Establishment of Geodetic Control Network for Land Records in Haryana- A Case Study

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NEED OF GROUND CONTROL NETWORK FOR LAND RECORDS MAPPING

•Land records are always subjected to litigations for the discrepancies in measurements and area.
•The old methods used in creating land maps and records using chains and tapes has its own limitation and has resulted in inbuilt inaccuracies in the present state of land record systems in our country.
•Today land is so valued that its accurate measurement and use need to be precisely defined and managed.
•When the government has given focus on the modernization and management of land records in the country it was explore to use latest technology of DGPS and surveys to create a platform which can be used for accurate measurements of the land.

For the purpose of setting up a state level network following type / level of Control Point has to be established under NLRMP project:-

- Primary Control Network
- Secondary Control Network
- Tertiary Control Network
- Auxiliary Control Network

Planning grids & SOI controls and benchmarks

Geodetic Network Establishment Configuration:

Primary Grid / Primary Control Points:

•Each 20Km (16 to 25 km)/Tehsil Head quarter spacing.
•Must be located in a secured Campus, a Government Office preferably a Tehsil Office or Block.
•Government building in Tehsil Head quarter and Panchayat Bhawan Government School or any other government property in a selected village for fulfillment of 20 Km criteria.

Secondary Grid / Secondary Control Points:

•Each 10 Km (8-15 km) spacing again in a secured campus as for primary grid.

Tertiary Grid / Tertiary Control Points:

• Each at 5 km spacing and / or seheda stone in of a village boundary.

Site selection

The selection of the site for GPS observation has been done considering the following parameters:

- Locations far from the strong radio transmissions to avoid disturbences in satellite signal reception.

- Stations should be situated in locations relatively free from horizon obstructions as Satellite signals do not penetrate metal, buildings, or trees and are susceptible to signal delay errors when passing through leaves, glass, plastic and other materials.

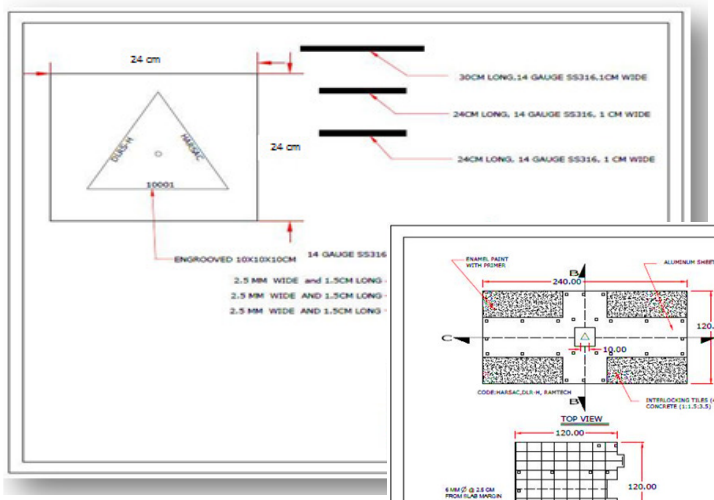
- Avoid locating stations near large buildings, large signs, fences, to avoid multipath errors.

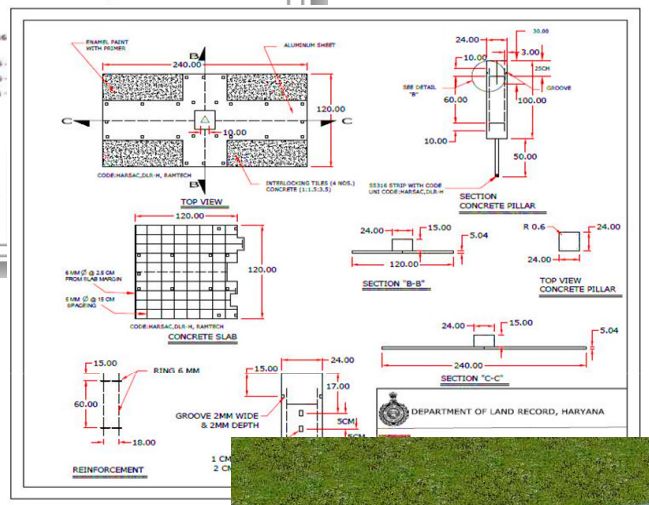
- Establishment of Control Points in the Government office premissis. Permission from government agency regarding the establishment of control point.

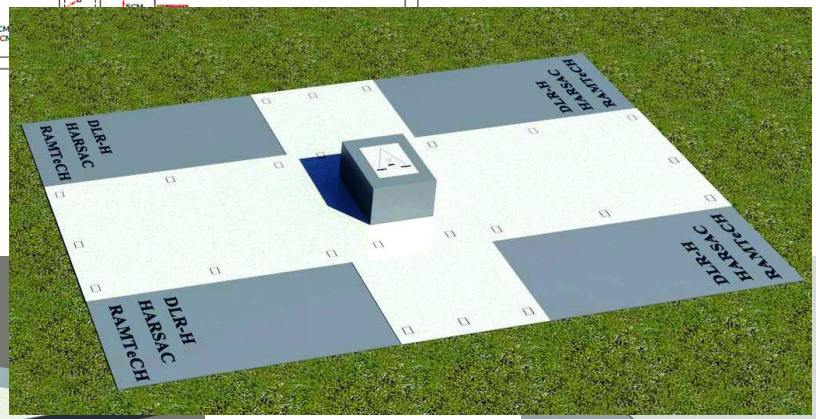
- Identifying and approval of the location by HARSAC.

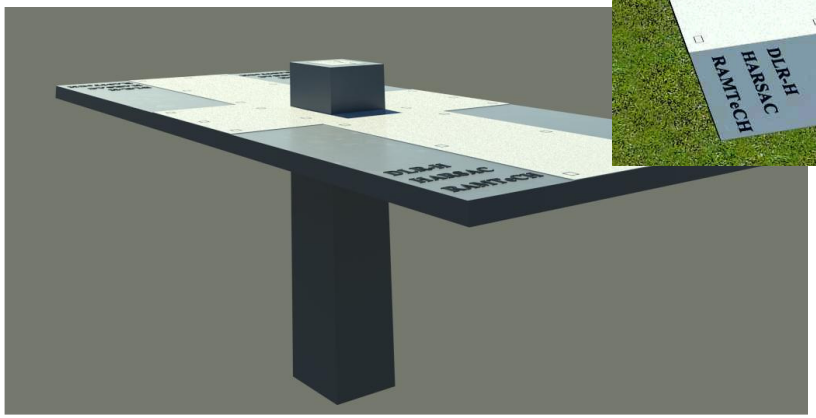
Monument design and construction and installation

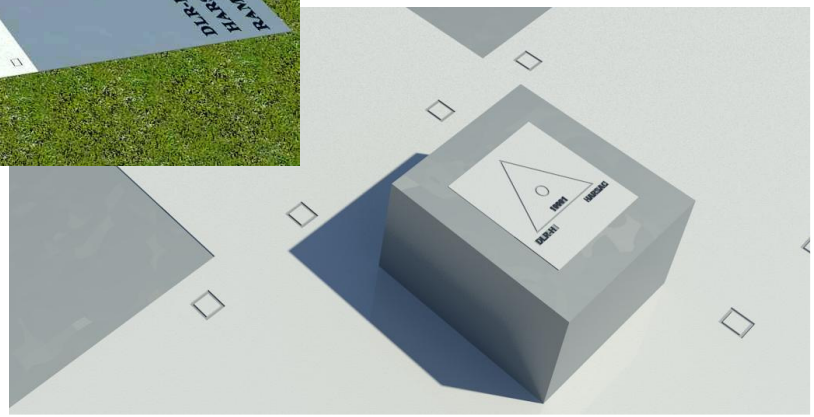
MONUMENTATION - DESIGN



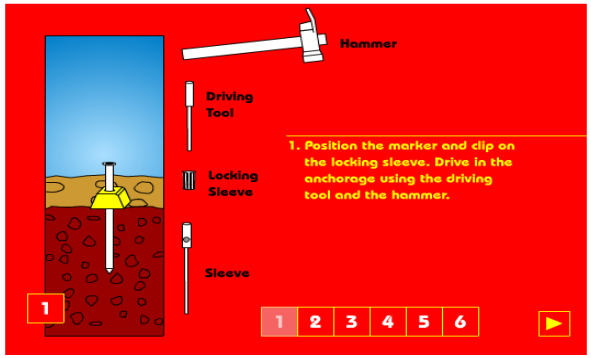


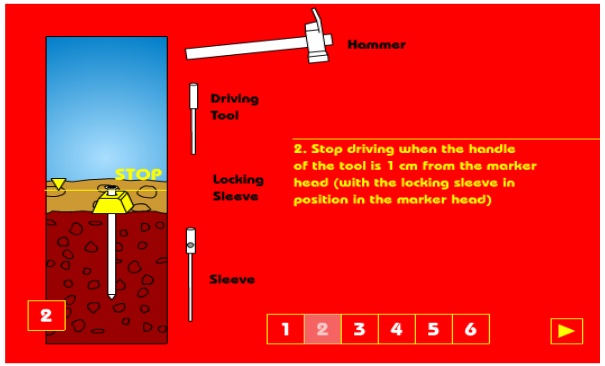


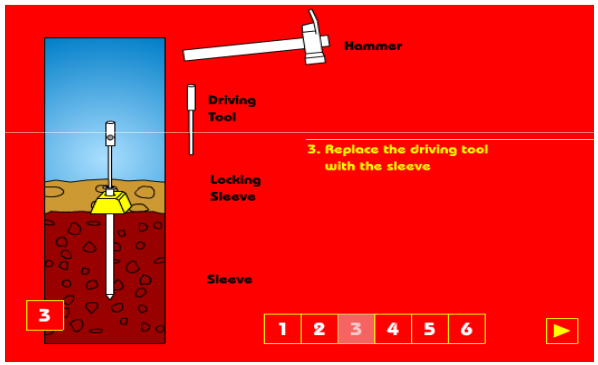




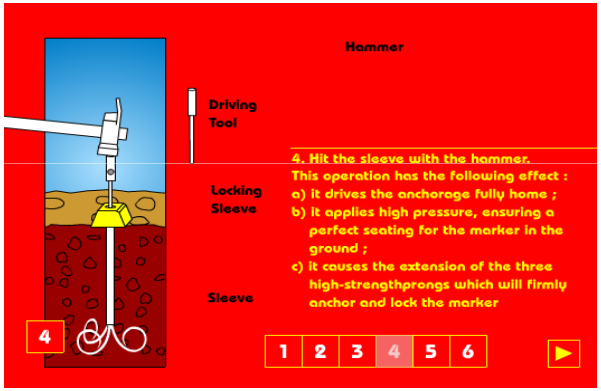
Secondary Point Survey Marker

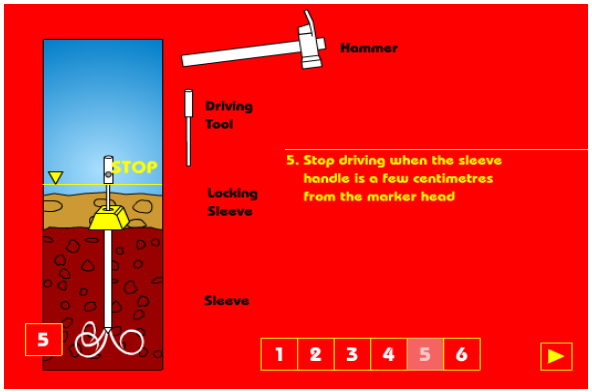


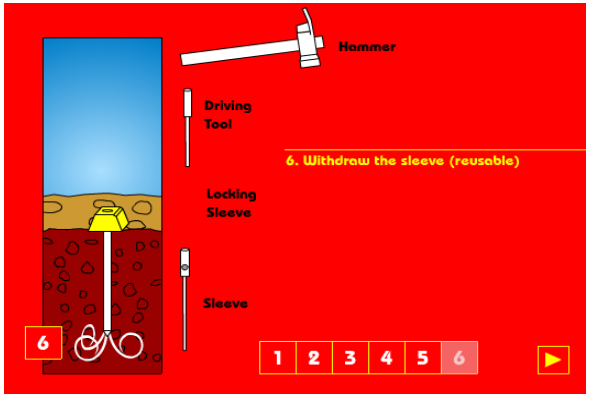




Installed Survey Marker

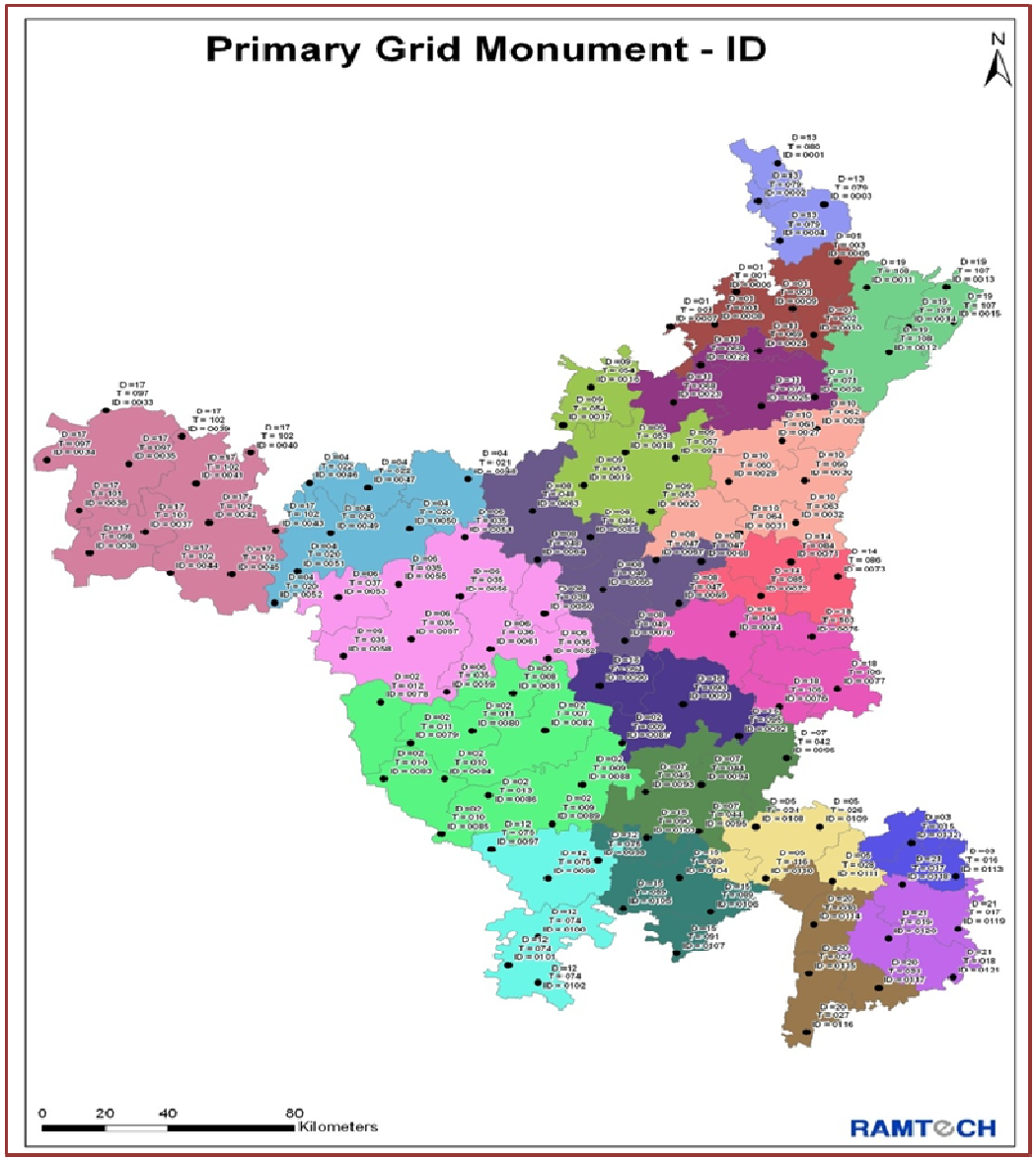




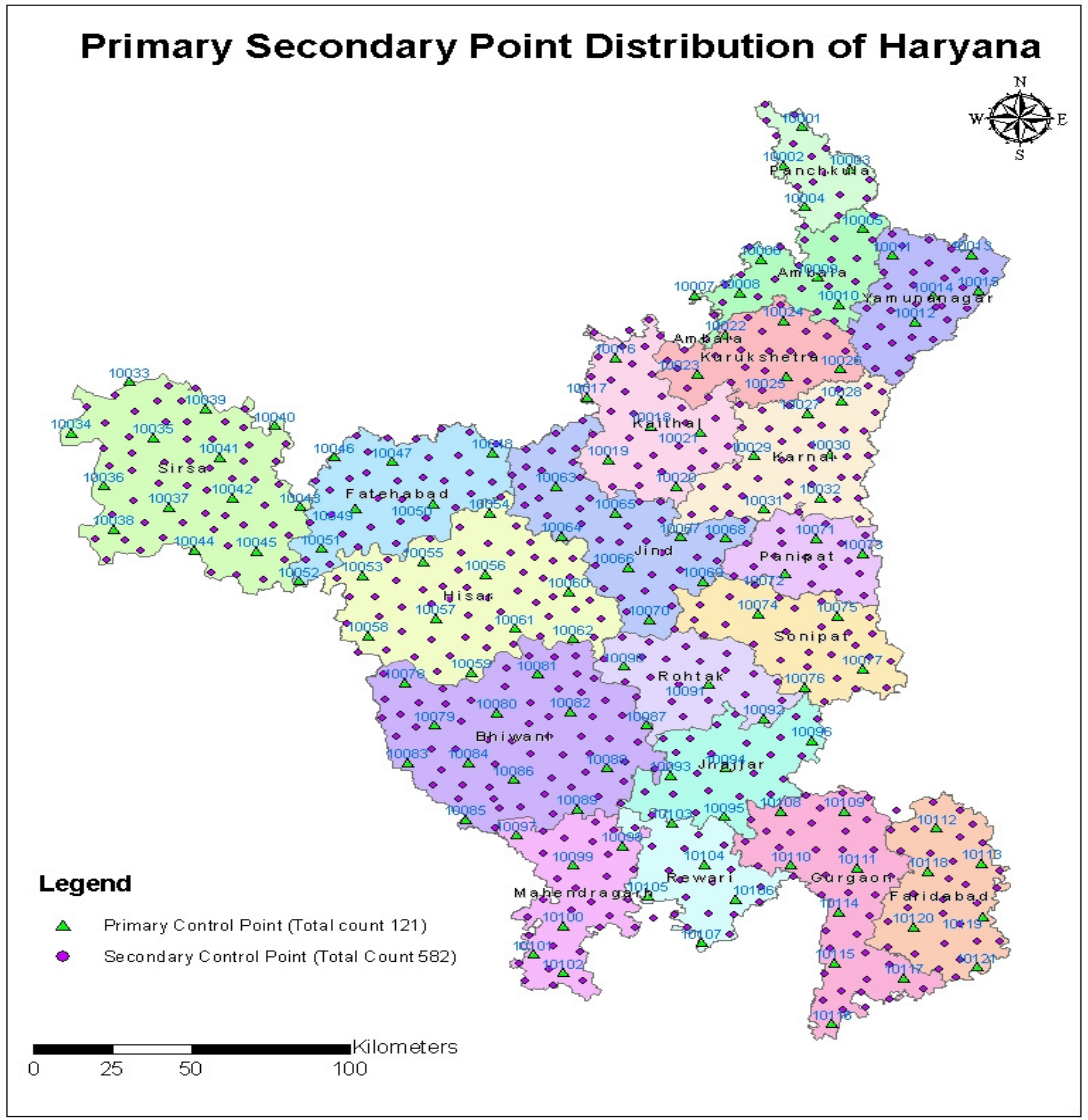


MONUMENTATION-PLANNING

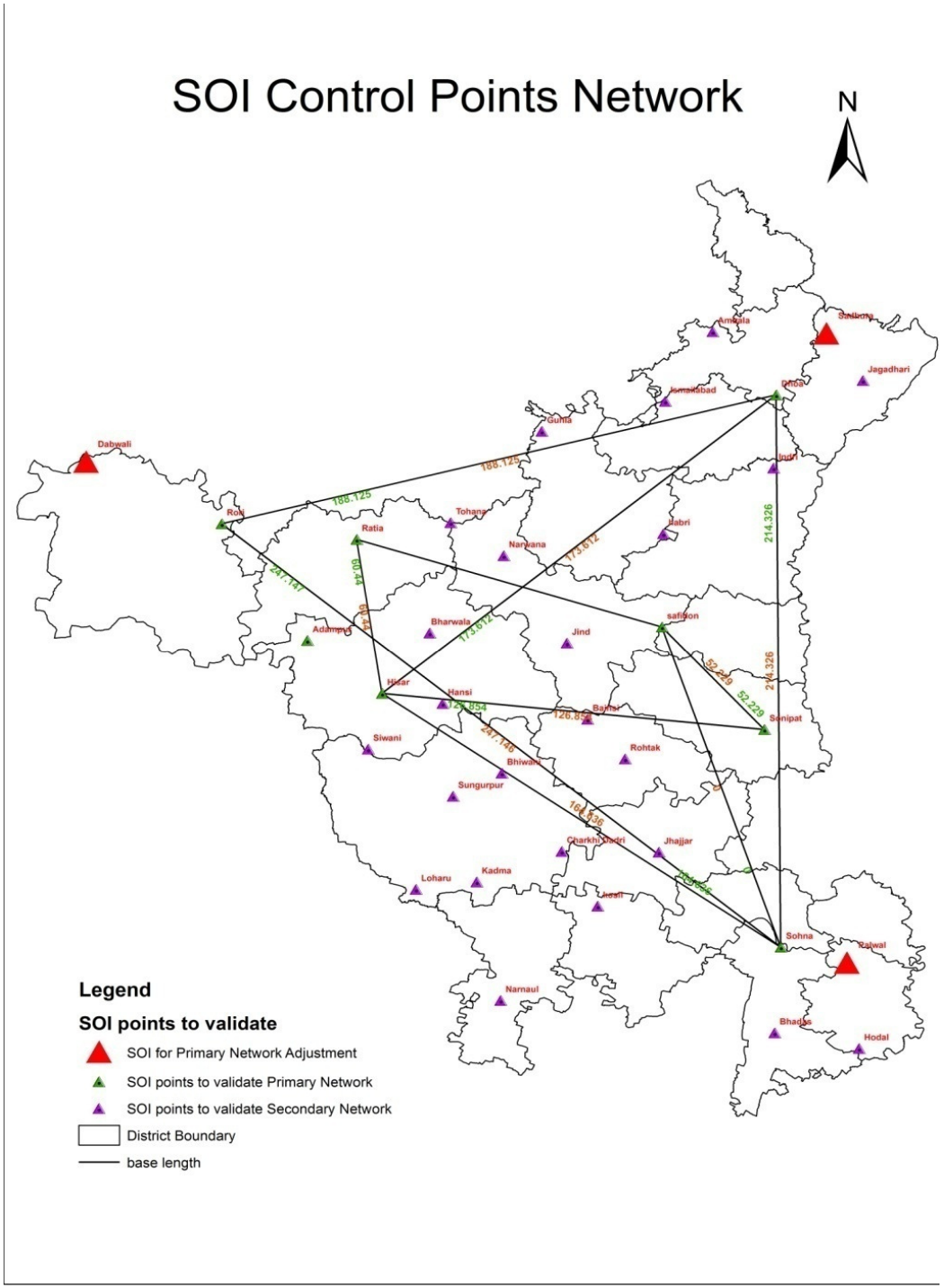
- **To create a state wide network of monuments HARSAC has finalized the distribution of monuments as**
  - **SOI Master Control Points: 35 Nos.**
  - **Primary Network- 20 kms interval: 121 points**
  - **Secondary Network- 8 kms interval 589 points**
  - **Tertiary Network – on shehda points (Village tri-junctions): Approximately 20,000**
  - **Auxiliary Points – To be placed for survey wherever sufficient controls are not available**



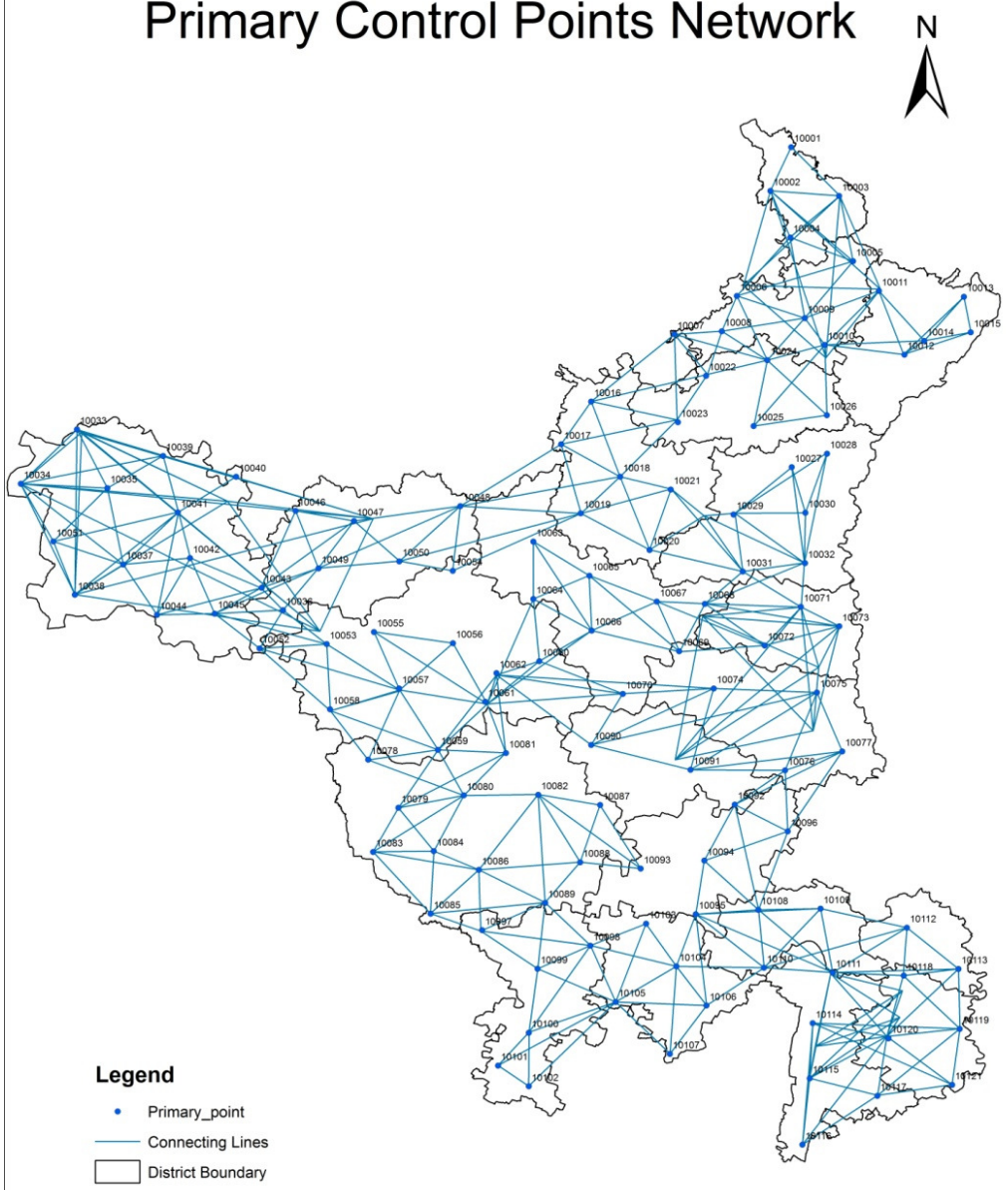
Distribution of Primary Points in Haryana State

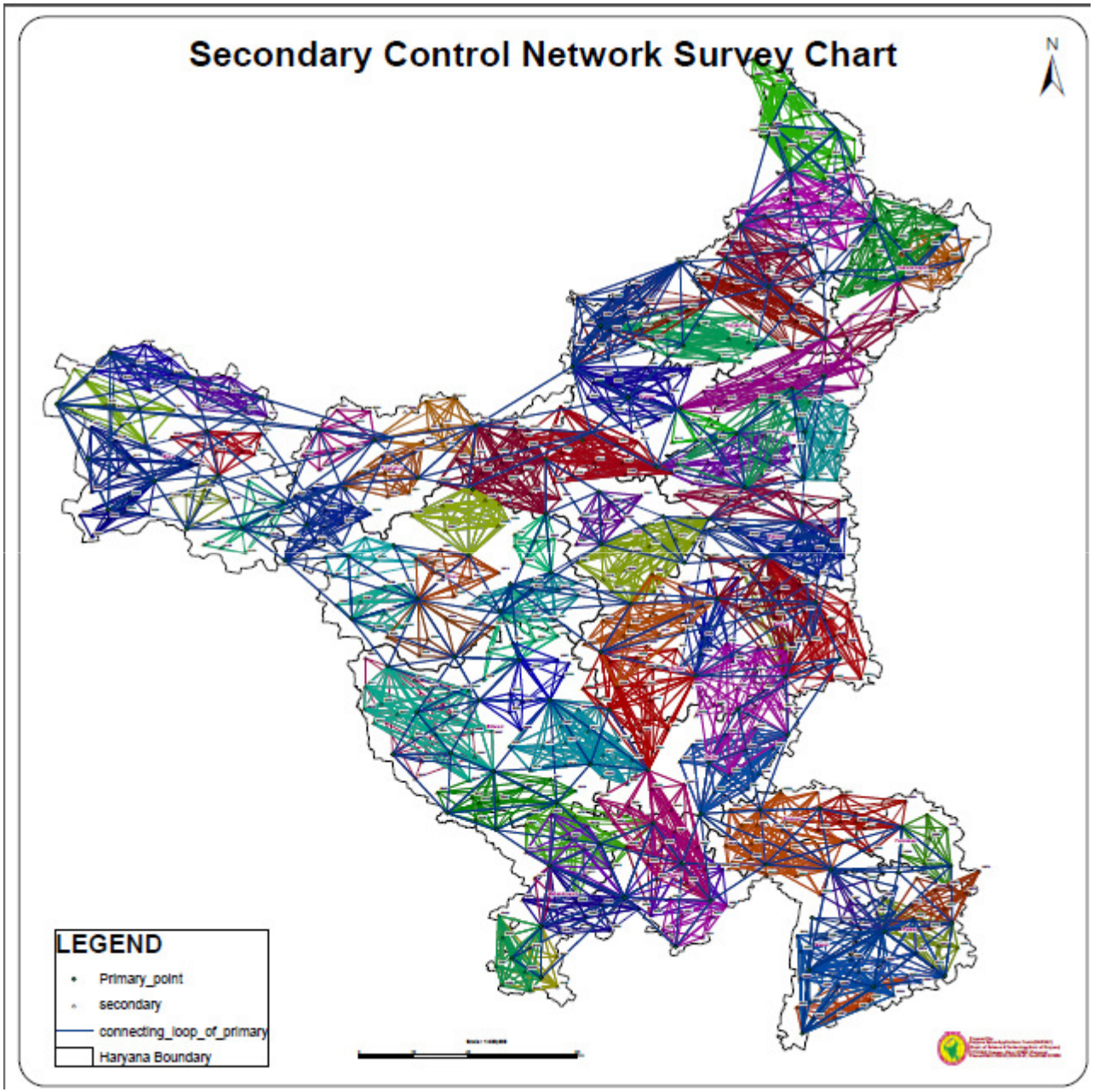


Distribution of primary and secondary points in Haryana


SOI Control Points Network
N
Ambala
Sirsa
Jagadhari
Panipat
Ismailabad
Gohana
Dabwali
Rohtak
Tohana
Jhajjar
Ratia
Narwana
Jabri
Bharwala
Jind
safidon
Adampur
Hisar
Hansi
Bawal
Sonipat
Siwani
Rohtak
Bhiwani
Sungurpur
Charkhi Dadri
Jhajjar
Loharu
Kadma
Jasail
Sohna
Rajwal
Narnaul
Bhadas
Hodal
Legend
SOI points to validate
SOI for Primary Network Adjustment
SOI points to validate Primary Network
SOI points to validate Secondary Network
District Boundary
base length

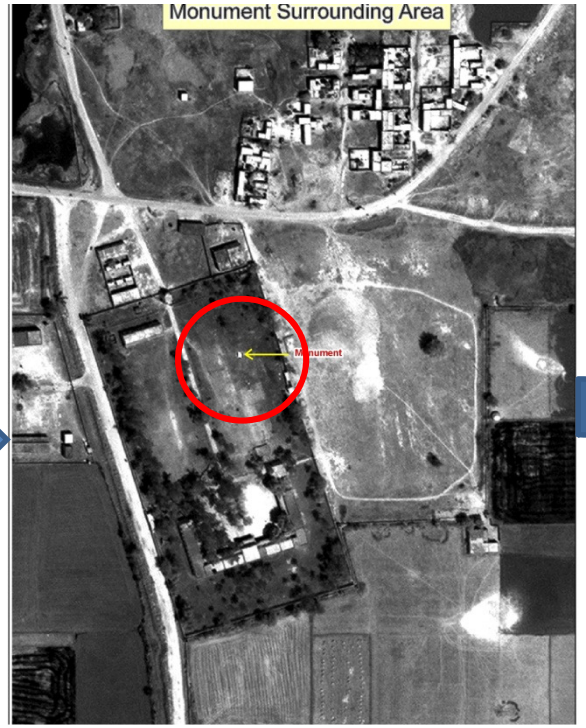
Primary Control Points Network

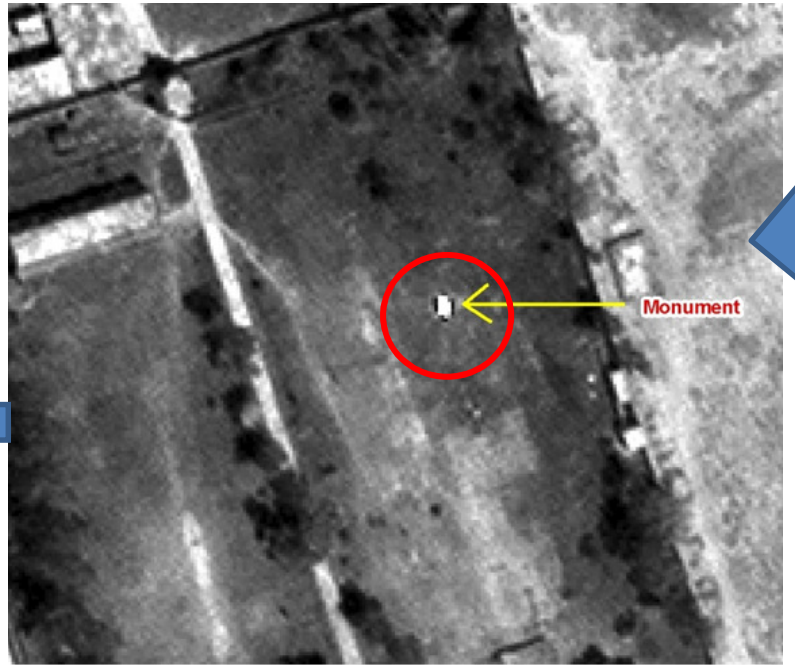


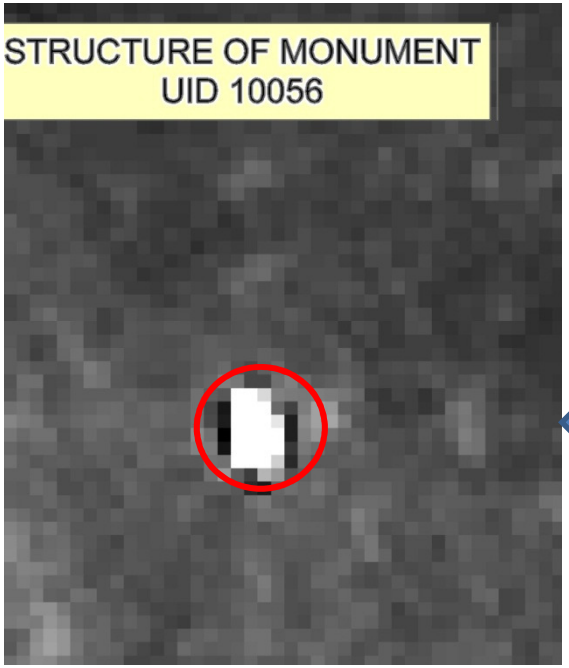

Secondary Control Network Survey Chart
N
LEGEND
Primary_point
secondary
connecting_loop_of_primary
Haryana Boundary

Visible primary point on imagery

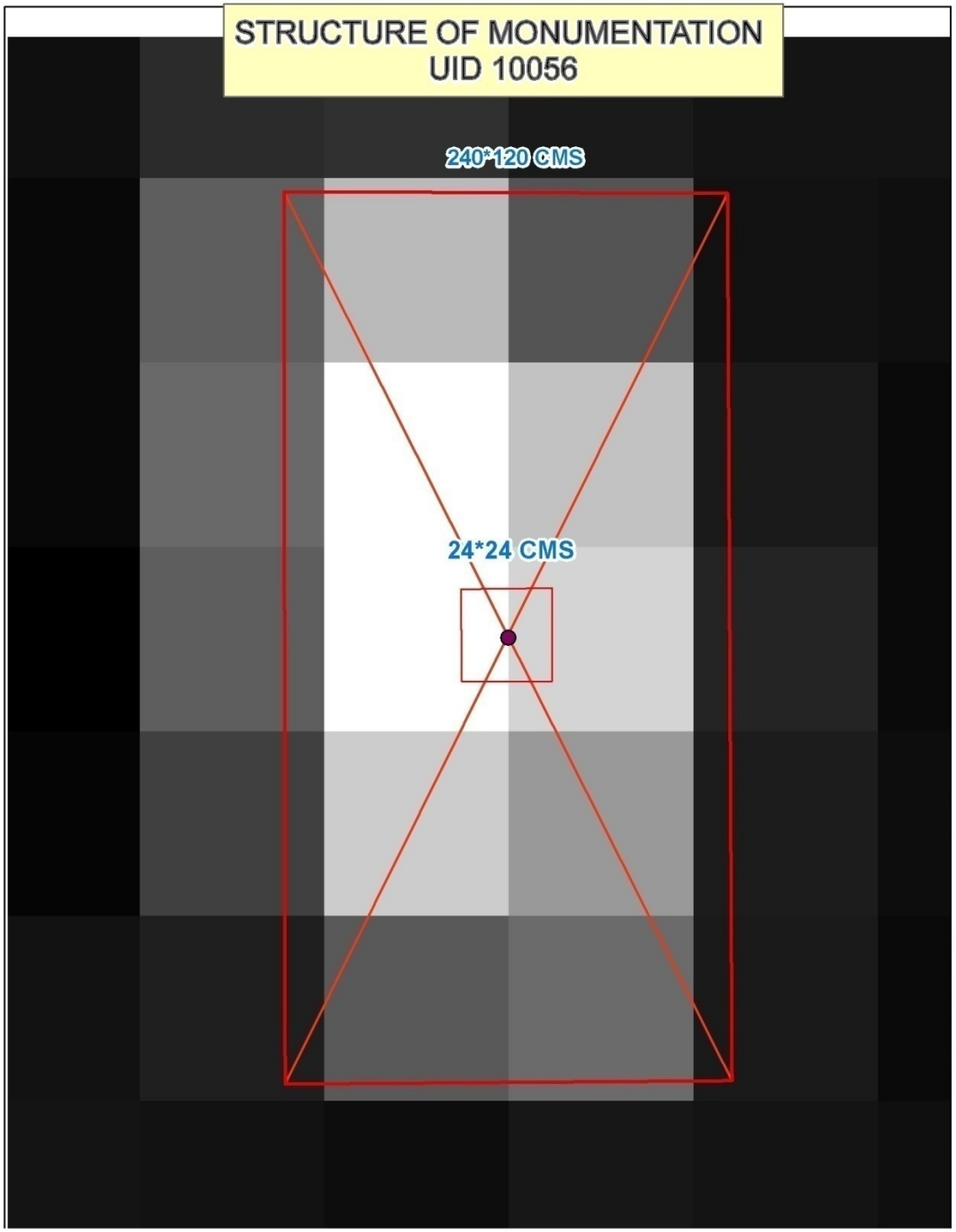

Monument in Rajli Village
Rajli
Monument


Monument Surrounding Area
Monument


Monument


STRUCTURE OF MONUMENT
UID 10056

STRUCTURE OF MONUMENTATION
UID 10056



Digging the pit for central pillar of primary point

Installed primary point

DGPS machine installed on primary point

Installing Secondary point

Installing code strip on secondary poly rock

Secondary point after installation

Field quality check

•First field quality check was carried out in the field immediately after the observation session.
•The station log was checked to ensure any instrument or power problem.
•The status of satellite observed was noted in log.
•The data was checked by importing in processing software (TBC).
•The position of the point and the duration of the observation was checked.
•Review the downloaded field file for correctness and completeness.
•Antenna height was checked for correctness.
•Compare the different observations of the same stations to check for discrepancies.

Transfer of benchmark heights using auto level and DGPS

•SOI benchmarks were identified

•Level transferred to the open sites where the level point was at congested site

•DGPS observation taken on the transferred points and connected to the network.

•Level transferred to primary points from the benchmarks through spirit level.

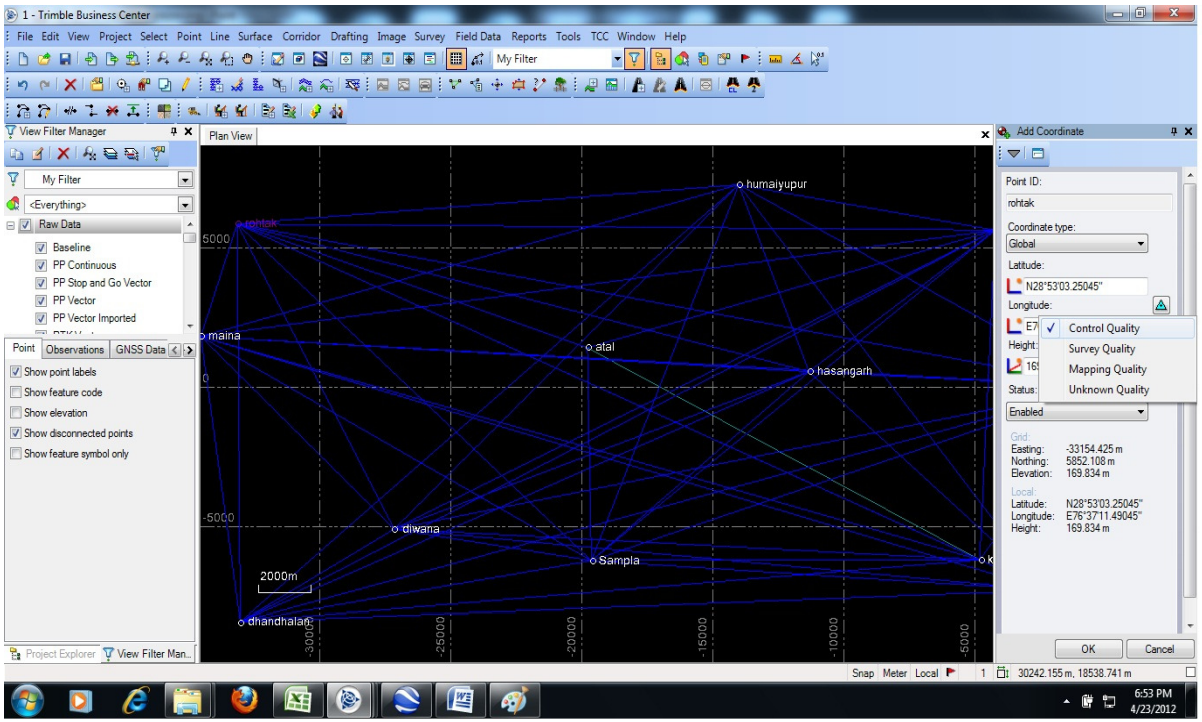
Data Processing:

•Baseline generated: Baselines are generated by importing the data of same session. The baselines are created and all the points are connected through base lines which have simultaneous observation.

•Processing the Baselines:
All the attributes of processing (e.g. cut off angle, acceptance criteria, data beat) are set and whole baselines of the project are processed.

•Removing the weak and faulty baselines:
Baselines those have high error or there solution is “Float Solution” are deleted and the healthy baselines are used to create the network.

•Points which have no connection or the points which are connected to the network with weak baselines are rejected or their values are checked with the values calculated by resurvey of that point.



Processing DGPS Data in Trimble Business Center

•After importing all the station files in the Trimble business center (TBC) the vector lines are generated between the stations which have simultaneous observations.

• Then the vectors are processed and a network with healthy baselines is generated.

•By fixing few points with known coordinates the network is adjusted and the coordinates of rest of locations are calculated.

Rework:

The rework/resurvey is carried out and the conditions are following:

After the primary quality check and pre processing, the points which are floated during the processing are considered for the resurvey. The point floating can be occurred due to many reasons like there is no enough number of satellites at the time of observation or the point is distant from the other points in the network. The list of these points is prepared.

During the processing the points are identified which are at weak position in the network are considered for resurvey. The list of these points is prepared. The resurvey is planned in the way that weak points and floating points are surveyed in common networks.

Rework due to data error at field: Some data was found corrupt while converting from raw format to RINEX. Either the size of the data is very low or the .RXN and .RXO files are not created.

SOI data integration and collection:

Integration:

•SOI points are well integrated in the primary and secondary network.

•Some of them are used to adjust the network and rests of them are used as checkpoints in primary network as well as secondary network.

Collection:

•SOI points were identified at ground with the help of description given by Survey of India. The points are plotted on available maps to know the surrounding and location of the points.

•Screenshots of the points and the description are very helpful to find the exact stone/pillar.

•Many of the points are in good conditions but one of them (station Indri) is dumped. After digging, the point is identified.

•Interaction with the local people is very helpful.

Coordinate pillar of Survey Of India

SOI point identified with the help of local people

Challenges and solution

•Level transferring to the points was the main problem faced during the project.

•The provided known level points were not well distributed trough out the area.

•They were in linear pattern (like along the national highway NH-1)

•Spirit level transferred to the points where possible (Shahbad, Rohtak)

•DGPS observation taken on the benchmarks and connected to the network.


Small Efforts May Lead to Big Results
THANKS