

STATISTICAL COMMISSION and  
ECONOMIC COMMISSION FOR EUROPE

Working Paper No. 4  
English only

CONFERENCE OF EUROPEAN STATISTICIANS

Work Session on Geographical Information Systems  
(Brighton, United Kingdom, 22-25 September 1997)

Item 3 of the provisional agenda

## **ESTONIA: NATIONAL REPORT**

by

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## I. BRIEF DESCRIPTION OF THE PROJECTS

1. The development of GIS in Estonian statistics is mainly connected with the implementation of GIS for the Census 2000. The aim of the **Census GIS program** is to create a geographic database of all dwellings, associate them with previous Census reports and produce maps for enumerators. As there is no digital map available in Estonia which would satisfy Census needs, an extensive mapping program has been launched.
2. Population Census Division has begun the following projects on GIS:
  - a) mapping of rural areas at scale 1:50 000;
  - b) mapping of urban areas at scale 1:5 000, including specification;
  - c) study "GIS and mapping for the Census 2000".
3. **Mapping of rural areas** started in 1995. Maps are based on the recently completed Estonian Base Map 1:50 000. The preparation of the map of rural areas involved actually adding dwellings from the 1989 Census map to the current cartographic base. Former and current administrative borders have been added as well. The whole territory of Estonia has been mapped, and in the following months verification will begin. After the verification, new buildings will be added to the map. Dwellings are associated with the previous Census with identifiers. Points shown on the rural area maps represent dwellings, not individual buildings.
4. **Mapping of urban areas** started in 1996. Maps are based on existing city plans on a scale of 1:2 000 to 1:5 000. Paper maps are scanned and vectorized. Unlike rural area maps, careful field verification was observed during the mapping process. Enumerator areas of the previous Census are digitized as well. Data from the building registry is associated with maps for the first time in Estonia.
5. The study "**GIS and mapping for the Census 2000**" involves two tasks. First, to familiarize the staff of the Population Census Division with the principles of mapping, recent developments of GIS, and describe the current state in Estonia. Secondly, Census GIS strategy was sketched, the total cost of the Census mapping program was estimated and a suggested schedule was outlined. A significant part of the study was devoted to dissemination issues. Technical aspects of dissemination (data standards, pricing, confidentiality enforcement) are relatively straightforward. Legal aspects (copyright, ownership, liability, privacy protection) are much more complicated, are largely theoretical, and these experiences are more difficult to adopt from other countries due to differences in legislature. The study underlined that Census GIS must ensure the independence of statistical analysis from changes of administrative borders.
6. The Population Census Division has also carried out a survey among towns in Estonia to acquire information on their level in digital cartography, available digital maps and willingness to cooperate. The main conclusion was that only a few of the largest cities can supply the required digital data; others expect the Statistical Office to show the initiative.

7. A number of other surveys have been carried out, but they are only marginally related to GIS: “Conceptual Plan of Census 2000”, “PR for Pilot Census 1998”, “Data of Administrative Registers and Classifications”, “Estimation DP costs for Census” and “Analysis of 1998 Pilot Census Questionnaire”.

## **II. DATA SOURCES**

8. The Estonian Base Map 1:50 000 is a primary source for Census maps of rural areas. The Base Map was produced from satellite imagery during 1993-1996, no field work was involved. The positional accuracy of the base map is very good (5-10m), but the map is not as comprehensive as could be desired. Only borders of built-up areas have been shown on the map - no individual buildings are outlined, although the scale would permit this. A number of small roads are missing, the type of road (paved, gravel, unpaved) is not shown. The goal of the Base Map was to create a locality-accurate map, and different authorities were expected to complement it with their own projects.

9. Urban area maps rely on existing paper maps on a scale of 1:2 000 to 1:5 000. Few cities have digital maps available as well, and where this was the case, their data was used, updated, and returned to the city. The quality of existing urban area maps is very variable, maps are dated between 1979-1995. Due to old soviet regulations, all town plans had their own grid coordinate system. As new Census maps will be in the unified mathematical base, conversion formulas are required for every settlement.

10. Unlike other mapping programs in Estonia, Census mapping employs heavy Global Positioning System (GPS) surveying. GPS helps to map existing buildings with good positional accuracy. The accuracy is necessary to attract more users to the Census mapping program, thus lowering the cost per user. GPS also helps to ensure that all buildings have been recorded by mapping the path of field verifications, and therefore that no region is neglected accidentally. For the Census itself, 100% coverage is necessary; the same stipulation is true for Census maps.

11. Building Registry data is used as alternative means for ensuring that all buildings have been included on the urban area maps. In rural areas this is more difficult as no official address system exists in Estonia. As a result, the identifiers from the Building Registry are stored in Census GIS, which will strengthen future analysis. It should be mentioned that less than 30% of Building Registry data has been digitized; data from paper files is not used in Census GIS.

12. Old Census maps and Census data have been used as much as possible. The ultimate goal is to associate previous Census(es) with the upcoming Census. This is ensured by mapping all dwellings of Census 1989 on current maps.

## **III. OUTPUT FROM THE GIS (PRODUCTS AND SERVICES)**

13. As final versions of Census maps are not yet ready (except for a few town plans), a large customer base is not expected. However, a dedicated study has been carried out to clarify the legal issues of dissemination of spatially referenced statistical data.

14. During the mapping process local municipalities will receive paper maps of their region for their own use. Digital data has been given in a few cases, but this will be done more actively as soon as the updating program has been launched.

15. The creation of thematic maps will be one of the most wide-spread uses of digital Census maps. Some maps have been published already - the major study of thematic map quality is scheduled for 1999, just before Census data becomes available.

#### **IV. HARDWARE AND SOFTWARE USED**

16. The Population Census Division has 3 computers (Pentium-150 Mhz, 16 MB RAM) configured for GIS use, delivered with support from PHARE program. The software used is primarily MapInfo (3 licenses) and ArcView (1 license). In addition MapInfo Runtime-based 3<sup>rd</sup> party application is used.

17. Census maps are created by subcontractors. Rural area maps are made with Arc/INFO 7.0.3 WorkStation, urban area maps with Intergraph Modular GIS Environment (MGE). As conversion between MGE and MapInfo is relatively easy, urban area maps are also converted into MapInfo. The Statistical Office of Estonia does not yet have hardware and software for creating a seamless GIS database for both urban and rural areas. This will be done as soon as appropriate financial resources have been made available. Since Oracle will be used as the database management system for Census purposes, the central GIS server must be compatible with Oracle.

#### **V. PERSONNEL AND FINANCIAL IMPLICATIONS**

18. The Statistical Office of Estonia has invested about 3.0 million EEK (8 EEK= 1 DEM) in mapping activities so far, including: for map creation 2.7 million EEK; and for equipment and training about 300,0 thous. EEK (from PHARE funding).

19. The staff of the Population Census Division now consists of 15 people, of whom 4 have had GIS training and 2 work with GIS on a daily basis. Most of the routine work has been done by subcontractors. Due to limited finances, the Census map contents will be somewhat restricted; this is particularly true for rural area maps. Significant support came from PHARE funding. Investment in the GIS server has to be made before the first quarter of 1998 at the latest. No major income from GIS data dissemination is foreseen until the Census has been carried out.

#### **VI. PLANS FOR FUTURE DEVELOPMENT**

20. The mapping program will continue. Pilot Census areas will be completed by Autumn 1997. The second priority is the closely built-up areas outside towns. Without the initiative of Census mapping these settlements would have no large-scale maps within a decade. Major towns will be left until the end of the process in the hope that they will take care of their own mapping.

21. A seamless database for Census maps will be created. As a result, there will be no separate urban and rural area census maps in digital form (paper maps, naturally, are printed on sheets and on a different scale). The appropriate software will be chosen by the end of 1997.

22. New enumerator areas will be generated as soon as the seamless database is ready. The technique can be tested at the end of 1997, after completion of the database of Pilot Census areas. Four types of areas are planned:

- a) Census preparation areas (matching with current administrative boundaries);

- b) Census enumeration areas (created for sharing dwellings between enumerators and ensuring the shortest path of travel);
- c) Census analysis areas (created on an *ad hoc* basis using a clustering technique);  
and
- d) Census presentation areas (most likely regular grid, they will help to enforce confidentiality and ease desktop GIS analysis).

23. Cooperation with local municipalities has been drafted and the programme will be announced in the third quarter of 1997. The essence of the cooperation programme is the continuous updating of Census maps and the provision of digital maps for small municipalities which could not invest in digital mapping on their own. As the major part of the GIS project budget consists of data creation and maintenance, proposed cooperation is expected to lower the costs of both the Statistical Office and municipalities.

24. Dissemination will be an issue as soon as a significant amount of digital data is available. A preliminary study has been carried out, and the contract forms and pricing principles will follow. Various techniques of disseminating of GIS data over WWW are under consideration, as well as more traditional means. Promoting the use of GIS data within the Office is also a great challenge for the Population Census Division.