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A State-of-the-Art National Grid Based on the Permanent GPS Stations of Israel

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FIG WORKING WEEK 2004, 22-27 MAY, ATHENS, GREECE

GPS Measurements since 1993 in NIG

- 4 or 7 Parameters Transformation Based on (at least) 3 Control Points

- The Results Depend on the Chosen Control Points

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New Israeli Grid (NIG) [1993/1998]

Map equations: Transverse Mercator
Reference Ellipsoid: GRS80
Point of origin: 882-M (Virtual point)
φ:31°44'03".817 λ:35°12'16".261
Scale factor on Central Meridian:
  M_0=1.000,0067

ITM
Israel Transverse Mercator

Accuracy: ± 10 cm (1σ)

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Ultimate Goal for Cadastral Boundaries: 5cm (2σ)

⇩

Accuracy of local (new) Control Points: 2-3cm (2σ)

⇩
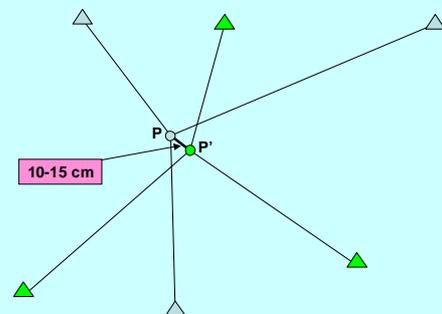
Need to Improve The NIG

⇩

IRN 2005 (Israeli Rectangular Network 2005) Based on the Permanent GPS Stations GIAN (GPS Israeli Active Network)

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10-15 cm

Inconsistency of coordinates due to different basing control points (P and P' are the same point in the field)

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Strategy

A. Decision about the Grid.

B. "Errorless" Coordinates to GIAN.

C. Direct Definition of the New Points.

D. Transforming the "Old" Measurements from NIG to IRN2005.

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GIAN
The GPS Israeli Active Network

- • existing site
- • to be established

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The Decision

(Like in Driving): Be Smart (practical) instead of Right

⬇

Staying with the Existing Projection and Mapping Equations.

(ING and IRN2005 "Can live together" in the Meantime although without reaching the SOI's Ultimate Goal)

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A. Decision about the Grid

(Ref. Ellipsoid, Projection, Point of origin, Scale factor, Origin of plane-coordinates)

Dilemmas and Considerations:

- • A state-of-the-art Grid based on Unusual Projection Parameters?
- • How to Distinguish between NIG and IRN2005: Create a large Shift ?
- • Need to Transform the Coordinates of all the Points measured since 1993 from NIG to IRN2005 before the Move !?

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1st order Triangulation + short-time GPS Observations → GIAN GRS80

IGS + Permanent GPS observations → GIAN WGS84
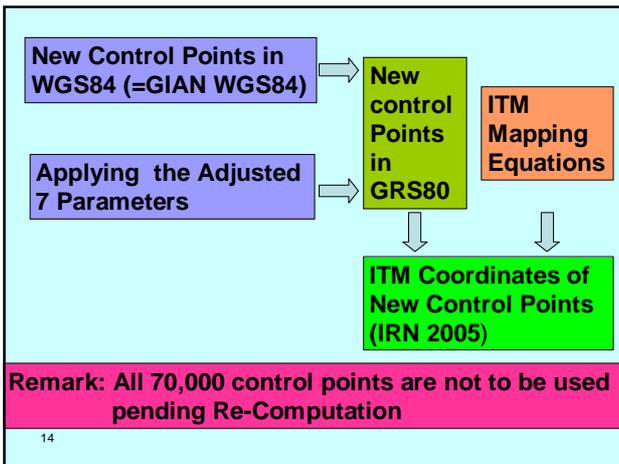
→ 7 Parameters Transformation

⬇

Adjusted 7 Parameters
New GRS 80 Coordinates of GIAN
ITM Mapping Equations

→ "Errorless" ITM Coordinates of GIAN

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B. "Errorless" coordinates to GIAN

New GRS80 ITM Nominal Coordinates to The Permanent GPS Reference Stations is given by Executing a 7-Parameters Transformation and Using the ITM Mapping Equations

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New Control Points in WGS84 (=GIAN WGS84) → **New control Points in GRS80**

Applying the Adjusted 7 Parameters →

ITM Mapping Equations

↓ ↓

ITM Coordinates of New Control Points (IRN 2005)

Remark: All 70,000 control points are not to be used pending Re-Computation

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C. Direct Definition of the New Points

The coordinates of New Control Points (and sometimes other points too) are based on Direct GPS Measurements to the Permanent Stations (as well as with the aid of VRS generated by the acquired software).

↓

Unique solution (± 2cm) for every point

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CONCLUSIONS

• The surveyors' work in Israel is under revolution: very soon it will be possible to measure control points, cadastral boundaries, points for topographic mapping and other engineering surveys, within a few seconds, with one GPS receiver, in Real Time.

• The Survey of Israel is already working to update the survey regulations and instructions, in order to prepare the surveyors, and to be prepared by itself, to the New Geodetic Era.

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D. Transforming the "old" Measurements from NIG to IRN2005

• Measuring about 1000 Control Points that were used as 1st layer for GPS measurements since 1993.

• Re-computing of Control Points based on this 1st layer, followed by Hierarchical Re-Computation of the Control points (about 50,000).

(With the help of a new Geodetic Database that includes the Measurements-Connections between the Points)

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Thanks for your Attention

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