

Data Quality Control for Topographic Mapping Production

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1 INTRODUCTION

This work is part of a project that aims to perform the quality control and the evaluation of intermediate and final products generated throughout the topographic mapping of Porto Alegre city.



30° 01' 58" S
51° 13' 48" W

496,682 km²

1 467 823 hab

Quality is a complex issue in cartographic products analysis, once it comprises a set of qualitative and quantitative parameters.

In Brazil

only the National Map Accuracy Standards (PEC) defines the quality of cartographic products.

PEC is an important classification parameter, but it just considers the positional accuracy.

Considering that mapping quality is directly related to the quality of data handled at each stage of cartographic production

Methodologies and criteria were defined for each one of the process steps.

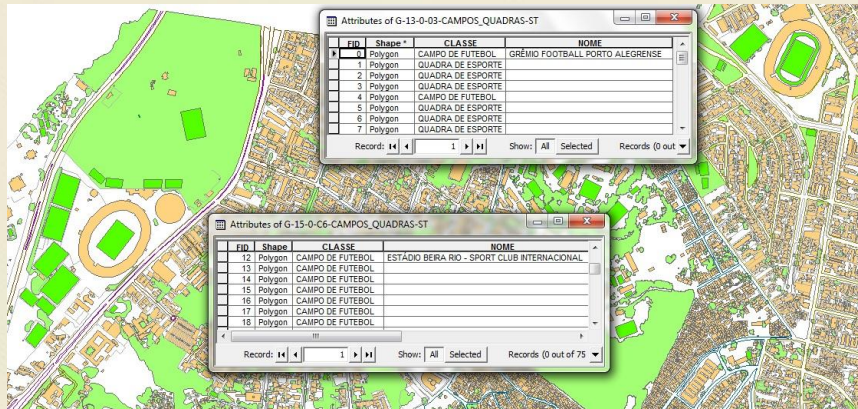
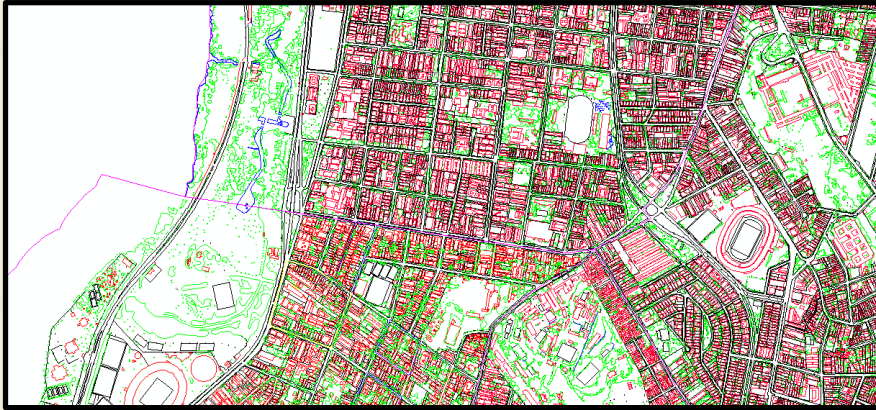
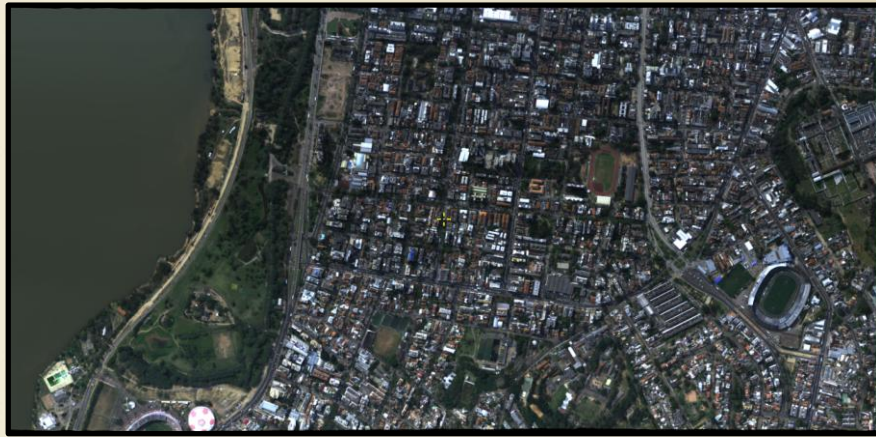
Mapping steps:

- a) Geodetic network implantation;
- b) Aerial photographic coverage, ground control and aerotriangulation;
- c) Aerial LIDAR coverage;
- d) Photogrammetric restitution ;
- e) Ortophotos;
- f) Maps and Ortophotomaps;
- g) Geocoding;
- h) Urban Cadaster.

2 OBJECTIVE

The present work shows the methodology and the results achieved by the quality control of the photogrammetric restitution stage.

- a) Geodetic network implantation;
- b) Aerial photographic coverage, ground control and aerotriangulation;
- c) Aerial LIDAR coverage;
- d) Photogrammetric restitution ;
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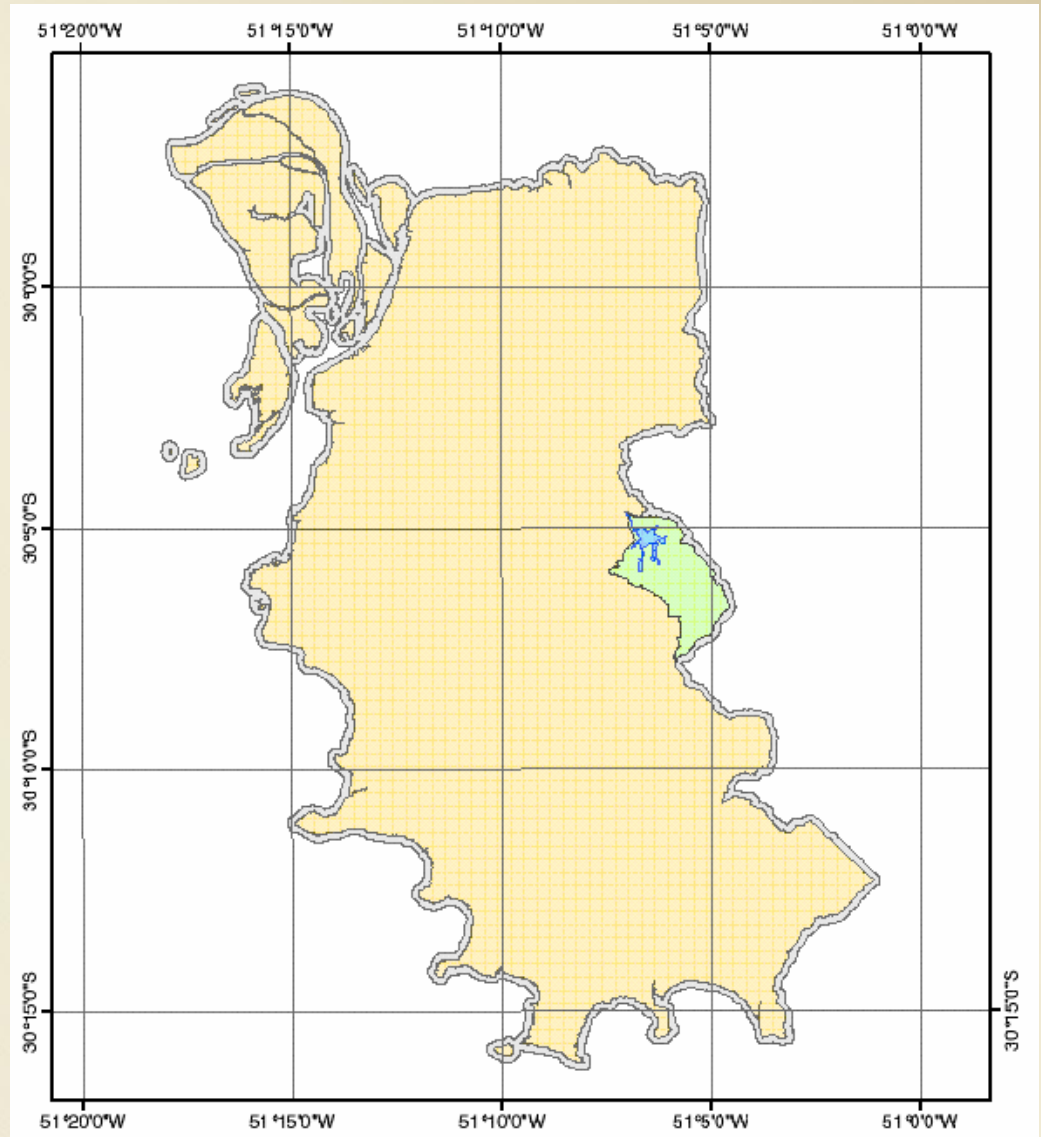
3 AREA

area of 545 km²

city area
+
250 m strip around the city
+
Saint'Hilaire Park area
(dam)

Analysis:

planimetric features
1:1.000 scale



4 CHALLENGE

How to manage the different interests and speeds:

Users x Producers x Technical/Scientific requirements

Actors:

Municipality Government:

- Hiired the service

- Hired a consulting to make the technical specification of the bidding process

Mapping Companies:

- consortium that won the bidding process

University:

- define the technical specification, standard requirements, methodologies and criteria for quality control.

Fiscalization Company:

- hired by the municipality to perform the quality control (to check and verifiy the consortium work), in accordance with the methodologies and criteria.

5 METHODOLOGY

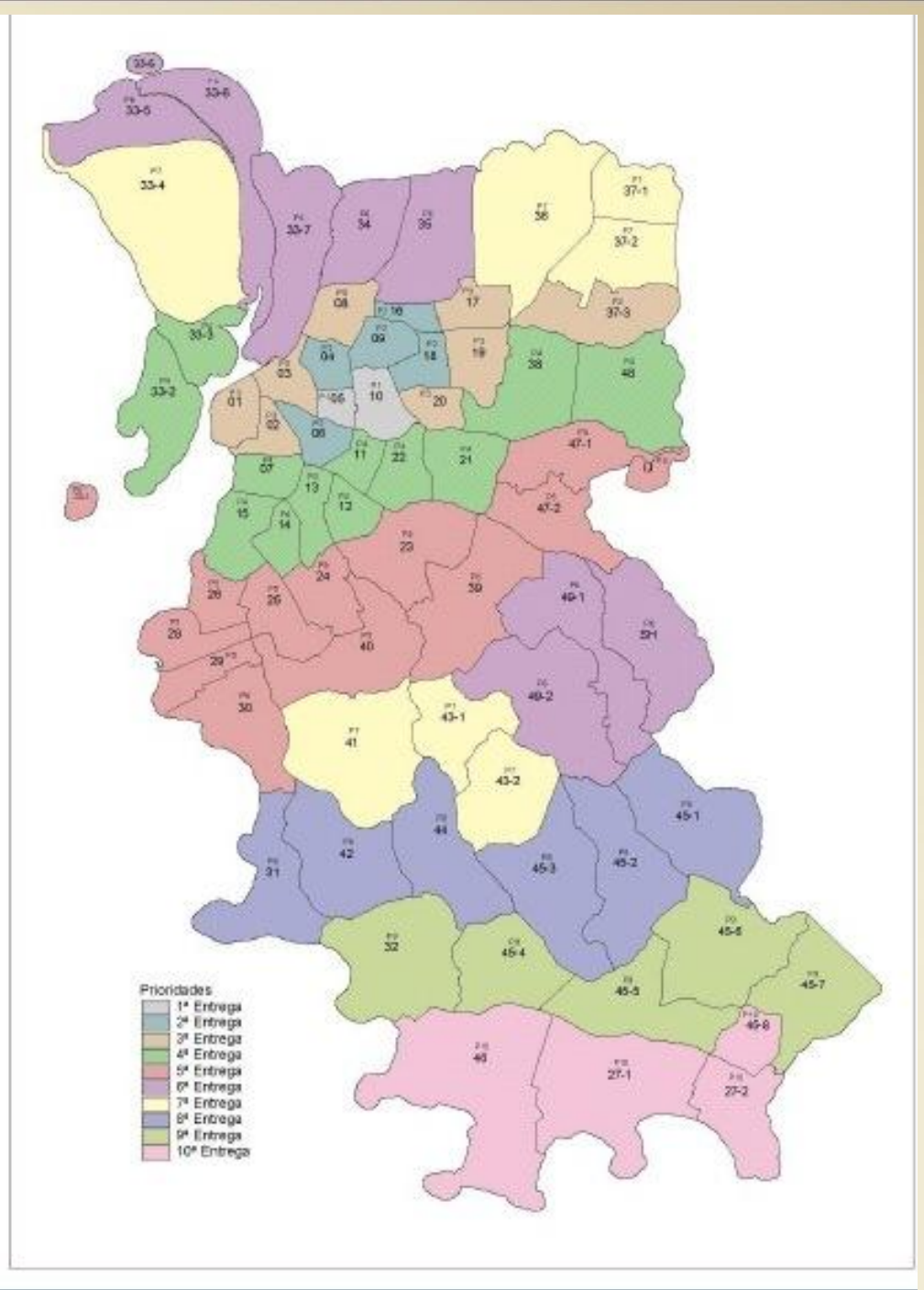
The methodology was developed considering

- the technical specification of the bidding process
- the Brazilian cartographic legislation (1967/1984)
- the international standards related to spatial data quality (ISO).

Set of **parameters** considered in the quality evaluation:

- positional accuracy
- completeness:
 - lack of features (features that should be mapped and were not)
 - features that do not exist (do not appear on the images and were mapped)
 - features with incorrect shapes
- logical consistency:
 - computational representation structure and storage
 - topological relationship
 - simbology
- semantic quality
 - features description and classification
 - geographical names
- attribute precision:
 - correct association of attributes for each feature or set of features

In order to perform the analysis the area was divided into 71 sectors.



Positional accuracy criterion:

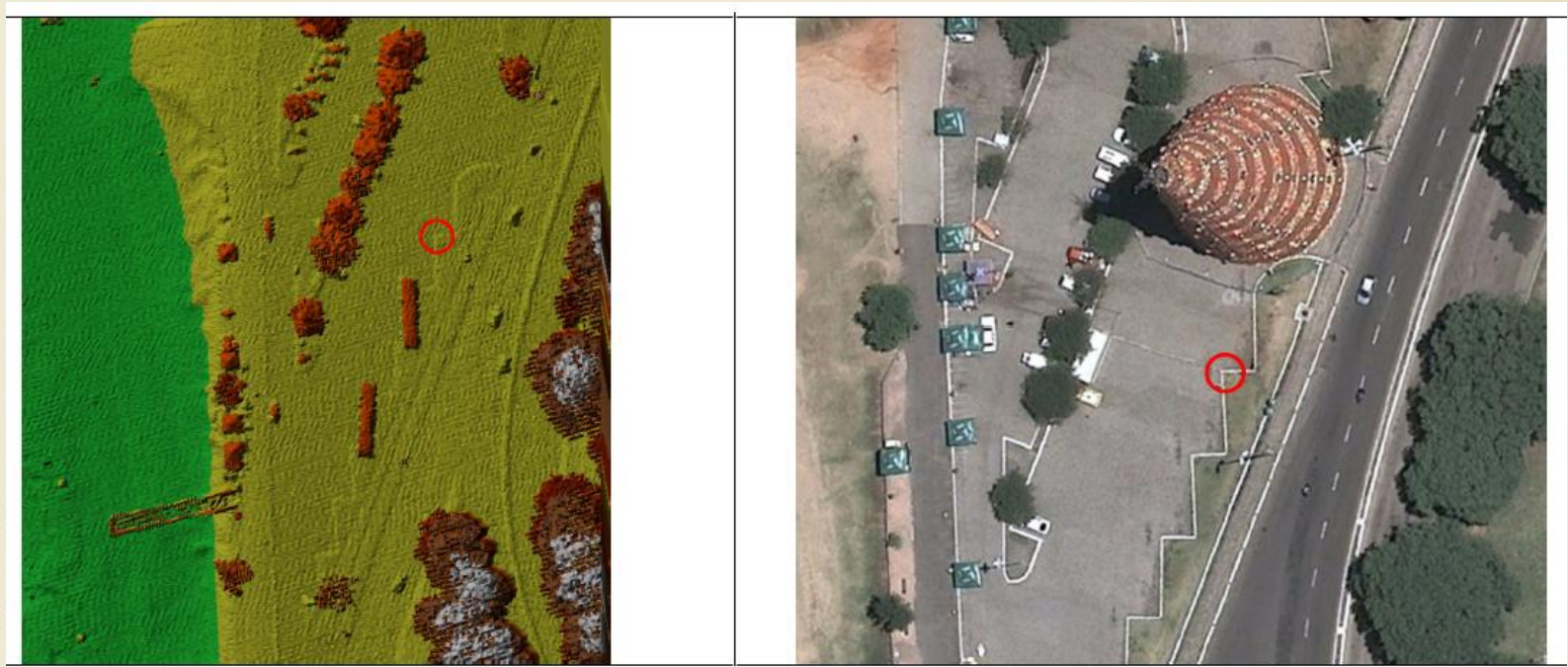
horizontal PEC

sets that 90% of the horizontal coordinates of points in the map when compared to the coordinates of the same points in the ground should not exceed 0.5 mm x map scale, and limits the RMS errors in 0.3 mm x map scale.

Positional accuracy evaluation:

we compared the horizontal coordinates of 180 well-defined points in the map with the corresponding points coordinates in the ground.

the ground points coordinates were determined by a horizontal check survey of higher accuracy.

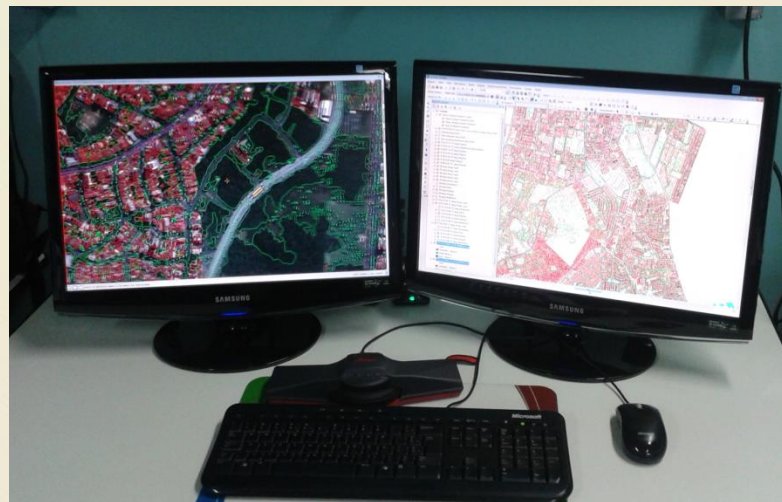


Other parameters criterion:

Completeness, logical consistency, semantic quality and attribute precision were analyzed in random samples of 10% of the mapped features, for each sector, with the support of a photogrammetric system.

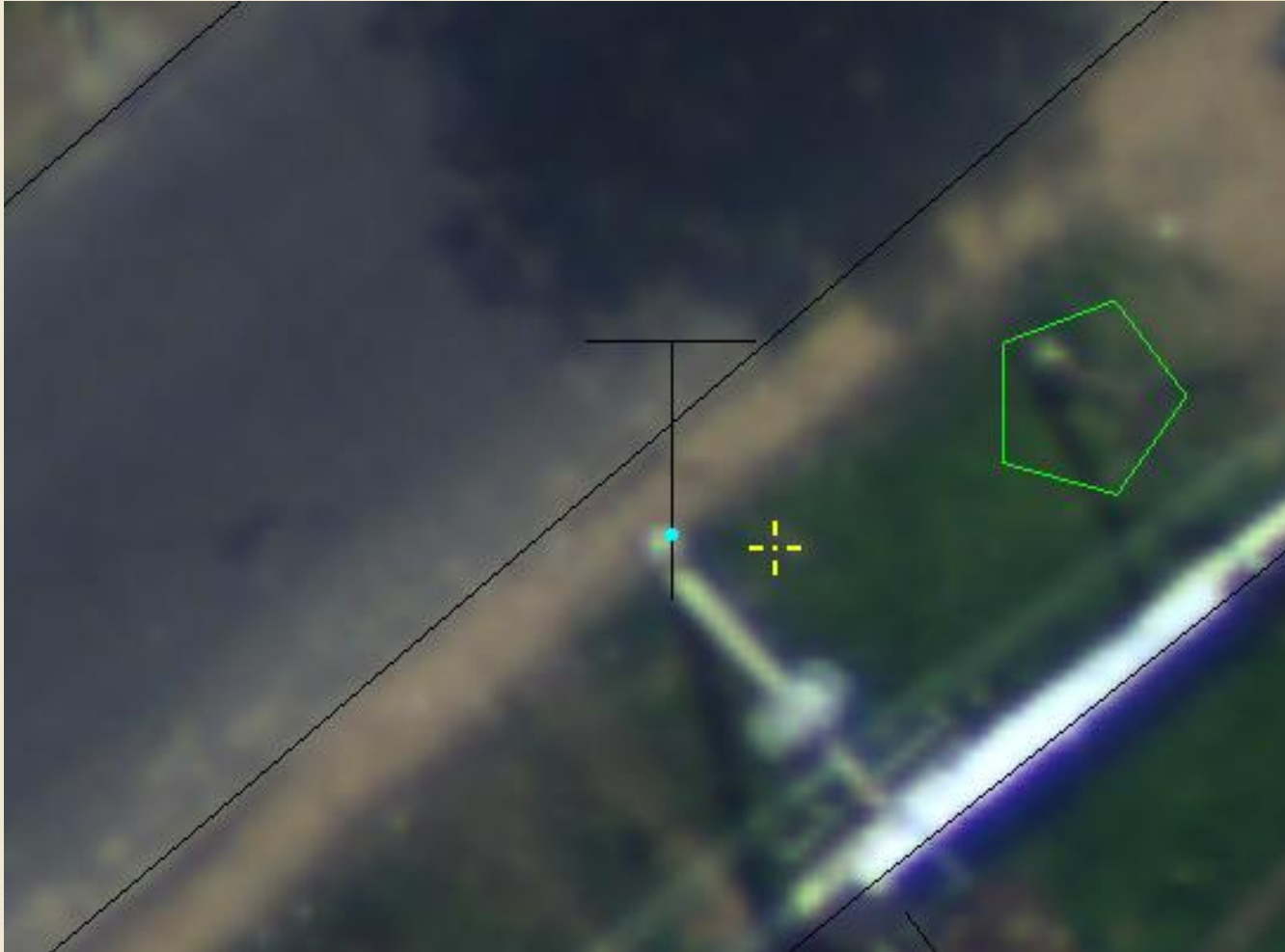
Other parameters evaluation:

Any nonconformity (0%) found in these samples resulted in rejection of the product.



6 RESULTS

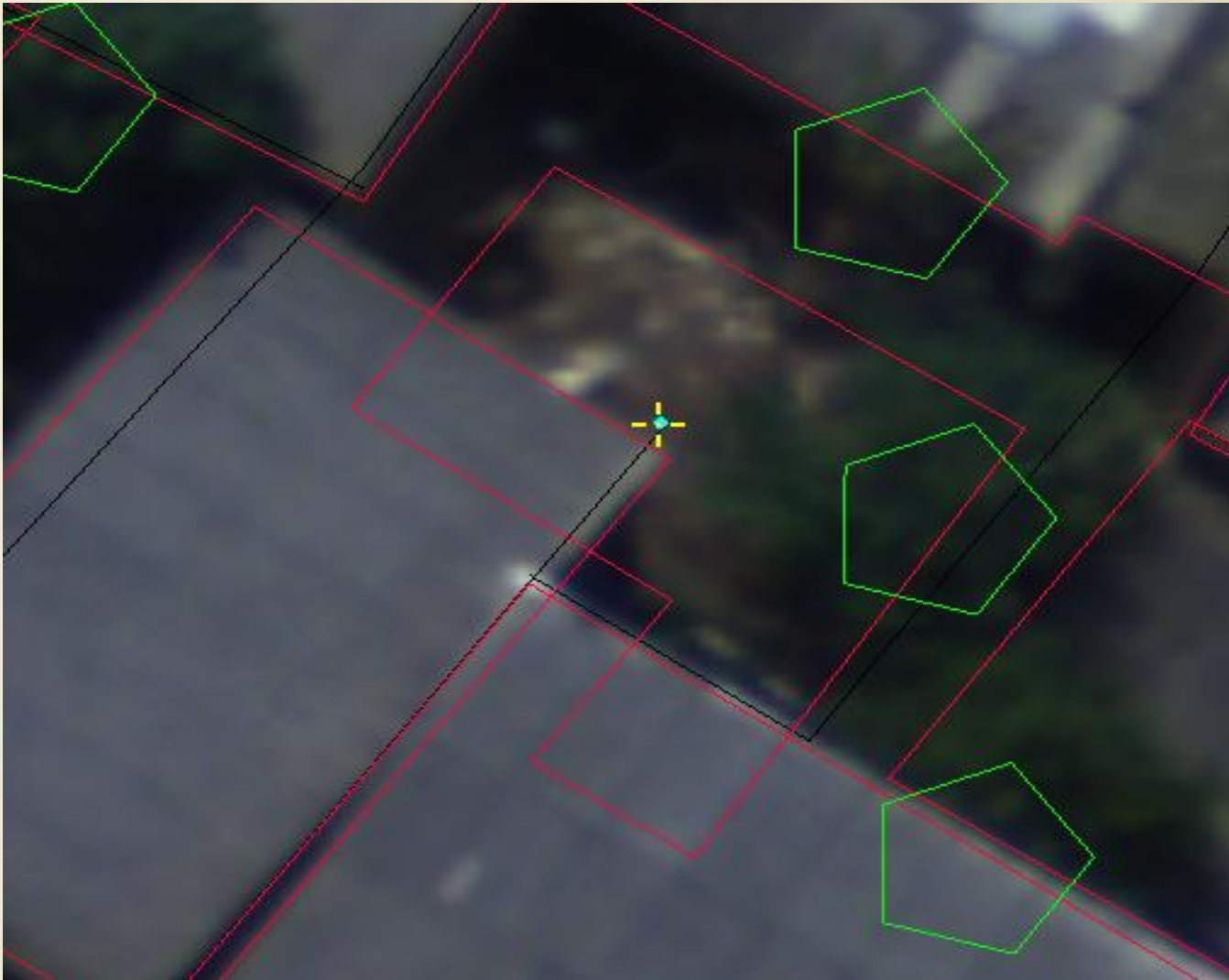
positional error



lack of features



features that do not exist



The results showed that positional accuracy was in accordance with PEC for topographic map class A at 1:1.000 scale.

On the other hand, completeness, logical consistency and semantic quality presented an amount of errors that exceeded the maximum number of errors previously defined. Therefore, the products were rejected and sent back to the producer company for correction.

Because of the large number of rejections some adjustments were necessary throughout the control process, concerning the level of acceptance and the sample.

So the level of acceptance increased from 0% to 2.5% of nonconformities.

The random sample of 10% of mapped features for the sectors that were not analyzed before remained the same.

But for the second evaluation of the rejected sectors, the random sample was split into two samples of 5%. One of them with the same sampled features of the first analysis and the other one with different ones.

7 CONCLUSION

the methodology and the parameters used were suitable to improve the quality of the products generated in the photogrammetric restitution stage.

some adjustments were necessary throughout the control process.

the quality control for each stage of the mapping process is important since it has an impact on the quality of the final products.



THANK YOU!

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