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"HELLENIC CADASTRE : QUALITY CONTROL OF THE FINAL PRODUCT"

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1. Introduction

Until recently, as a result of the pressing administrative and technical priorities for the establishment of the Hellenic Cadastre (HC), which were: the formulation of the Law, the establishment of the Agency of KTIMATOLOGIO SA, the selection of the Project Manager, the compilation of the Technical Specifications for the Cadastral Surveys (CS), the commissioning of the 1st and 2nd pilot phases of the CS and so on, scant attention was paid to the subject of "quality control".

Undoubtedly, the quality control of the cadastral product is of overriding importance and will prove to be its most critical factor. The Technical Specifications as prescribed by HEMCO, are specifications applicable to the result and not to the procedures that should be followed; the lack of specifications for the control methods renders things somewhat obscure.

Following the Decision 2868/24.10.96 of the Directing Committee of the Technical Chamber of Greece, the Working Group (the names of its members are mentioned as authors above) was convened in 20.7.1997. The members of the WG are experienced qualified Surveyor Engineers, who have worked extensively in Photogrammetry, Geodesy and Field Surveying for the Cadastre, either professionally or in research or both. The WG undertook the task of studying and proposing the most suitable method for the quality control of the final product.

As the final product is considered to be both

- the digital cadastral diagrams, produced photogrammetrically and completed by field surveying, at scales of 1:1000, 1: 5000,1:2000 or 1:10000 depending on the terrain type, the environmental importance and the land values

and,

- the cadastral tables, in fact the cadastral data base, which contain all the administrative and legal information about each landparcel, i.e. code number and

accuracy of the textual information contained in the cadastral tables, which is topologically related to the landparcels and the correct description of topology as well.

The main factors, that influence the quality of the final product, concerning its geometric accuracy and completness, are: the quality and scale of airphotos used, the photogrammetric hardware used, the scanning resolution of analog airphotos, the experience of the responsible agency for the CS, the experience of the operator of the photogrammetric instrument, the number, location and measuring accuracy of the control points used, the measuring accuracy of field surveys in general, the software used, the clear and accurate recognition of land boundaries in rural and urban areas etc.

According to Law 2308/95 for the HC, the quality control of the CS's product produced during the 1st and 2nd pilot phases must be executed based on the first (unrevised) edition of the Technical Specifications, published in the GG 639,2nd issue,19.7.95.

The control for these works, has already started at HEMCO. A proposal for the control method is under preparation by the personnel responsible for the task, but, for the moment, the procedure followed is as briefly described below:

The selection of a sample, of approximately 10%, is made according to the density of each area. The selected sample is then examined on the analog photogrammetric instruments for its "completness". The geometric accuracy, so far, is checked on the digital photogrammetric SoftPlotter Vision, at a level of "how acceptably the produced DTM fits the ground surface". It is understood that these preliminary checks do not constitute a proper control for the work.

The **second part** of the proposal deals with the experience gained so far of the responsible agency for the CS, Surveyor Engineers and Private Companies, which work for the pilot phases. Some critical aspects are pointed out, part of which have already led to modifications to the Technical Specifications, but unfortunately this second edition is not legally valid for the 1st and 2nd pilot phases.

The **third part** of the proposal examines each unit of work separately, ie. the Topographic Network, the Cadastral Surveys, the Administrative enquiries, the Photogrammetric Mapping, and all the localised problems . Comments are made and

suggestions for their improvement are given, placing the emphasis on providing proper documentation to aid in Quality Control procedures.

Finally, in the **fourth part** of the proposal, all the main and critical points are collated and presented as the resolutions of the WG's work.

3. First Resolutions of the Proposal

The first resolutions of the proposal, are:

3.1. Quality Control Timing for each type of product

The most suitable times for the quality control procedure of each particular product type is proposed as:

a. The delivery time for the Topographic Network

b. Before the First Suspension for the topographic and photogrammetric diagrams

c. Before the First Suspension for the Cadastral Diagrams and Tables

d. Before the Second Suspension for the changes and corrections, which will be done to the Cadastral Diagrams and Tables following the submission of new ownership statements and the rulings on disputes by the First Degree Committee,

e. Before the final delivery for the new changes and corrections, which will be done to the Cadastral Diagrams and Tables following the rulings on appeals by the Second Degree Committee and the submission of statements on transfer of rights.

3.2. Comments on the Application of the Control Method

The quality control should be executed by sampling techniques. Great consideration should be given to:

address of the landparcel, name and address of the owner, the land rights (such as ownership), mortgages, charges, easements, seizures, claims ,the land use, etc.

The WG has worked on the subject systematically, for nearly 5 months, in contact with both the HEMCO and the KTIMATOLOGIO SA (responsible agencies for the HC) and with the Private Sector (Surveyors and Companies) that have undertaken the work. All available information has been collated from all the sources involved and analysed. Particular problems have been noticed and some of them have already led to changes in the 1st edition of the Technical Specifications. The information is now being processed and the compilation of the final proposal of the WG, will be submitted to the Technical Chamber by mid January in 1998.

2. General Aspects of the Proposal

The **first part** of the proposal refers to the theoretical approach to the quality control. Definitions concerning the terms "quality", "accuracy", "quality control" etc are given, and the purposes and limits of the quality control are defined. Some examples of the sampling technique and the control method are given.

Briefly mentioned: The term "quality", through the rules of the free market, signifies the guaranteed and prescribed agreement of a product, with the specifications and the prescriptions used for its construction or its availability.

The contract commitments are specified as the technical specifications for the product, but are also related to factors such as the cost (construction, availability), competition, user satisfaction etc.

Despite the fact that the quality level is not only judged on how well the product agrees with its technical specifications, but also by the satisfaction of time and cost commitments as well,the purpose of the proposal focusses only on the investigation of the quality descrepancies of the cadastral product, referring to the valid technical specifications (Governmental Gazette 639, 2nd issue,19.7.95) or the contracts for the "Compilation of the National Cadastre".

Concerning the term "accuracy", it should be emphasised that the control should deal not only with the geometric accuracy of the cadastral diagrams, but also with the

- the definition of the sampling method, which must be carried out with great respect to the international standards. More details about the sampling method and the size of the sample will be given at the final proposal of the WG
- the statistical model must be clear so that the algorithm for the sampling can be uniquely defined. It may lead to cost saving if the sampling area will be classified and the sample selected by a stratified approach. This will be included to the final resolutions of the proposal.

  The whole area under CS must be divided into various categories without any overlapping i.e. rural areas, urban areas, suburban areas, etc. Each of the above can be divided into subcategories if necessary, ie. mountaneous areas, semi-mountaneous, flat areas, etc. The selection of the sample (sheet and the parts of the grid to be tested) should be done in such a way that the sampling will be distributed smoothly over the whole area and that it will contain measurements that will represent all the above categories.
- the definition of the error limits must be clearly and easily understood by everyone
- the responsible agency for the CS should be present during the execution of the quality control
- the quality control should be standardised. Appropriate forms and queries should be filled in and control records be kept according to the area and the product type.

3.3. Basic Necessary Presuppositions

In order to achieve substantial and valid control results of high credibility, a number of basic presuppositions must be taken into consideration, before the quality control starts:

- Quality control should be executed for:

  a) the "standard format" of the final product. All delivered digital information should follow the standard format ratified by HEMCO.

  b) the "completeness" of the final product. All delivered digital information should be tested for its "geometric" and "textual" completeness. The term "textual" signifies the administrative and legal information.

  c) the detection of "gross errors". The location and sizes of geometric features should be tested. Also, the cadastral tables should be thoroughly tested for the correct transfer of information.

  d) the "accuracy" of digital geometric information

- In terms of network density it is proposed to establish one monumented trigonometric point every 300-800 m in urban areas and every 1.5-3 km in rural area, bearing in mind that urban networks should be discontinued because they are cumbersome to establish and operate and costly to maintain.

- As far as integrating existent material to the HC it is proposed to publish the accuracy of the transformation using the HEMCO-HAGS-NTU coefficients and require computation of new local parameters in case the accuracy requirements are not satisfied.

- The network densification should be checked in terms of its design and its capability to cover the needs of the mapping process. Moreover, the accuracy and reliability of the network should be checked via statistical tests pertaining to blunder removal, proper weighting, net-measurements compatibility and internal/external reliability.

- The photogrammetric surveying should be tested for the accuracy of the orientations, the DTM's and for the accuracy and completeness of the photogrammetric restitutions, in photogrammetric workstations. Field control should also be carried out, with the help of GPS, for the accuracy and completeness of the cadastral diagrams.

- The sampling for the control of the cadastral textual information should be big enough in order to ensure the standards specified by HEMCO.

- Technical directions and a protocol for measurements need to be compiled by HEMCO and delivered to the agencies involved (ie. those responsible for the CS and those responsible for the control). These directions must define and clarify exactly:

  a) the expected philosophy to be followed during the photogrammetric restitution or the field survey, so that it will ensure that the selected points and the points controlled will refer to the same ground point (ie. fence-walls width, etc.)

b) the problem with the "names of places".In many areas more than one name are used (especially during the compilation of the notarial contracts or at the Urban Planning plans) and the solution to that might be the adoption of the toponymy used at the maps and the gazetteer of the Hellenic Army Geographical Service.

- The structure of the appeal and dispute should be standardtised. It would be very helpful if HEMCO admits the idea of a standardised form for the submission of the appeals and disputes. That could save cost and time for the classification, and could help the process and ruling of the appeal, since the period for that is only two months. An example of such a form is being prepared by the WG.

  The form should contain information concerning:
  - the identity data of the owner
  - the landparcel data (code, area, etc)
  - a brief description of the reasons that led to the appeal
  - a mention of all the legal documents attached
  - on all cases involving the geometry of the parcel a plot of the area in standardised form.

  The opinion of the surveyor responsible for the CS should also be presented in standardised form.

- The necessary finance needs to be made available for the quality control. In the case that HEMCO or the KTIMATOLOGIO SA are not in themselves prepared to carry out the work in time, other solutions must be found. One of them might involve other agencies or the Private Sector. For the commissioning of the work , the compilation of a list of controllers may be necessary. For that reason the expected budget must be determined and ratified. KTIMATOLOGIO SA must have the right to control the Private Companies and revise the list of auditors periodically.

- The agency, which will undertake to carry out the quality control, must be equiped with hardware and software of higher or at least similar accuracy to those used by the responsible agency which has produced the work.

- The personnel who will work for the quality control must be well qualified both typically and substantially.