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Improved Practical Mechanism for Reconstruction of Old Cadastral Boundaries by Coordinate Transformation

Gershon STEINBERG and Gilad EVEN-TZUR, Israel

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The problem

- Most of the ”old” (1920 – 1994) Israeli cadaster is based on the Old Israeli Grid which was not accurate enough and was replaced by the New Israeli Grid.
- The survey traversing regulations were too liberal, and the cadastral measurements methods and equipment did not fit today’s standards for Coordinated Based Cadaster.

Israeli cadastral regulations (and practice)

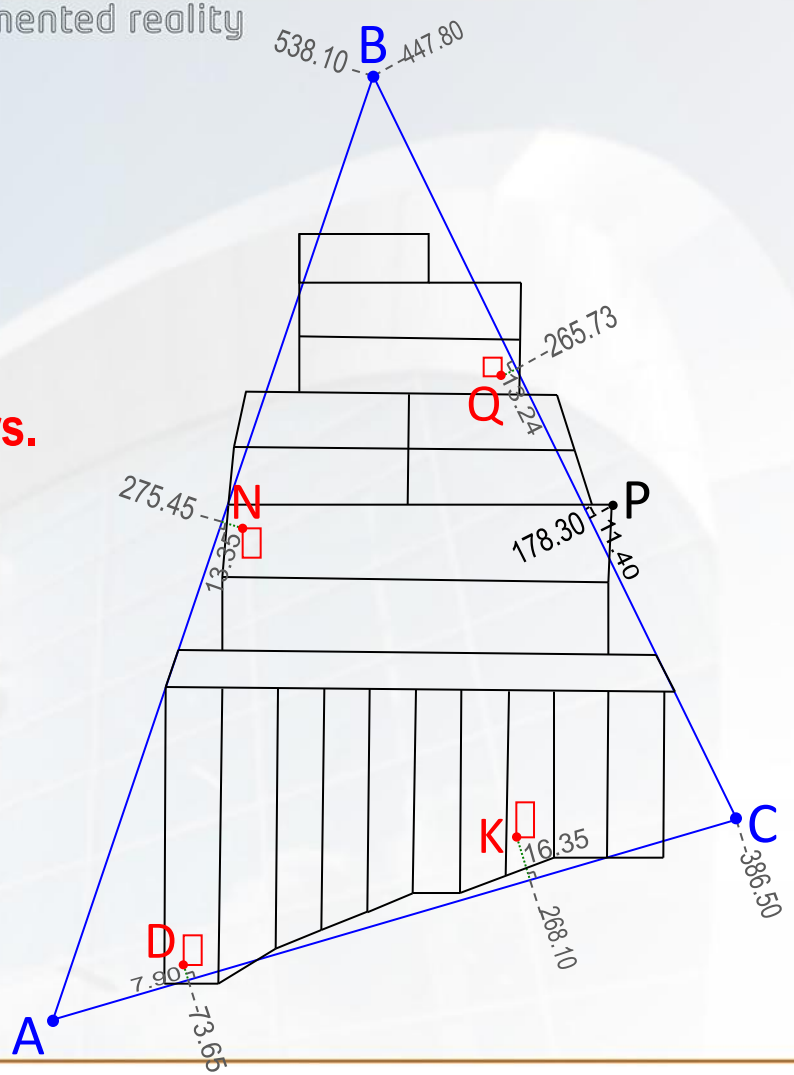
- Old cadastral boundaries are reconstructed by coordinate shifting transformation from the old to the new Israeli grid, based on few original marks which survived the fast development of Israel and are capable for re-measuring.
- We suggest practical improvement aims to achieve better transformation results followed by accuracy estimation of the reconstructed boundaries.

Illustration diagram

A, B, C – Control points.

D, K, N, Q – Authentic building corners.

P – Authentic boundary mark.



Why we need accuracy estimation?

Accuracy estimation of the transformed boundary points coordinates should be used in order to decide whether to accept an existing boundary like fence or wall ("compatible boundary point") as legal.

Because there is a high probability that the fence/wall was build to replace the original boundary mark in the same place.

Focus on one (quite surprising) insight concerning the weighting of the base transformation points

The weighting of the base transformation points dictates the transformation results and the accuracy estimation.

The orthodox weighting approach

- The usual way in a least square adjustment is to weigh the observations reciprocally to their Mean Square Errors.
- The basic control points get the highest weights since they are considered as the most accurate.
- Due to error propagation the boundary marks and their nearby objects get the lowest weights.

Oops, it is wrong in our case!

- The highest weights should be given to the authentic boundary marks and their nearby authentic objects.
- Authentic marks prevail since they exsisted before they were measured.
- The new measured coordinates of authentic marks can not be changed.

Unorthodox weighting approach is needed

- Reversed error propagation:

  From the original (authentic) boundary marks to the basic control points in the old grid, on which the cadastral survey was based.

Practical initial weighting recommendations

The weighting is reciprocal to the square of the recommended following accuracies in each direction (y or x)

Base transformation points within the transformed zone:

- Original control or boundary point: ±3 cm.
- None authentic boundary walls or fences: ± 5 cm.
- Authentic objects ("details"): ± 10 cm.

Practical initial weighting recommendations (continue)

Base points outside of the transformed zone:

The same basic accuracy with an addition of ±5 cm error per every 100 meters distance from its closer transformed boundary point to be reconstructed.

Other isues in the paper

- Criterion for choosing the preferred transformation method.
- Rejection of outliers.
- Weighting of base points belongs to the same object.
- Accuracy estimation of the transformed boundary points coordinates.

THANKS FOR YOUR ATTENTION