Journal of Young Scientist, Volume II, 2014
ISSN 2344 - 1283; ISSN CD-ROM 2344 - 1291; ISSN Online 2344 - 1305; ISSN-L 2344 – 1283

DIGITAL LIBRARY USED IN LAND SURVEY MAPPING CONTAINING SCALABLE SYMBOLS, LINETYPES AND HATCHES AIMED FOR CROSS-PLATFORM USE AND COMPATIBILITY

Dan-Eugen AMARIE[1], **Adrian SCHIPOR**[1]

Scientific Coordinators: Prof. PhD Eng. Marcel DÎRJA[1], **PhD Eng. Adela HOBLE**[1]

[1]University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Calea Mănăştur 3-5, 400372, Cluj-Napoca, Romania | Tel: +40-264-596.384 | Fax: +40-264-593.792 Email: schipor_ady@yahoo.com, amariedan@yahoo.com

Corresponding author email: amariedan@yahoo.com

Abstract

The aim of the research is to create an complete, annotative (scalable), cross-platform library that can be imported and used in the most common CAD softwares (AutoCAD and it's variants, ArcMap, Corel Draw etc.). Currently, inserting the conventional map signs and symbols at scale in a CAD environment presents a problem to the average surveyor. There is no annotative complete library of these symbols present in any software, him having to resort to custom made librarys of incomplete list of the signs, markers and linetypes, third-party applications that are often incompatible to his CAD software of choice, or don't meet the specified requirement. In the cross-platform library were incorporate the following attributes to all the conventional signs used in different land survey domains: uniqueness (most important attribute), permanence, simplicity, ease of maintenance, flexibility and reference to geographic location. The content and format of the final product may be carried out in a variety of ways, depending on the scope and magnitude of the mapping projects (surveying, cartography, photogrammetry, landscape design, forestry planning etc). Regardless, the cross-platform library suits to how the mapping function is performed, specifically assigned to project plan development to serve as the organization's blueprint.

Key words*: conventional signs, markers, linetypes, mapping projects, project plan development*

INTRODUCTION

Land surveyors, architects, cartographers, landscape engineers, construction engineers and many other professions use digital map symbols in accordance with The Conventional Signs Atlas (Bucharest, 1978) in their CAD drawings and projects. These symbols haven't been integrated and standardized in the various software applications utilized by each respective profession. Therefore, the following paper addresses the concept of a cross-platform digital library of map symbols that simplifies import-export operations of the drawings and projects and encourages inter-professional collaboration.

The conventional sign is a geometric figure with size and figure established conventionally, which aims to suggest the image and nature of a topographical object or detail. Some topographical details can be translated to scale, containing enscribed a conventional sign. These are standardized and contained in The Conventional Signs Atlas.

The conventional signs are grouped into 7 categories: geodetic base, urban area details, industrial installations, utilities and boundaries, transportation networks, hydrography, landscape.

Besides the mentioned categories, the conventional signs are divided into:

- conventional signs that do not represent the object at scale (these signs have fixed dimensions, specified in the Atlas):
  - geodetic point signs;
  - culvert signs;
  - signs used for some buildings
- signs with fixed dimensions – for buildings that cannot be represented at scale
- signs for building scale representation
- conventional signs that represent the object from terrain at map or plan scale:

  - terrain parcels
  - buildings
  - roads over a certain width
- conventional hatch signs
  - vegetation: orchards, vineyards, grassland
- soil types

Placing conventional signs on plans or maps is done by the following criteria:

- the real position of terrain elements has to coincide with the center of the conventional geometric sign: circle, square, triangle
- the conventional signs' orientation will be:
  - parallel with the side of the plan for: base points, tv and radio stations, meteorological stations, monuments, etc
  - according to the real orientation of terrain elements: buildings, stadiums, etc
  - parallel with the longest side of the representation: orchards, etc
- the conventional axis sign has to correspond with the topographical axis: railways, roads, bridges, dams, dikes
- the minimum distance between two conventional signs has to be 0.5 millimeters.

MATERIALS AND METHODS

Autocad 2013, CorelDraw X6 and ArcGis 10.1 have been chosen for this demonstration (Fig.1).

Figure 1. Logos of ArcGis 10, Autocad 2013 and CorelDraw x6, from left to right.

All of above use a set of templates and files which contain their respective symbols, line types and hatches. The purpose of this study is to create a set of templates that is compatible with Autocad, Corel and ArcGis and is standardized accordingly to The Conventional Signs Atlas.

Autocad, one of the leading CAD applications, includes a set of powerful tools used by engineers in their designs and plans. Mainly, symbols are inserted as block references, standardized lines (property boundary, building boundaries, utilities, fences, train tracks, etc) are inserted as linetypes and hatches that define certain areas (forests, lakes, ground and vegetation elements, etc).

ArcMap (ArcGis component) uses a system of .style files that define symbols (base point graphical objects), lines and patterns (the equivalent of hatches in Autocad)

Corel Draw is fully compatible with the Autocad system of symbols with its own addition, the Symbol Manager.

As base material for this paper, the Conventional Signs Atlas or Atlasul de Semne Conventionale was used. It dates back from 1978, its standards still apply today to Romania's land surveyors in accordance to A.N.C.P.I.'s regulations. Firstly and especially, the symbols are used at technical documentations for topographical plans. They have to be inserted correctly and at scale in the digital plan.

RESULTS AND DISCUSSIONS

We have designed a digital library prototype that contains the correspondent symbol, line or hatch for each software used and that can be translated or transferred from one software to the other.

Autocad's Block Editor was a very useful tool in designing most of the symbols, but some third-party applications and .lsp files were also used. Converting the elements in Corel's Symbol Manager was done by saving the blocks as .dwg files and importing them into Corel. But, transferring the library into a .style ArcGis compatible file format was difficult and most of the elements had to be recreated manually in ArcGis.

Linetypes are created in Autocad just like a normal .dwg but can be saved as linetypes during the process.

For hatches, we used a third-party .lisp file that generates pattern files based on a grid, scale and a custom made drawing.

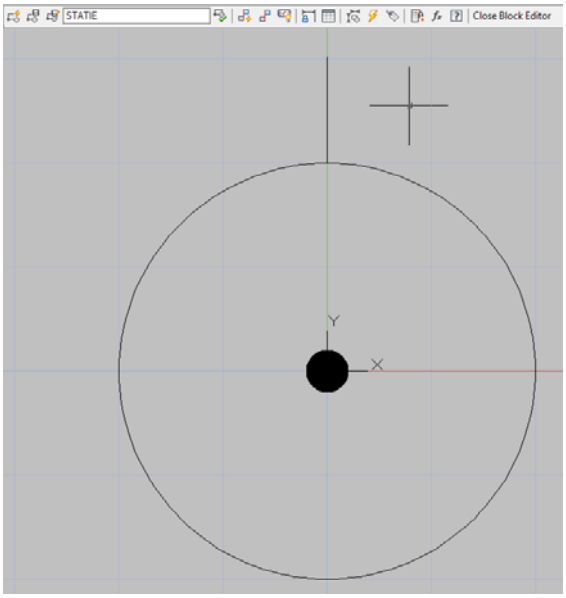

Figure 2. Autocad Block Editor

The purpose of this is, for example, the capability of a land surveyor to open a Corel Draw construction design in Autocad without having to complete the plan by manually inserting the missing symbols. This applies to all other types of designs, plans or digital maps that are supported by the applications and professions mentioned before.
Therefore, our library will be divided into 3 sections: symbols, lines and hatches (Fig. 3). And each entity will have three variants accordingly to the software that will be inserted to.

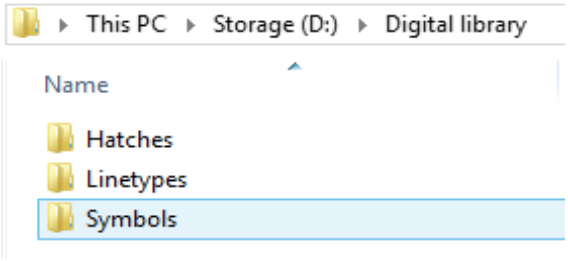

Figure 3. Digital Library Folder Content.

For the library to work in a cross-platform environment the inserted objects have to contain a set of file paths in case they are accessed in a different software then the one they were inserted into.
For example, an AutoCad symbol needs to contain an attribute that targets the corresponding file for opening the symbol in Corel Draw and ArcGis.
Autocad's DXF file format has been created for the purpose of data interoperability between Autocad and other programs. Its file structure contains sections relevant to our paper that can be easily imported into other programs. The way a .dxf file is divided into these sections is very similar to the way a Gis database is structured.
Even more, ArcGis 10.1 has added a geodatabase tool named "CAD to Geodatabase" (Fig. 4) and ArcGis's Data Interoperability Tool is almost completely compatible with the .dxf and .dwg formats.

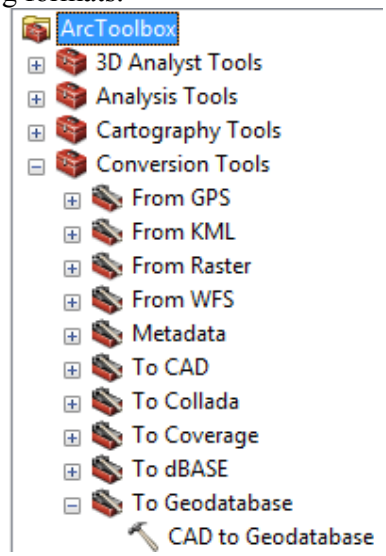

Figure 4. CAD to Geodatabase tool - ArcGis 10.1

The only issue that remains is completing the missing references in the import/export operations and setting an annotation scale to the objects.

We studied the Conventional Signs Atlas and divided most of the symbols and signs into the three sections mentioned earlier: symbols, lines and hatches (Fig. 5,6,7)

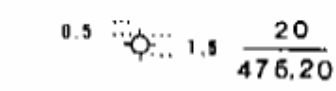

Figure 5. Thickening Point of National Geodetic Network

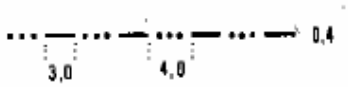

Figure 6. Commune Administrative Territory Boundary

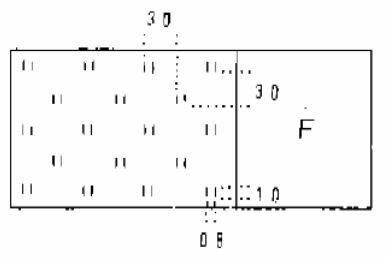

Figure 7. Hayfield

Most of the symbols and signs had to be designed accordingly to the dimensions mentioned in the Atlas, and some had more than one version, if their scaling were not directly proportional.

CONCLUSIONS

The library has a very large number of applications and it will be the first digital version of the Conventional Signs Atlas 1978 that is currently used by many professions in their designs.

Some of the applications would be:

- easier collaboration between land surveyors and land designers (Autocad - Corel Draw compatibility)
- easier integration of topographical plans into Specialized Cadastre maps (Autocad -ArcGis compatibility)
- faster and simpler development topographical engineering marking plans based on designs made in Corel Draw

Basically, this digital library proposes the upgrade of a regulation based on analogical source to be based on a digital one.

Most surveyors design their own symbols, keep a partial library in their database and/or copy symbols from one design to the next.

At the moment, most objects designed into our library can be easily transferred from one program to the other but there are exceptions. It is a work in progress, but the result will bring the professions of architecture, land surveying, landscape designing and many others at a higher efficiency and cooperation.

In retrospect, there still is a lack of compatibility between CAD and GIS programs, but improvements can be made.

REFERENCES

ESRI, 2014, http://resources.arcgis.com/, ArcGis Resource Center

Autodesk, 2014, http://knowledge.autodesk.com/, AutoCad Knowledge Network

Corel, 2014,http://learn.corel.com/,Corel Discovery Center

Ministrerul Agriculturii si Industriei Alimentare,1978,Atlas de Semne Conventionale Pentru Planurile Topografice