



# A New Methodology for an Automatic Evaluation Procedure of Cadastral GNSS Measurements According to the Surveyors' Regulations

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## Motivations

- **Digital Cadastre** – grid coordinates as the main prove in the court.
- Cadastral points' coordinates should be computed in high accuracy level according to the surveyors' regulations.
- The SOI goal for cadastral boundary point coordinates – **5 cm in 95%**





Pedant goal

## Motivations


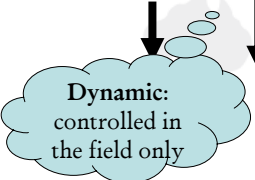
- The **surveyors' regulations** instructions might be **complex** for achieving this pedant goal.
- When licensing cadastral measurements: Surveyor has to deal with the boundary point similar to control point.
- RTK GNSS technology be the T.S of the future.
- Survey agency will suffer from **huge number** GNSS cadastral projects for licensing.



## Motivations

- The **waiting time** for licensing process will be **long** than usual... 
- The surveyor might have his **report** after long time with **failed results**. 
- Reasons for failing licensing points may be divided into two parts:
  - Low quality of GNSS observations.
  - Poor understanding of the regulations instructions

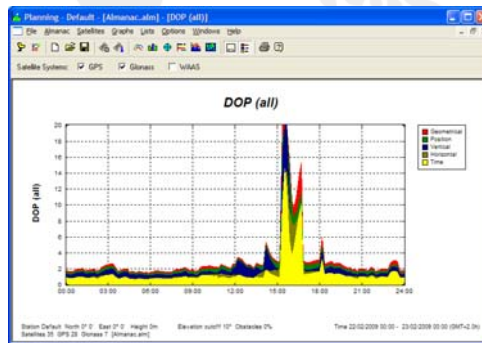
## Motivations

- Most significant factors that affect GNSS observations quality are: 
  - **Satellite Constellation** (position and number)
  - **Signals Quality: noises** around the GNSS receivers (SNR)
  - **Distance** between GNSS receivers 
  - The location of the receivers: **multi-path** phenomenon

## Low unexpected DOPs values

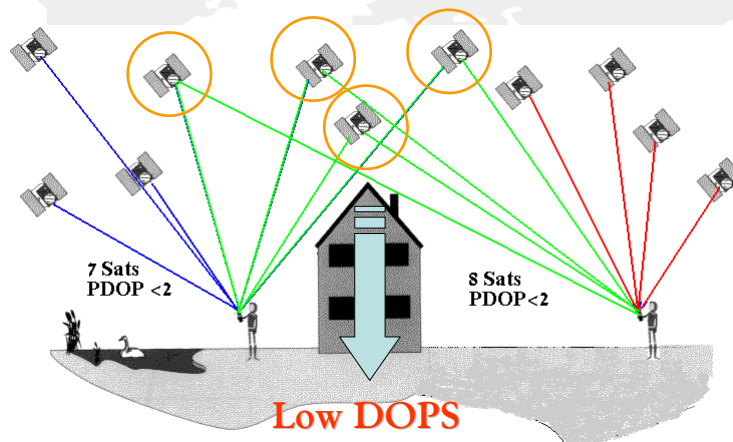
- Most of the survey agency required **DOPs** values  $< 5$  for accepted GNSS observations.
- Mission planning for the GNSS satellite could help surveyors avoiding period times with low DOPs values:

Surveyors can also watch their GNSS receiver's DOPs while measuring...



## Low unexpected DOPs values

- Are these operations sufficient for good **DOPs**?



## Poor understanding of the regulations instructions

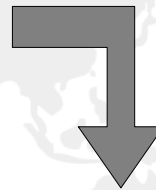
- **Complex regulations'** instructions leads to:
  - Uncompleted submission data,
  - Incorrect computations...
  - Insufficient consideration for the instructions



Surveyor prepare the final report for submission



Regulations Instruction



Survey agency Validate the report

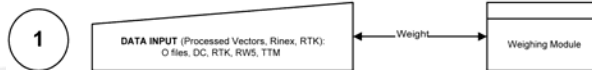


## An Automatic Effective Solution Software

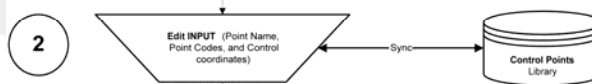
- Major<sup>®</sup> is designed for helping:
  - Surveyors:
    - For quick preparation of GNSS measurements project final reports for submission against regulations...
    - Minimizing the uncertainty of the report validation results.
    - Understanding their regulations.
    - Managing their GNSS projects in geodetic mentality.
  - Survey agency:
    - Minimizing the validation and licensing process time
    - Maximizing the reliability of the validation

### Major<sup>®</sup> concept is existed in final patent registration process

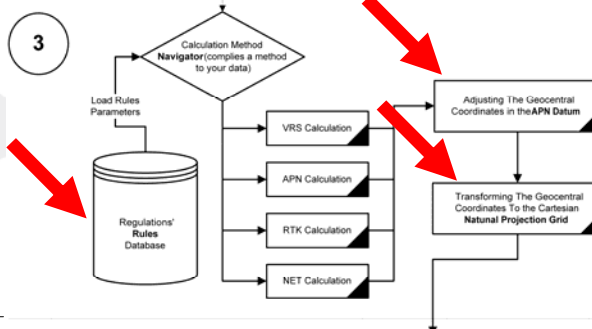
Data input



Editing data:  
Defining points  
types, known  
coordinates



The main algorithm:  
Defining your own  
regulations



Choose your desired  
method and run  
report



## Example

### Israeli VRS method as a study case

- Every New horizontal and vertical control point must be linked to the Active Permanent GNSS station Array
- The example method is one of several methods designated for licensing S1 degree New Horizontal Control points (NHC)



## Israeli VRS method as a study case

1. Every NHC point must be measured against two different VRS.
2. Between two measurement sessions:
  - Minimum **60 minutes**
  - **5 cm** - Antenna height
3. VRS points < **5 km** from each NHC.
4. At least one Checker points linked directly to one VRS.
5. The difference between the measured and computed IG2005 coordinates and its licensed coordinated < **4 cm**.

## Israeli VRS method as a study case

6. The distance of the checker point  $< 10$  km from every NHC.
7. The distance computed from the coordinates' differences between the two independent VRS sessions of every NHC  $< 2.5$  cm level.
8. The GNSS PDOP **single station** measurements **values** for each point  $< 5$  level **during minimum 15 continuous minutes**.
9. The GNSS PDOP **multi-station** vector **values** for each vector in the net  $< 5$  level during **minimum 15 continuous minutes**.

## Movie



Run Software – VRS  
Method



Major as international  
software

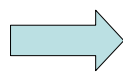


## Summary

- **Major**® : automatic computation and validation of the regulations' instructions.
- Several regulations instructions' method exist in the **Major**® library.
- **Major**® has several automatic cadastral-geodetic-oriented features such as:
  - Automatic weighting method for RTK vectors.
  - Point description
  - Library licensed control points

## Summary

- New method could be generated and added to the library - **Major**® suitable for all other countries.
- Rinex module could be work as stand alone for validate the GNSS observation directly when getting reports.
- The **Major**® is designated for web-base cadastral report automatic management system.
- Integrated work between surveyors and survey agency using **Major**® :



Establishment of high accurate and reliable digital cadastral database



***Thank you for your attention...***

