FIG Working Week 2012
Rome, Italy 6–10 May

Knowing to: Manage the territory, Protect the environment, Evaluate the cultural heritage

Positional Control in the 1:25000 Cartography

Oporto Region

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Summary

- Why to do it?
- How do we get there?
    - Production steps;
- How do we do it?
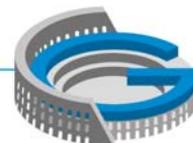   - Positional control;
- Results;
- Conclusion.

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Why to do it?

- National reference entity in the production of geographical information;
- Our information is used in several appliccations (air navigation, territory management);
- Unique institution that has geographic information from all the territory (including rocky islands spread throughout the atlantic ocean);
- Evaluate if the procedures are correct or need to be improved (continuous improvement policy – ISO9001);
- Assess if the invested human and material resources are beeing well managed.

Evaluates if the accuracy of the geographic information produced is within the international standards and suitable for the applications that can use it.

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How do we get there? – Production steps

Oporto block:
- 21 sheets (10km x 16km);
- 1:25000 scale;
- Oporto region and Douro river valley.

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How do we get there? – Production steps

1 - Acquisition of 3D coordinates of photogrametric points:

- Well defined points;
- 12 points per sheet (160km^2);
- 2 3D geodetic control points;
- 292 points were measured;
- Accuracy:
  - (E,N) – 97% < 1cm;
  - H – 80% < 1cm.
- SERVIR CORS network.
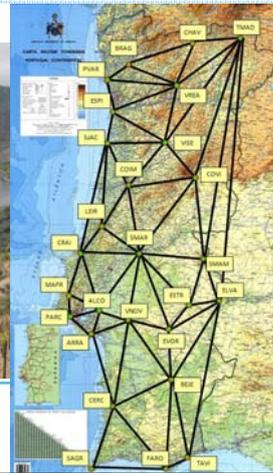
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How do we get there? – Production steps

2 - Aerial triangulation :

- Used only photogrametric points;
- 3D Positional accuracy was verified using 33 geodetic control points;
- "True" (E_{iT},N_{iT},Z_{iT}) vs "measured" (E_{iM},N_{iM},Z_{iM}) coordinates;
- Root Mean Square Error (RMSE):

$$RMSE_{EN} = \sqrt{\frac{\sum_{i=1}^{n}(E_{iT}-E_{iM})^2 + \sum_{i=1}^{n}(N_{iT}-N_{iM})^2}{n-1}} \qquad RMSE_{Z} = \sqrt{\frac{\sum_{i=1}^{n}(Z_{iT}-Z_{iM})^2}{n-1}}$$

- 0.44 m for planimetry and 0.51 m for the vertical component.

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How do we get there? – Production steps

3 – Restitution:

- Interpreting and acquisition of information, according to the Object Catalogue and the Acquisition Rules;
- Consistency of information in all territory;
- Areas, lines and points (cells);
- Photogrametric Operators visual acuity.

Positional Quality control.

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How do we do it? – Positional control

1 – Selection of control points:

- Randomly selected;
- Homogeneous distribution throughout the study area;
- Establish a unequivocally correspondence between the acquired point on the photogrametric workstation and the point measured on the field;
- Objects in which "real" geometry and the geometry of representation in the Maps is the same;
- Walls, fences and roof corners;
- Planned and measured 104 points.
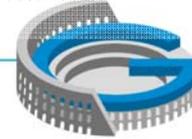
How do we do it? – Positional control

2 – Processing the information:
- Removal of outliers;
- 101 points were considered for the final calculations;
- Root Mean Square Error (RMSE):

$$RMSE_{EN} = \sqrt{\frac{\sum_{i=1}^{n}(E_{iT} - E_{iC})^2 + \sum_{i=1}^{n}(N_{iT} - N_{iC})^2}{n-1}} \qquad RMSE_{Z} = \sqrt{\frac{\sum_{i=1}^{n}(Z_{iT} - Z_{iC})^2}{n-1}}$$
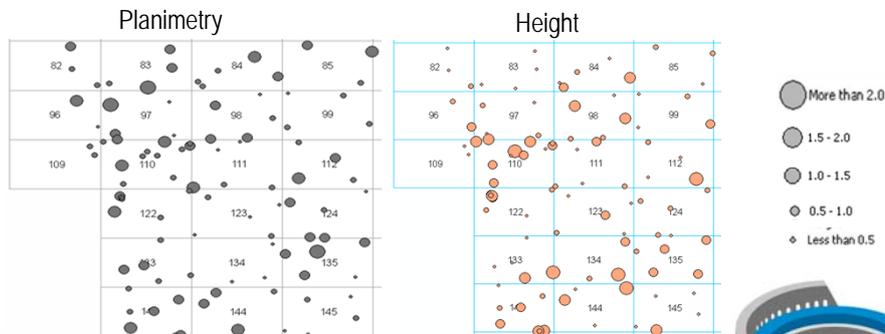
- "True" (E_{iT},N_{iT},Z_{iT}) vs (E_{iC},N_{iC},Z_{iC}) coordinates, extracted from the vector data.

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Results

- RMSE of 1,02 m for the planimetry and a RMSE of 1,04 m for the height;

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Results

- Class distribution:

Lower limit (m)	Upper limit (m)	Easting	Northing	Height
0	0.5	51%	52%	39%
0.5	1	31%	34%	35%
1	1.5	14%	8%	18%
1.5	2	3%	5%	5%
>2		1%	1%	3%

~80% < 1m – E, N

~75% < 1m - Height

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Conclusion

- Errors are randomly distributed;
- Relief and photogrametrist independent;
- The geographic information produced in this block, achieves and exceeds all the elements of positional accuracy required not only to the cartography of medium scales, but also to the cartography for higher scales;
- This study also allowed to validate the methods and processes used by IGeoE in the production of its geographic information;
- IGeoE keeps asserting as a producer of cartography of high quality and accuracy.