

## Updating and Re-establishment of Cadastral Control Points in Korea by GPS Observations

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## Korea Cadastral Survey Corporation (KCSC)

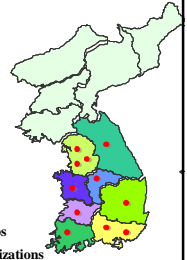
- **Public organization, established in 1938**

- **Nationwide organization network**

- Headquarter, Cadastral Technology Education Institute
- 12 Branch Offices, 210 Local Offices
- 3,800 cadastral engineers & 200 administrative officials

- **Major activities are :**

- Conducting cadastral survey on behalf of the government in accordance with Cadastral Act
- Producing and reproducing of cadastral maps and forest maps
- Supply land information to the public and other public organizations
- Training and re-educating of cadastral surveyors and public officers
- Research and development of cadastral system and technology



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## Main Objectives

- **Improve quality of control network by using GPS observations.**
- **Accurate determination of parcel boundary coordinate in current cadastral surveying.**
- **Provision for converting current cadastral maps into new coordinate system (ITRF) which we will employ sooner or later.**
- **A systematic management of control points and cadastral maps would contribute to realize in the context of cadastral reform project.**

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## Current Situation Analysis(1)

- **Most of cadastral surveys are conducted on a graphical method referred to the preceding cadastral maps.**
  - Survey records are not consistent, largely depend on surveyor's experience
  - Poor management of original survey data and paper maps
- **Parcel Based Land Information System (PBLIS)**
  - 748,000 cadastral maps digitization was completed in 2003
  - Digital cadastral database (PBLIS) is available as of 2003
- **Coordinated cadastral surveying**
  - Tying boundary points to accurate control point is required.

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## Current Situation Analysis(2)

- **Control network**
  - Established in 1910s
  - Bessel ellipsoid
  - 13 baselines
  - 189 points (1<sup>st</sup> order)
- **Problems**
  - 80% of TP were lost
  - No Laplace station
  - Several local coordinate systems are used



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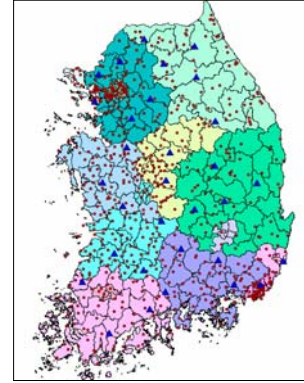
## Research Methodology

- Observe nationwide control points using GPS and find out well adequate control points
- Determine regional control points coordinates (20-50km)
  - Permanent GPS Stations (CORS)
- Construction of local control points (10km density)
  - 1,000 points over the country
- Renew coordinates of existing cadastral control points

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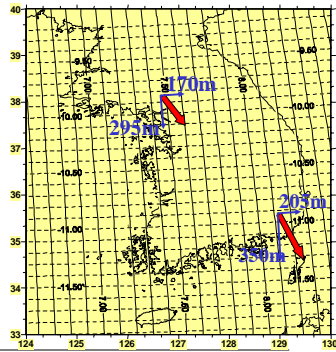
## GPS Observations

- GPS Campaign since 2003
  - 6 times, more than 1,000 observations
  - 170 observations at a time (3 or 4 days)
- 32 Permanent GPS stations
  - 20 to 50 km distance
- Usage :
  - Finding characteristics of current network and fix controls for network adjustment.



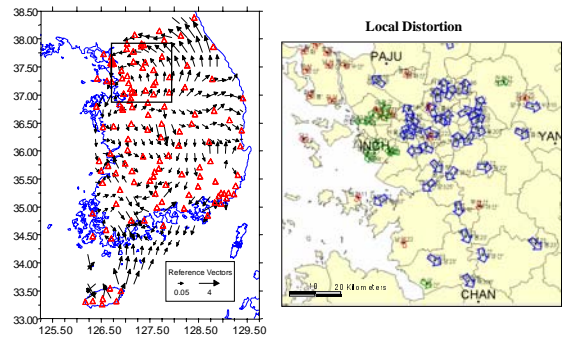
## Analysis – Characteristics of current network

- Latitude
  - -11.5 sec to -9.5 sec
  - 350m ~ 295m southward
- Longitude
  - 7.0 sec to 8.5 sec
  - 170m ~ 205m eastward
- 180 comon points
  - RMS diff. 25cm



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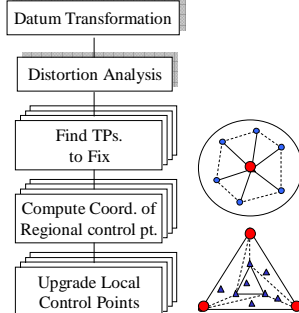
## Analysis – Network Distortion



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## Adjustment Procedure

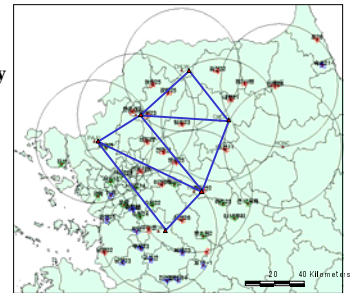
- Find coincident triangulation points by datum transformation
- Adjustments are carried out block by block
- GPS baselines are reduced to the geoid



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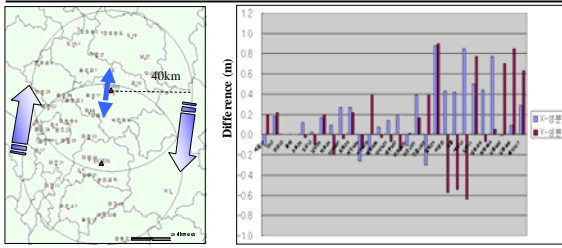
## Adjustment

- 32 triangulation points
- 6 regional control points are computed by using 5~10 TPs.
- The secondary points are adjusted by fixing the 3 regional control points



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## Research results



- Coordinate error of regional control point ranges 5cm to 20cm (5ppm)
- Current control points in cadastral surveying have errors up to 1m
- Adjusted points have errors less than 5cm

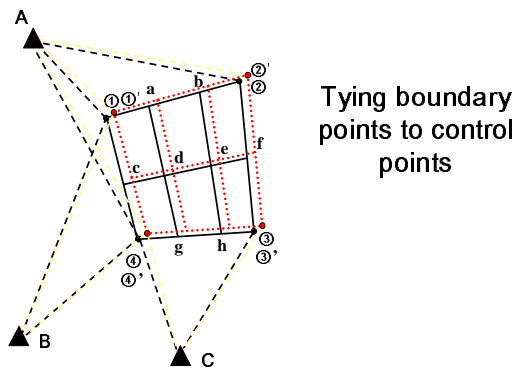
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## Conclusions & Recommendations

- The main objective is to improve quality of the current survey network by GPS observation in order to support for an accurate cadastral surveying in Korea
- It will be much easier to convert the current cadastral maps into a new a new geodetic system such as ITRF
- A systematic management of survey control points using GPS and database technology would contribute to realise in the context of cadastral reform project

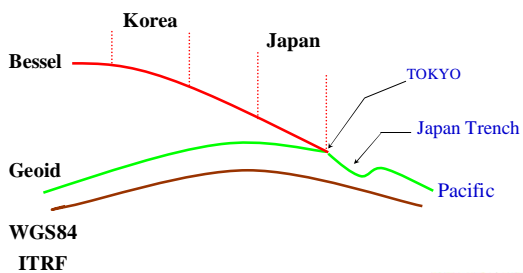
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Thank you very much for your attention !



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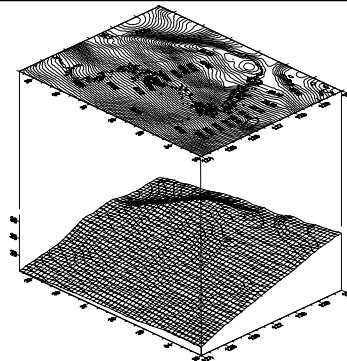
## Datum Transformation – Basic Difference



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## Geoid Height above GRS80



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