earliest record of practicing surveyors is available in relief forms on Egyptian monuments of Paroh's time. The surveying tools or one may call them surveying instruments that they used were very simple and primitive in nature but they achieved the desired results. When we check them now using our modern instruments we find them astonishingly accurate.

Annual flood inundated agriculture land boundaries which those surveyors were called upon to reestablish. Their services were also used in the assessment of land tax of the time. One may say that Parohs also had ***Patwaris*** in their service.



Early Egyptian tomb painting shows an official land survey party using measuring ropes

Progression of the Profession

This profession is the primary field of activity for all development projects. Starting from feasibility stage to detailed design stage followed by the construction phase when G*eomaticians* are called upon to ensure line & grade including taking measurements for excavation and placement of fill materials further to ensure that electrical and mechanical components, if there are any, go at the exact location as per the design. Its progression has been a very long and slow in the beginning but it pick up pace with the industrial revolution in the West.

Geomatician services are inevitable irrespective of the size of the project. It is a primary activity.

The sequence of a *Geomatician's* role in development projects involves the following activities / works:

- Prefeasibility stage – collection of existing maps and data.
- Feasibility stage –
    - Establishment of survey control network in the project area with connection to Survey of Pakistan grid and mean sea level datum.
    - Limited extent of survey and mapping.
- Feasibility & Design stage –
    - Densification of survey control network to cover the whole project area.
    - Detailed survey & mapping of the location of the project components.
- Construction Phase –
    - Joint surveys for earth works.
    - Checking of the layouts of the works.
    - Monitoring line and grade.
    - Checking of installation of the electrical & mechanical components.
- Post construction phase –
    - Deformation monitoring during Operations and Maintenance period, in the case of large structures e.g. Dams, Power Houses, Major Bridges, Buildings, Oil Refineries etc.

Journey of the Surveying Instruments

Importance of Surveying remained limited over a long period of time however with the industrial revolution in Europe it could no longer stay stagnant. Invention of telescope and accurate machining of components gave a big boost to angle measuring instruments e.g. theodolite.

Geomatics involves three basic measurements:

1. Rotation – i.e. angle measurement
2. Linear distance measurement
3. Vertical (distance) measurement

Angle measurement – tool of the early Egyptian – Groma was basically similar to optical square for right angles setting out. With the availability of machine divided circle into 360 degree during the industrial revolution gave birth to accurate horizontal circle of angle measuring instrument; the theodolite.

Development of micro-electronics brought in electronic theodolite or digital theodolite where-in the angle readings are displayed on a screen and with the pressing of a button electronically recorded on board in electronic memory of the instrument. The data downloaded to computer for further processing thus completely eliminating the human error of reading and writing angular measurements.

Linear distance measuring progressed from knotted rope to graduated tapes and steel bands followed by Invar Wires and Invar Rods / Tapes for accurate baseline measurement.

Microelectronics development also brought in the electronic distancing measuring (EDM) thus eliminating the use of tapes / bands etc. for distance measurement. Further

miniaturization merged the electronic theodolite and EDM and it gave birth to the modern day all too famous Total Station.

Vertical (distance) measurement progressed from the early Egyptian A-frame to U-tube to levelling instrument fitted with telescope and bubble tube – the famous Dumpy Level. Levelling instrument has also seen many changes and development over the period to time. The progression is from Dumpy level to split bubble and then self-aligning automatic level followed by electronic level reading a bar coded levelling staff.

All these developments also changed the mode of field data recording starting from good old field survey field book to electronic (field book) data logger to present day recording of field data in the electronic memory on board the instrument.

Plane Table and Photogrammetry were the leading technologies for mapping; bulk of the mapping of the Indo Pak sub-continent in the nineteen century was carried out through Plane Table method and we salute those surveyors for the immense work done in some of the most difficult terrain. Photogrammetry then contributed to making major portion of the earth.

Global Positioning System (GPS) has very quickly replaced the age old method of survey control establishment i.e. triangulation/trilateration and traversing etc. GPS in RTK Mode are replaced tachometric method of survey.

Scanners; airborne and land based are very rapidly replacing field data collection methods for mapping for development projects. Similarly the Ground Penetration Radar (GPR) is providing a powerful tool for mapping services located underground.

Miniaturization of large capacity computers provided means to digitize maps and include attributes information / data. This in turn gave birth to a completely new technology called Geographic Information System (GIS) which is providing immense data for planning of development projects and assists the policy makers. Many GIS persons tend to forget that geomatics is the mother of GIS.

Conclusion

Geomatics had been a very important and powerful profession associated with the planning and execution of development projects in the past and it will continue to be so in future.

New electronic instruments & digital techniques of field survey data acquisition have strengthened the old surveying profession and the present day surveyor's performance is much significant than what was say 30 to 40 years ago.

Techniques and tools will be further developed and modified with time and there will be more demand on the old surveying profession. It will mold itself into new role and diversify its techniques / methods and justify its name change from surveyor to geomatician.