A Method For Building Legal Digital Cadaster Without Using Cadastral Measurements Field Book Data – Is It Accurate Enough?

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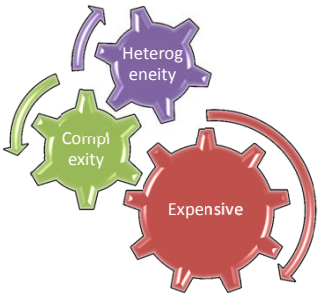
Motivation

- Building the Legal Digital Cadaster is an Israeli national task:
  - High costs
  - Very complex
  - Non-homogenies results caused by lacking of technical instructions in the surveyors' Israeli regulations



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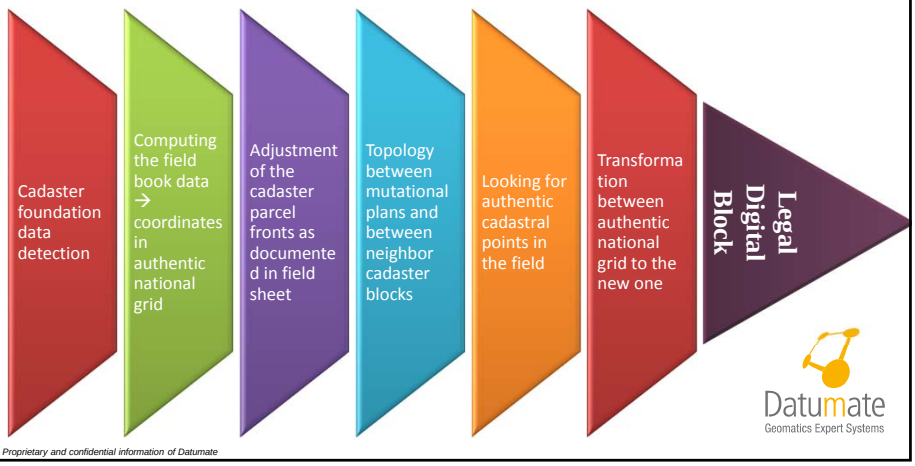
Motivation

- The main geodetic processes required for fulfilling the task:



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Motivation

- Previous researches prove:
  - Usually, boundary points' coordinates accuracy: 15-50 cm in 95% confidence level.
  - Despite the marginal efforts invested the accuracy is not impressive!
  - The marginal effort → Computing the field book data
  - When in most cases: **field books are lacked**…

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The Problem Definition

- The main principle of the solution is:
  - Try to define boundaries without using of field books! What is the optimum result that could be achieved and how?
  - According to the Israeli surveyors' regulations: when there is no field book:
    - Only the SOI digitized coordinates should be used.
    - Legal fronts from field sheets should be adjusted.
    - Legal registered areas should be adjusted as well.

Improving the digitized coordinates for legal fronts and areas adjustment

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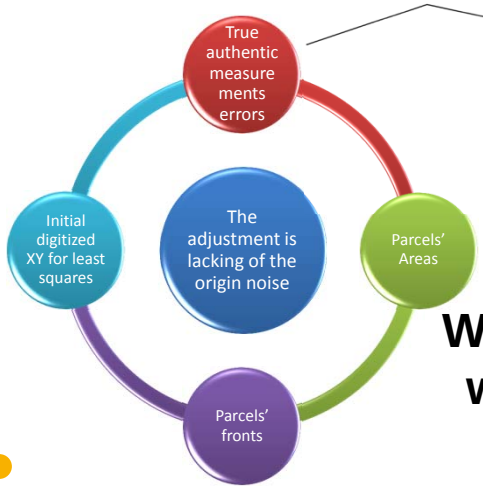
The Problem



Error noises could be extracted only from the FB despite the motivation is to ignore it !!!

What can we do?

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The Proposed Solution

Automatic extraction of **virtual** field book measurements' data

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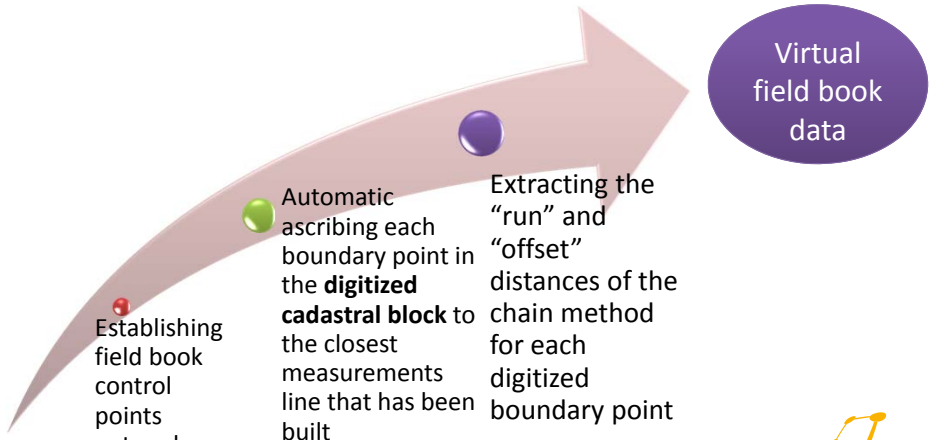
The Proposed Solution



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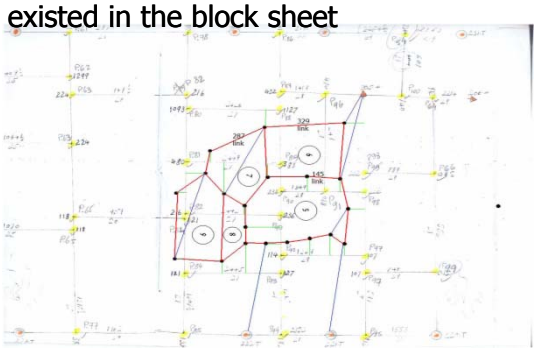
The Proposed Solution

- If field book is existed the field book **control network** should be derived from the first page original data.
- If field book is lacking: a **virtual FB control** network could be derived manually or automatically and arbitrary from the control points existed in the block sheet



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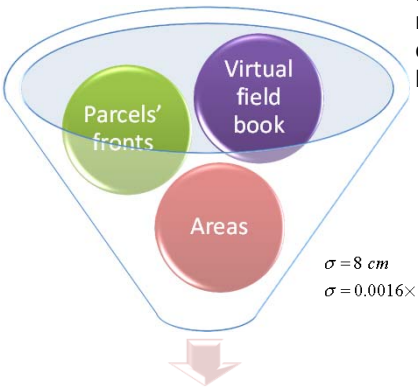
The Proposed Solution: Least Square Adjustment of All the data

Reducing the weights of the virtual field book data



Field authentic monuments consideration for better results

The accuracy of the virtual data computed by adding 0.5 mm in the cadastral block paper sheet scale to its known accuracy

$$\sigma = 8\ cm \quad for \quad Dist \leq 50\ [m]$$
$$\sigma = 0.0016 \times Dist \quad for \quad Dist < 50\ [m]$$

Semi Digital Block

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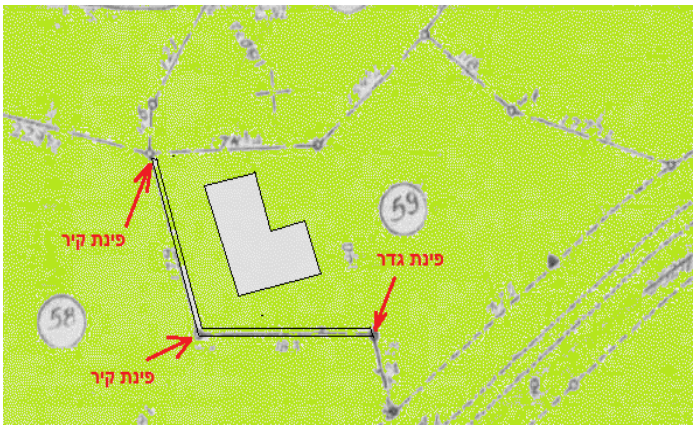
The Proposed Solution



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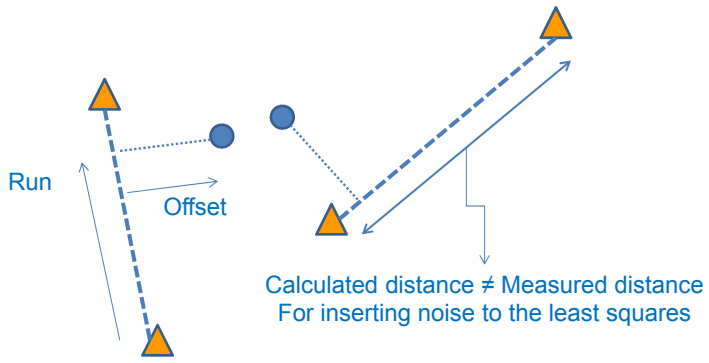
Tools

1. Working with AutoCAD: a function connects automatically every boundary point to the closest line and compute the "Run" & "Offset" distances for each of them:



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Tools

2. Working with AutoCAD:
   - A function provide least squares computations' process of all the data.
   - The same function must enables user to customize changes for the weighting method and its parameters for achieving better results.
   - Measured authentic cadastral points could be added to the least square process as a fixed points for better results.

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Tools

- These functions have been:
  - Full characterization of **Geo-point L.T.D** - a geo-technological, cadaster, real-estate and civil engineering firm.
  - Established by **Omnitech L.T.D** an authorized developer and value added reseller of Autodesk in Israel.
  - The name of the application is "**GeoCadaster**" and it could be shown in "Omnitech" booth in the FIG 2012 working week.

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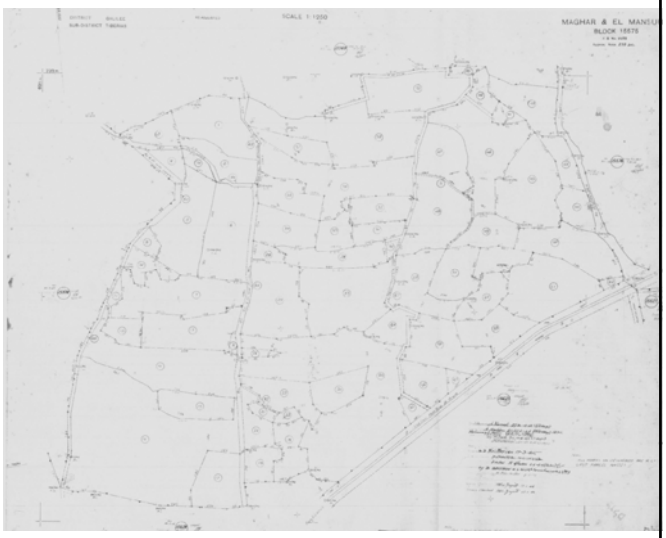
Experiment

- Cadastral block:
  - # 15575:
  - Scale 1:1250



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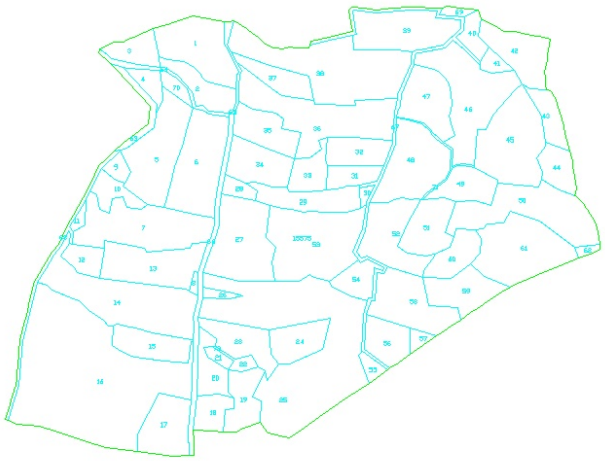
Experiment

- The SOI digitized Block:



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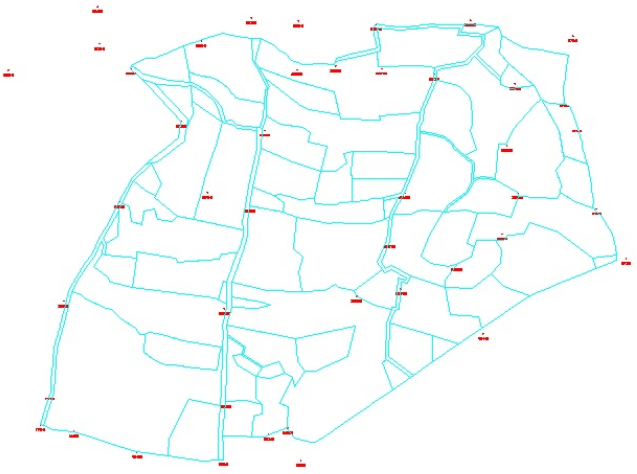
Experiment

- Adding Control points to the digitized layer:



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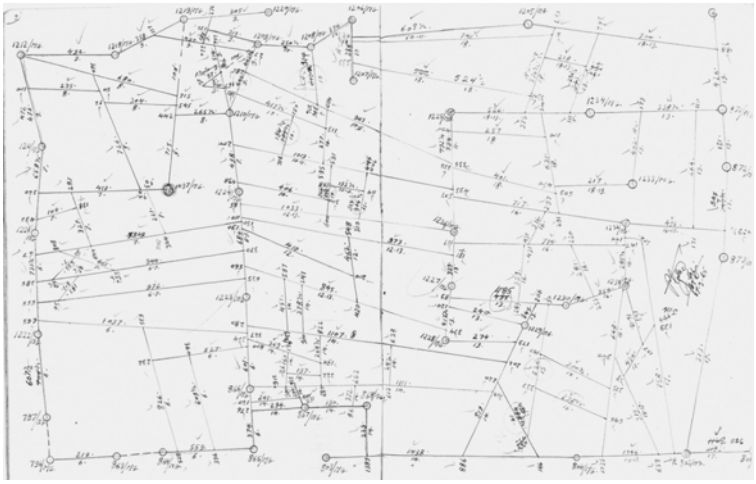
Experiment

- Building the control network from the true field book if existed:



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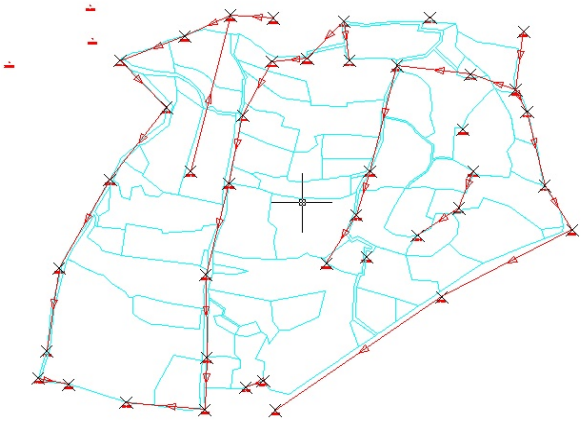
Experiment

- Adding the control network for the same layer to establish the chain method virtual lines:



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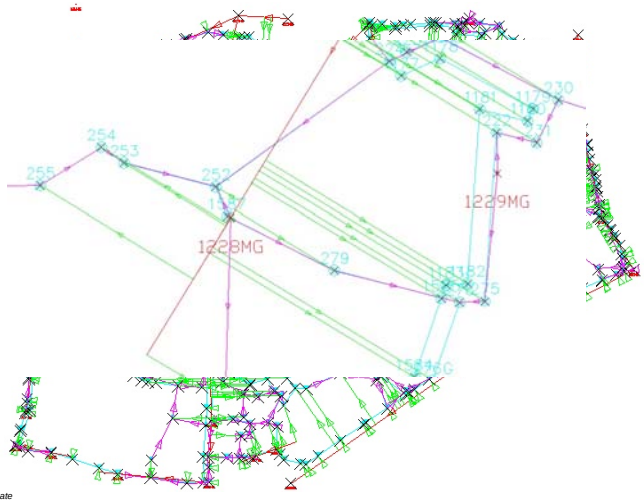
Experiment

- Automatic ascribing of boundary points to the closest chain method's lines.



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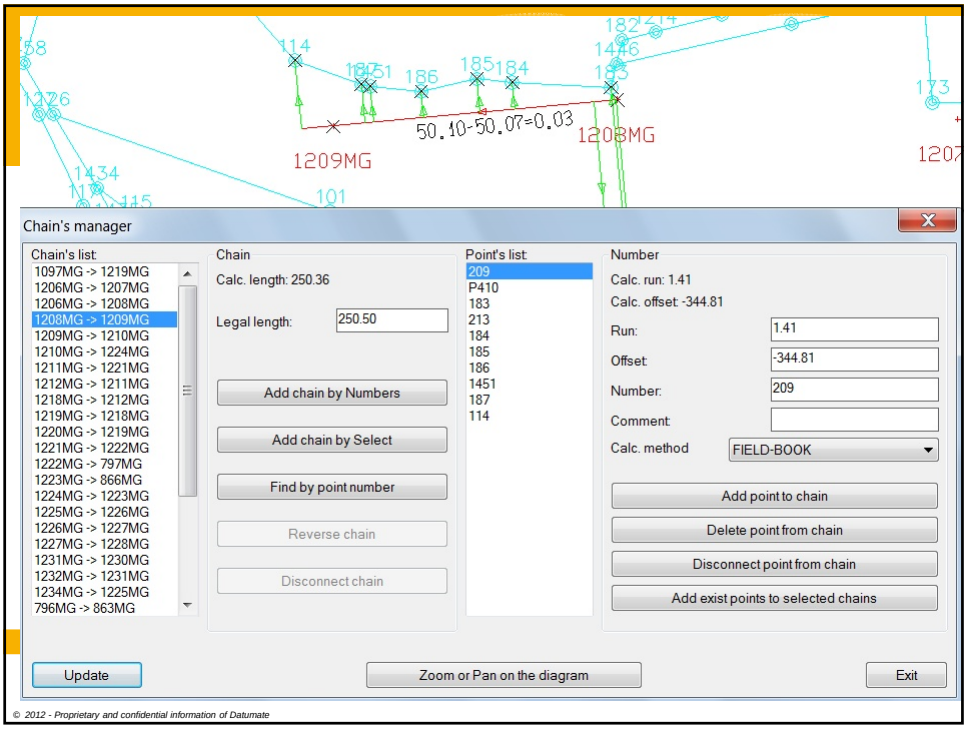

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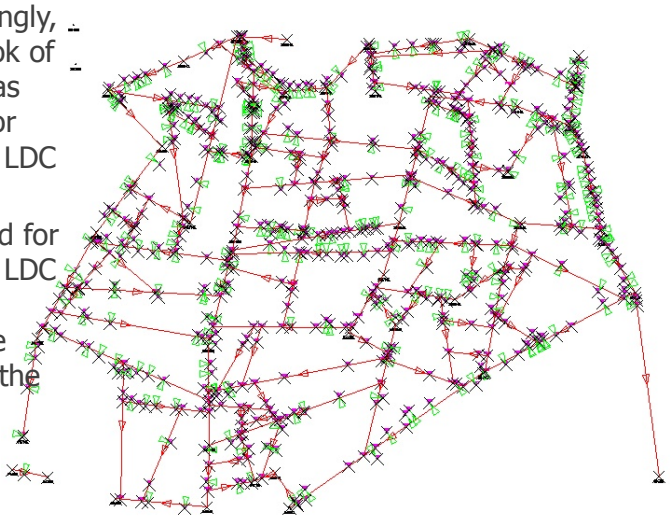
Experiment

- Correspondingly, the field book of the block was calculated for building the LDC block.
- It was solved for building the LDC block for checking the accuracy of the proposed method.



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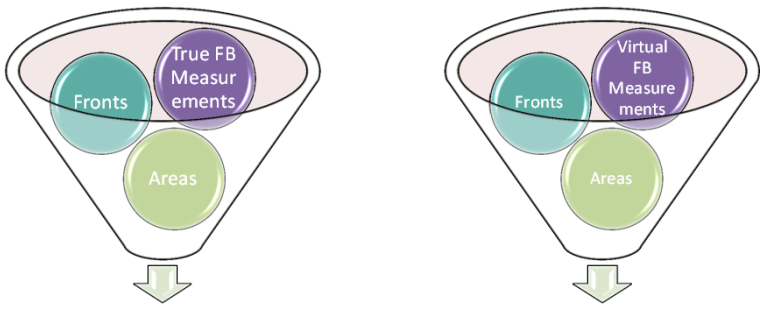
Experiment



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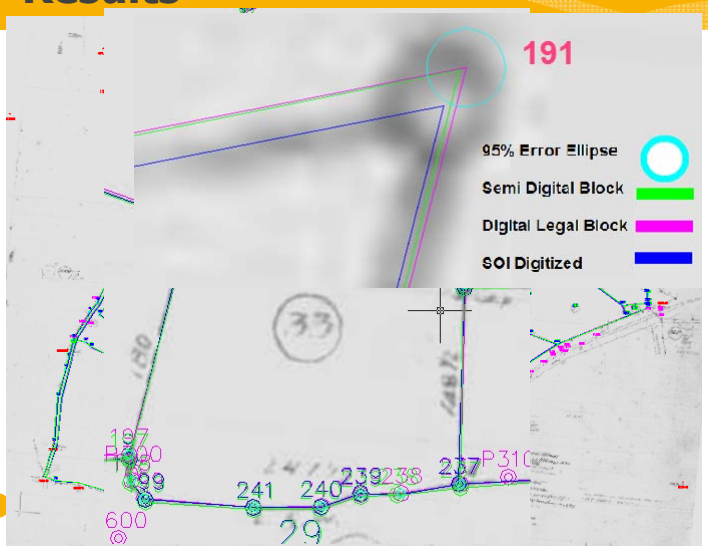
Results



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Results

Survey Of Israel Digitized Block				Digital Legal Block					
After Adjustment Semi-Digital block		Before adjustment		After adjustment		Before adjustment		Description	
100%	319	100%	319	**100%**	**328**	100%	328	Fronts number	1
99%	315	24%	75	**96%**	**314**	24%	79	Fronts meet the criteria	2
1%	4	76%	244	**4%**	**14**	76%	249	Fronts do not meet the criteria	3

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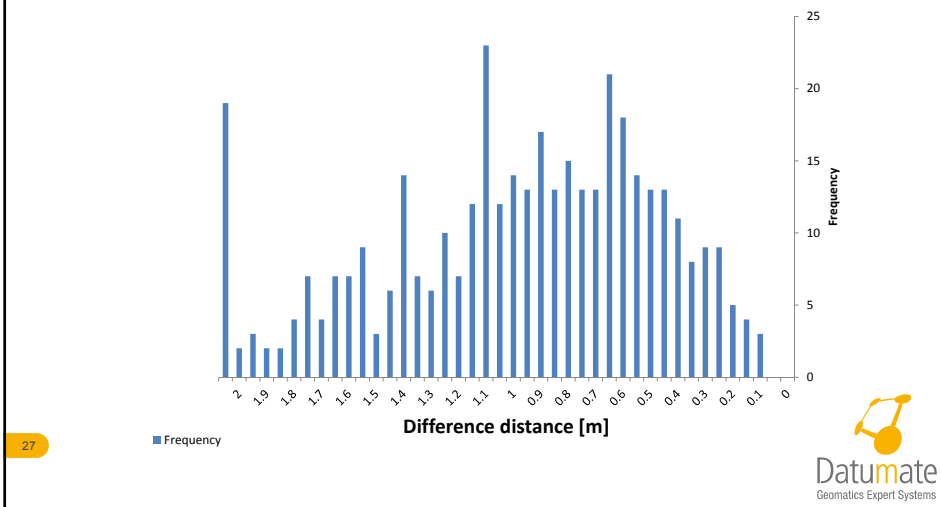
Histogram describes the difference between the position of the **SOI digitized coordinates** and the Legal Digital Block position



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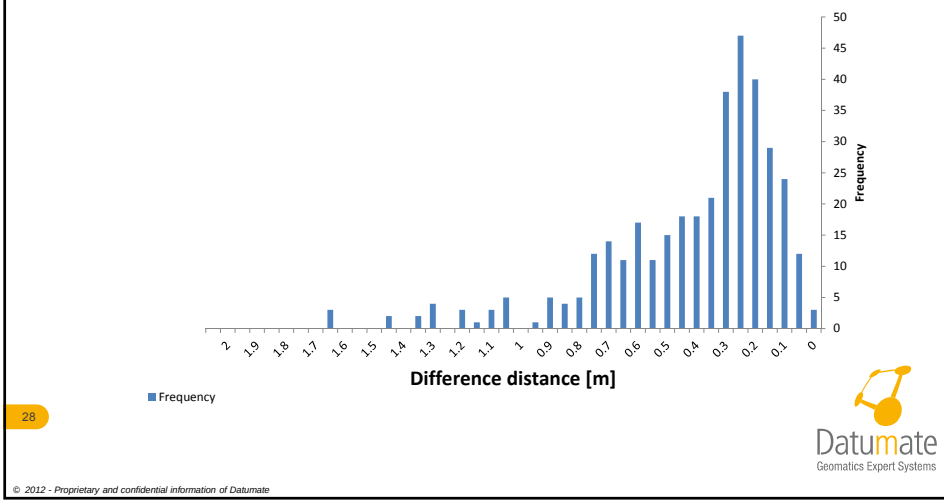
Histogram describes the difference between the position of the **Semi Digital Block** coordinates and the Legal Digital Block position



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Summary

- The Semi-Digital block geometry is similar to the LDC block.
- The Semi-Digital Block could be used:
  - As a base for zoning planes.
  - For establishing the LDC in Israel for blocks that have no field books existed.
  - For establishing LDC for agriculture blocks since sub-half meter accuracy could be sufficient for such cases.
  -
- It is important to mention that the cost of establishing the Semi-Digital block is between10% to 20% of the LDC Block.

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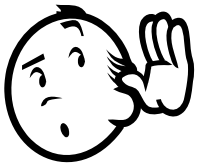
Thank you

Special thanks for:

- **Mr. Dima Brikman – Omnitech**
- **Mr. Alexey Goldalevetch – Geo-point**
- **For you audience for your listening..**



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