

Technical Aspects of Converting Analogical Cadastral System to Digital System

A Study Case in Israel

Jad Jarroush, Israel

Zeibak & Sabbagh L.T.D



Index

- Project description and task definition
- Standard methodology for fulfilling the task
- The new proposed methodology
 - Technical challenges
 - Application development for execution the mission
 - Looking for authentic points
- Results
- Recommendations



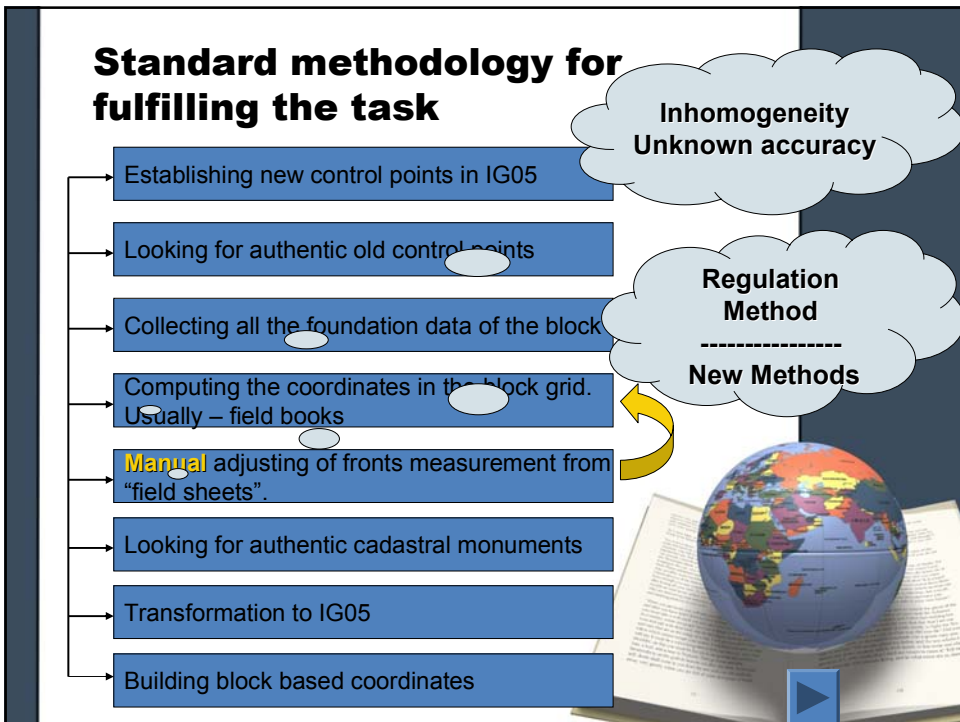


Project description and task definition

Project description and task definition

- In the year 2006, the Survey of Israel (SOI) published a tender for converting sixty cadastral blocks, bounded to the Israeli seashores, to digital cadastre.
- The mission: **Coordinates in IG05 for each boundary point in maximum accuracy.**
- Four surveying companies won the tender.







The new proposed methodology

Three questions were asked:

1. Has the SOI let one surveyor company to perform the entire mission for the whole block individually?

– Advantages:

- Working in parallel – minimizing the time.
- Higher accuracies of the results

– Disadvantages:

- Complicated management mission.

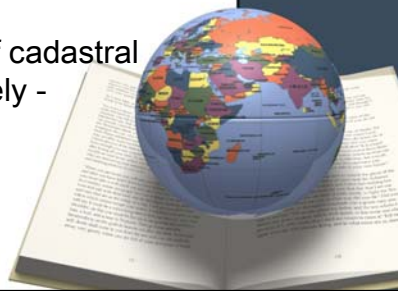
2. How could surveyors achieve highest accuracy and homogenous results?

3. Since it is very important: Is it possible to start immediately looking for authentic points without calculating cadastral authentic foundations' data?



Technical challenges

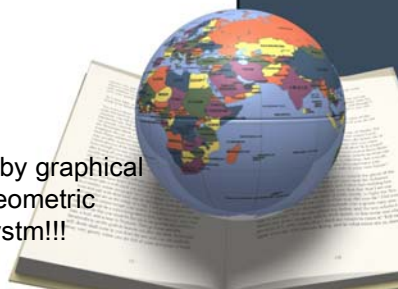
1. Least Squares adjustment with constraints - **computing local grid coordinates.**
2. Trying to avoid “**Kasini Soldner**” controls - low and inhomogeneous accuracy.
3. Looking for maximum number of cadastral authentic monuments immediately - **transformation method !!!**

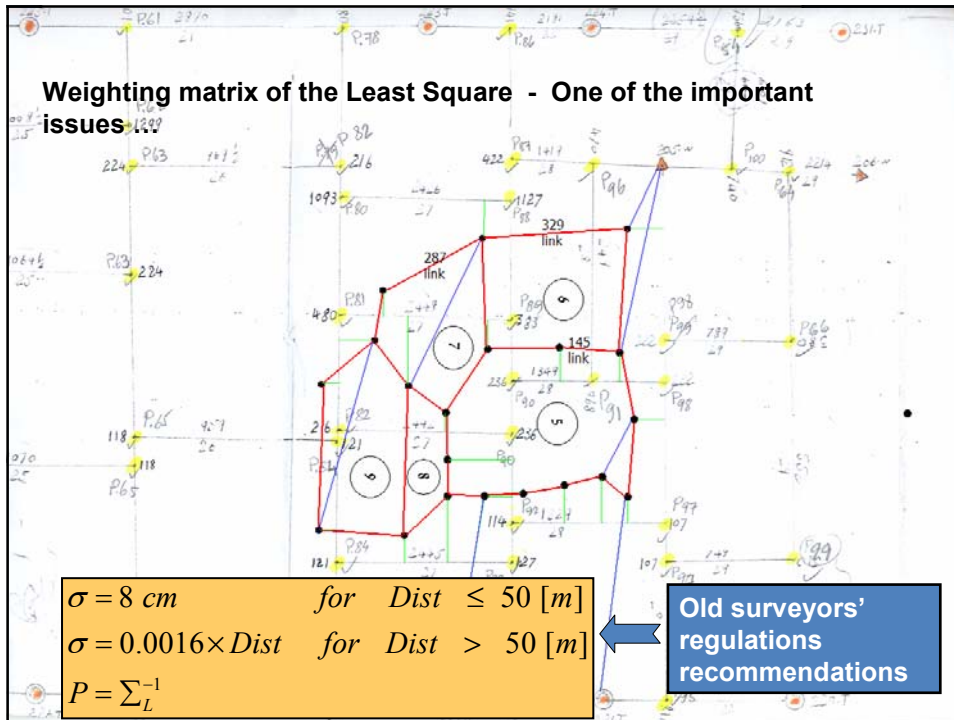


Technical challenges

Least Squares

- Using the known **Least Squares** formulas when measurements **mostly** are:
 - Chain method measurements.
 - Run distance along line.
 - Offset perpendicular
 - Fronts between boundaries' points (distance)
 - Linkage boundaries to control points (distance)
 - Intersection between lines.
 - Cross distance.
- Geometrical Constraints:
 - Parallel lines.
 - Points in one line...
- Since parcels areas were computed by graphical methods they do not play a role of geometric constraint in the same adjustment system!!!





Technical challenges

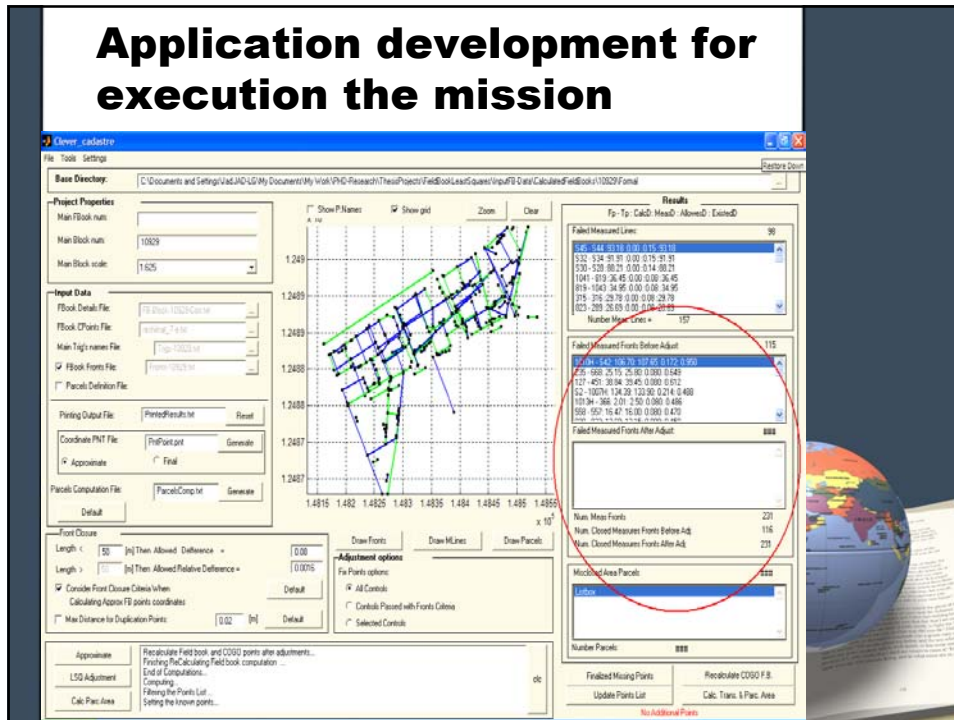
Avoiding "Kasini Soldner"

- Avoiding "Kasini Soldner" old grid of Israel was not possible because of too few authentic control points were found.
- It was not sufficient to solve the "defect" of the field book network.
- Transformation process from Kasini soldner grid to the IG05 was investigated including looking for authentic points.

Block was treated as a suit which we have to sew it from different material – then some body have to dress it (transformation)...

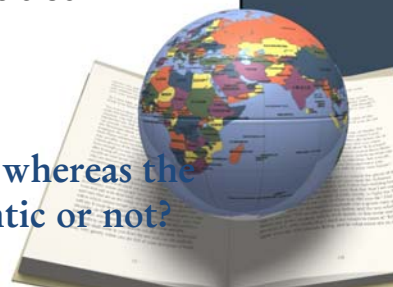


Application development for execution the mission



Looking for authentic points

- After one block execution (pilot): the field staff start looking for authentic points using digitized boundaries coordinates taken from the national cadastral GIS layers.
- Old Kasini controls points were also included...
- The main problem is:
 - How could staff decide whereas the founded point is authentic or not?



Looking for authentic points

- Digital photos for cadastral experts



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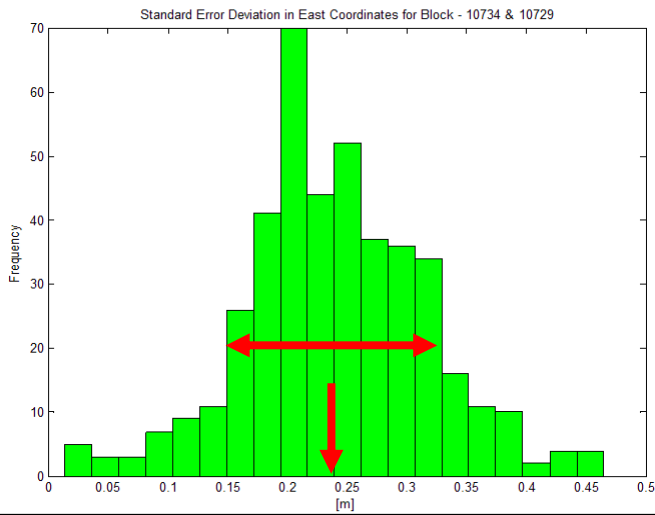
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Results

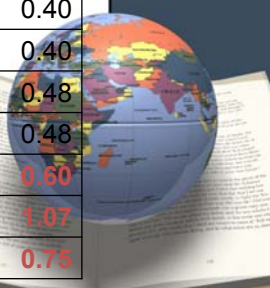
Results



Results

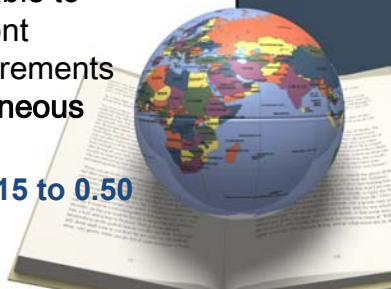
Standard error deviations of authentic boundaries positions were compared against their true position and the results meet their values...

Block	σ_{North}	σ_{East}	Max North	Max East
10929	0.13	0.14	0.30	0.30
10818	0.18	0.15	0.35	0.35
10749	0.35	0.35	0.55	0.58
10750	0.35	0.35	0.55	0.58
10744	0.23	0.19	0.42	0.40
10742	0.23	0.19	0.42	0.40
10729	0.23	0.18	0.45	0.48
10730	0.23	0.18	0.45	0.48
10727	0.35	0.35	0.55	0.60
10719	0.50	0.57	0.80	1.07
10718	0.45	0.37	0.66	0.75



Results

- Adjustment system of each block contains between 350 to 600 cadastral points.
- More than thousand measurements takes part in building every block and its parcels shapes...
- The Least squares method was able to close more than 90% from the front measurements with those measurements taken from field books – **Homogeneous results... Unusual results**
 - Accuracies of points were: **0.15 to 0.50 [m]**,
 - **Most of them around 0.25 [m]**



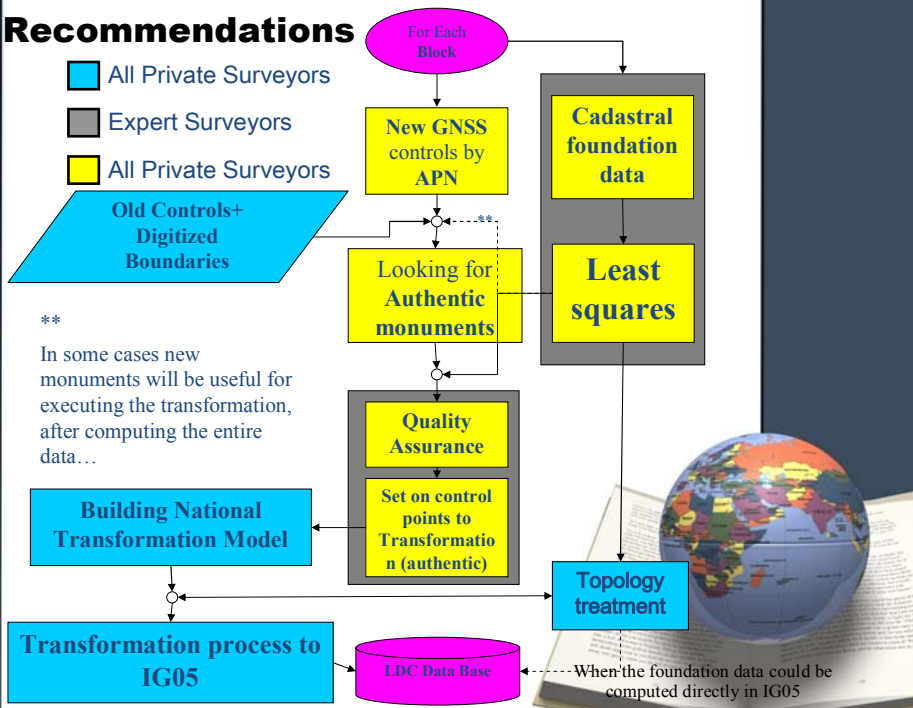
Recommendations

- All Private Surveyors
- Expert Surveyors
- All Private Surveyors

Old Controls+ Digitized Boundaries

**

In some cases new monuments will be useful for executing the transformation, after computing the entire data...



Recommendations

- Strong recommendation to start:
 - Working with Least Squares ...
 - Start immediately to look for authentic points in all over the country, because:
 - They are disappearing with time...
 - More authentic points – increases the accuracy of the Legal Digital Cadastre database...



**Thank you for
listening**