The Transition from Paper Hardcopies to Digital Media in Survey of Israel – a Review

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SUMMARY

Maps were and still are submitted as paper hardcopy at most public institutions. These maps were used to supervise cadastral processes and were manually signed or stamped. Thousands of maps are printed on paper to be collected and archived at each institute; this process usually requires many copies of each map.

Working with paper hardcopies has many disadvantages:
– Multiple copies are made of each map which is environmentally wasteful.
– The copies need to be compared manually to make sure they are correct and updated.
– During the cadastral process copies often need to be sent to outside parties for revision or approval, the sending is done using postal services which slows down the process.
– Storing the maps requires allocating storage space which is costly and should be efficiently used; freeing the archives allows more space for worker needs.

This paper will offer a review of the process that has undergone in Survey of Israel of going from paper maps to digital ones and the new possibilities that this transition opened for us. The transition to digital media allows various automated checks to be performed on the file, streamlining many of the rudimentary checks of the map, and leading to better standardization of the cadastral product.
The automated tests also detect compatibility of the map to cadastral products neighboring it, shedding light on potential problems and documenting the way they were resolved.

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1. MAP AND DOCUMENT STORAGE METHOD

At the early stages of the map production process, the surveyors produced hand-drawn maps on clear paper. The drawbacks of using this type of paper are: the lack of long time durability, the fading of map captions and distortion of the maps due to physical effects. In addition, as a result of folding of the map, there were often tears in the seam of the fold that required taping the map pieces. The maps were kept in plain binders, each containing maps for a particular block or region. And the folders were arranged on moving shelves to store more maps in the same compartment.

In order to keep the maps from tearing and the various captions from fading for many years, maps were drawn on durable thick paper that was not folded. These maps were kept in drawers that were sized to fit the size of the map. And for this reason, the maximum size of a map presented by the surveyor was determined at the Survey of Israel (from here on SOI), which required large storage areas dedicated for this purpose.

Over the years, an increase in the number of hired workers, a lack of physical work stations and an increase in the cost of renting storage areas were reasons to consider switching to a digital environment and converting archives to office space for SOI employees and other purposes.

The use of digital maps without the need for paper has benefited the surveyors and saved them many costs, such as printing many copies of maps during the inspection process, the need for travel to submit the map to the SOI and receive the map after approval by the director of the inspection unit.

In the past, surveyors needed to obtain maps or other material to recreate the boundaries of registered parcels of land had to send a detailed request concerning the blocks and parcels they wanted to reconstruct. Copies of the requested material were prepared and printed by the staff of the Archives Department (at the main office in Tel Aviv), a date was set with the surveyor to collect the material prepared.

In light of increasing number of requests that required quick response and treatment and the desire of sparing the surveyors from travelling to the main office, SOI created a system for keeping the maps as digital files that the surveyors could access in the SOI office nearest to them and could print the required maps or documents there.

This method was found to be better and more efficient for keeping the map documents and certainly cut down on travel time for the surveyors. The system was upgraded to a more

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efficient system called "Tazpit". The surveyors paid for web access to the system and also for the amount and type of documents printed.

In the spirit of innovation and accessibility of information to surveyors, the "Tazpit" system was converted to a web service, so that surveyors can enter with personal identification data from his office and download or print the material required for his needs.

As a result of the incorporation of the "Tazpit" system and the transition to digital file storage, there was a need to scan all the maps and accompanying documents accumulated in the various archives during the years and also all the new maps that were inspected by the various SOI departments were approved for registration.

2. QUALITY CONTROL FOR THE CADASTER MAPS

The next step after receiving the documents required to prepare a cadaster map is submitting the map to SOI for inspection and approval. The inspection procedure requires extensive experience and knowledge in the field. Guidelines published by the SOI describe the audit process from submission to approval and registration of the parcel or block.

Despite the improvements in making cadastre material available to the surveyors, SOI still required a hardcopy on clear paper be submitted for audit in the relevant department.

In addition to the hardcopy the surveyor submitted the map in digital format (.dwg) as well as additional documents the "Calculations Dossier" and "Technical Account". The "Calculations Dossier" contained the record of all the cadastral calculations made by the surveyor and the "Technical Account" contained a full account of the recreation of parcel borders.

During quality control, if the map is found faulty, the surveyor was required to fix and update the digital map file and all related map documents so that all of them are fully compatible.

Any modification of the map whether in border reconstruction or cartographic correction, the surveyor was required to produce a new copy of the revised file and send it back to the auditor for further review. This method has two drawbacks: 1. There was a chance that the map will be produced from the non-corrected file. 2. No tool existed for comparing the digital map with the printed one.

Surveyors who had fewer errors have saved themselves unnecessary printing as well as travel time to the SOI or regional district. Despite the vast experience and knowledge of the surveyors, the process of restoring borders, strict quality control and the often complex cadastral basis material increase the chances of errors. Therefore, it was necessary to consider a method for submitting maps digitally during the inspection process. Also after map approval there was a need to transfer the map file digitally to the "Tazpit" system.

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3. DUPLICATE INFORMATION ON MAPS AND MAP DOCUMENTS

The printed map is the legally binding document and the existence of a digital file and other documents created data duplication. The map documents and the printed map must be fully compatible.

Data duplication types:
– The coordinates of the parcel boundaries in the digital map file and the coordinates recorded in the accompanying map documents.
– The coordinate of the control points in the map file and the coordinates listed in the accompanying map documents.

On the one hand, the signed hardcopy is the binding legal document, and on the other hand, the map documents that were scanned after the map was approved and added to the "Tazpit" system were binding too. The data duplication created many problems when the parcel borders were incompatible between the map and its documents, and it was necessary to decide which was correct and how to perform the correction.

A decision was made that the coordinates listed in the "Tazpit" documents should be adopted in case of conflict even though the paper-based map is the official and legal document. The reason was that the surveyors have already used the material uploaded to the "Tazpit" and therefore it was binding too.

It is important to note that in outlier cases when it's proven that the coordinates documented in the "Tazpit" documents are incorrect and require fixing, the solution is to submit a new map that corrects the previous one. The boundaries of the new map after its approval are the approved valid ones.

4. DIGITAL MAP SUBMISSION

In view of the disadvantages mentioned in the previous section, a change was made in the maps submission process to waive the need to submit a printed map. The surveyors were asked to submit digital map files and accompanying map documents would no longer include coordinates of parcels

This process shortened the audit time on cadastral maps as it removed the need to check compatibility between the various submitted documents. The surveyors were no longer required to print hardcopies of maps or travel to submit the maps.

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In the next step, online forms were developed that enabled the surveyors to submit cadastral documents for various tracks. The submitted material was manually checked to meet certain thresholds and basic standards before progressing to the audit stage.

A new geographic information system, called "Topocad", was developed to meet the needs of SOI and the surveyors. This system contains the various geographical and cadastral layers required for cadastral work. The system also contained all the archived documents that were scanned for "Tazpit". A decision was made that downloading said documents will be free for any licensed surveyor that registered.

"Topocad" also has an administrative system for submitting and tracking the map audit process for various cadastral products. The progress of the audit can be monitored by different users (private customers, surveyors, companies, etc.) at any given moment.

The system also included a mechanism for calculating the transformation coefficients between the various Israeli grids, with all the transformations and their control points stored in the database and viewable by users of the system.

5. THE "RAKEFET" WIZZARD

The maps that were submitted to SOI for audit were submitted as a digital map and a hardcopy, from the digital map, the surveyor would produce five text files that define the topology of the plots and the order of operations of a parcelation plan. These files were entered into a database through a system developed by SOI called "Exceed". This system was adapted to the 1998 surveying bylaws that were in effect during this period.

In the transition from the 1998 surveying bylaws to the 2016 surveying bylaws (start of 2016), the "Exceed" system no longer conformed to the requirements of the new regulations, and a new system was developed that would upload the maps into the SOI database and perform a set of automatic tests on them. "Rakefet" (Primrose) wizard was developed to meet the requirements of the new regulations and the guidelines issued by the SOI.

Many tests have been integrated to the system according to the regulations and needs of the audit work. The basic tests are: syntax, topology, area calculations, comparing against neighboring parcels, order of operations and parcel dimensions. Some of the tests performed by the system were done in the past manually and required a lot of worker time (such as comparing the registered dimensions of parcel sides vs actual dimensions). A run of the "Rakefet" wizard might produce two types of errors: The first is "report" and the second "critical". If a critical error is found, it is not possible to proceed to the next step and the error must be corrected. If a "report" error is encountered, it is possible to proceed to the next stage, but the error must be addressed.

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The "Rakefet" wizard system was at first an internal system that worked only on the SOI computers; a short time ago the system became online so that it could be used via the "Topocad" system. The surveyors can now (and are expected to) handle all the errors before submitting the map for audit, saving the inspection and correction time needed during the audit.

6. SIGNING THE MAP

Maps were signed manually until about two years ago, when an electronic signature procedure began. There are two companies that are certified by law to provide electronic signature software. The surveyors purchase magnetic cards to be able to sign electronically. This procedure exists in many governmental institutions, and is now also used for signing cadastral maps.

One of the issues encountered with digital signatures is that the cadastral map is in ".dwg" file type and the legally certified software cannot currently sign this file type. Instead of signing this format, a ".pdf" file is produced from the map file and this file is signed. To ensure that the ".pdf" file was produced from the final map file and to prevent duplicates it was decided that the map auditor would produce the ".pdf" file from the map file that was submitted to the SOI.

After the map audit is finished and the map is approved the director of the relevant cadastral department will electronically sign the ".pdf" file and the file will be sent to the surveyor to be signed. The file, signed twice, is sent back to SOI to store in the "Tazpit" archival databases and made available to surveyors through the "Topocad" system.

The electronic signature is a good tool for authenticating signatures and preventing forgery as opposed to manual signatures. It is also now commonly used in various government departments and agencies, so it is considered efficient and important in the era of rapid technological progress.

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7. FUTURE WORK

– Parts of the map database are considered classified and therefore it is required to protect this information from cyber-attacks.

– Transitioning the various tools to a more open source environment to reduce costs and dependency on third parties.

– Upgrading databases to more efficient and appropriate platforms for technology advancements that are adapted to current needs.

– The ability to store and back up data through the cloud, and increase storage space according to the expected future volumes.

– The possibility of queries and manipulations to generate insights and suggestions for improvement in the audit process.

– The possibility of working in real time, so that the material will be updated simultaneously to the user without the need for unnecessary waiting.

– Adapting the "Topocad" system to smart cellular devices so that it will be possible to perform operations from anywhere.

– Continue the process of converting all maps printed on paper and accompanying documents to digital media files.

BIOGRAPHICAL NOTES

Danny Raisky is currently a senior coordinator in land registration department of the Survey of Israel responsible for auditing land registration cadastral maps.

He has participated and led several cadastral projects such as the registration of Mediterranean Sea blocks, unifying non-contiguous blocks and registration of large parts of the Negev

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