Collecting Parcel Data on Handheld Computers

by Edgar Clodfelter, Randy Link, and Thomas E. Walker

O ver the past several years, appraisers have made great strides in applying computer technologies to facilitate greater control over assessment information in the office. In the field, however, data collection is often paper-based or conducted using a laptop or tablet computer which can prove awkward during sustained field use, not to mention, expensive to implement.

For the past year, Maine Revenue Service (MRS), Property Tax division, and APAS, LLC, a Vermont-based property appraisal firm, have been utilizing handheld Pocket PC-type devices to do their field inspections. They partnered with Clearpath Innovations, Inc., a developer of handheld data collection programs, and MicroSolve Corp., the mass appraisal software company, who collaborated in the development of the handheld implementations. This article describes the development process and the experiences the appraisal organizations had using their handheld systems in real-world settings.

The handheld system developed for use in Vermont was based on the data set employed by the MicroSolve CAMA program in that state. That database is built around the Marshall & Swift cost approach. The Maine system was based on the database recently created by MicroSolve in emulation of an earlier system in longstanding use at MRS that applied cost tables developed and maintained by that agency.

The major part of the development process involved configuring the handheld device to match each database. Clearpath Innovations' Field Assessor™ software was the development environment. The product is written in Microsoft's .Net framework and is designed to run on off-the-shelf Pocket PC devices. The program also can be modified to allow for wireless field access to a central CAMA database if the device uses Microsoft's Windows Mobile operating system.

Equipment Employed

The handheld system was developed, tested, and implemented using a Dell Axim X50v Pocket PC running Microsoft Windows Mobile 2003/2005 (figure 1). The device incorporates a 640 MHz processor with 64 MB of RAM. It has two expansion slots and was equipped with the extended battery for up to 16 hours of use. Each unit includes a stylus that can be used for program navigation and sketching. The hanheld is designed for cold-weather operation. The cost was below $400 per unit, not including the extra extended battery.

Figure 1. Handheld used in implementation

Figure 2. Digital camera attachment

The camera used in development and deployment was the Pretec SmartCam SDIO digital camera (figure 2). It is attached to the handheld by insertion into one of the expansion slots. Once in place, the camera body can swivel 180 degrees for picture-taking at different angles. It has a resolution of 640 x 480 (VGA) and captures images at a maximum of 1.3 megapixels. The camera is priced at just over $100.

Figure 3. Parcel list opening screen

The unit's other expansion slot was used for a flash memory card that stores changes made to the property characteristics as well as any photos and sketches of the property. Both organizations used a 512 MB card. A 256 MB card is the minimum capacity recommended by the application developer.

Application Overview

Each handheld device was loaded with a copy of Field Assessor™ software that had been adapted for use with the organization's database. To begin the day's work, the field appraiser docks the handheld to a computer with access to the CAMA system. He or she then opens the CAMA application, identifies the parcels needed in the field, and clicks the button, "Export Parcels to Handheld." This action downloads the data, photos, and sketches related to the selected parcels to the handheld, and the device is then ready for the field.

The number of parcels the handheld can hold is determined by the capacity of the memory card and is dependent on the number of photos and sketches each record contains. For example, if a record included only one photo and one sketch in addition to the property characteristics, a 256 MB memory card could hold more than 3,000 records. In the Vermont appraisal firm's experience, its appraisers would download typically 50 to 75 parcels at a time and still have plenty of room left on the card for information added during the property visits.

When the appraiser turns the handheld on in the field, the Field Assessor™ application first shows a list of parcels, along with a preview pane that provides additional information on the selected parcel, including the photograph (figure 3). To begin working on the selected parcel, the appraiser clicks the associated "Edit"

Figure 6. Photo Manager captures and organizes property images

button, which brings up the electronic parcel card in the application. The key categories such as Overview, Land, Outbuildings, and Section are listed along the top of the screen (figure 4). Clicking on a category box brings up the list of property data contained in that category (figure 5). If there are multiple pages of information in a given category, sub-category navigation is offered at the bottom of the screen. The majority of data fields use either pull-down list selection or a pop-up number pad for selecting values. The application automatically validates data entry informing the user if a selection is invalid.

The program also contains a photo capture function that allows property images to be added or updated dur-

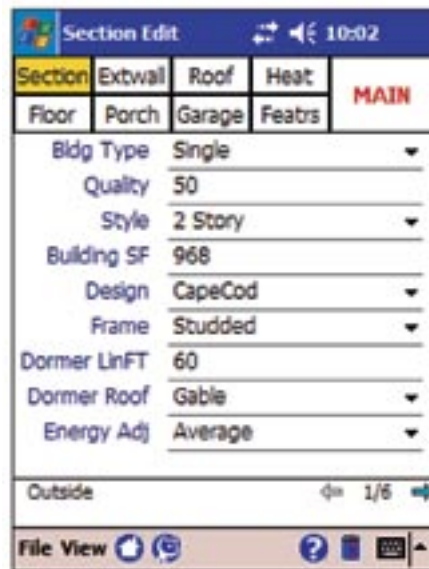Figure 4. Electronic property card

Figure 5. Building characteristics located in section category

Figure 7. Available screen views in Sketch Manager

ing the inspection process. Photo capture is begun by clicking "View" at the bottom of the screen to access "Photo Manager." (figure 6) Photos are arranged on the screen with date of capture and an optional description. Multiple photographs can be included for a given parcel. Clicking the "Edit" icon or the "New Photo" button launches the camera software which allows the use of the attached camera. When the image is saved, it is automatically associated with the current parcel and will be uploaded to the office's CAMA database with the property data.

Appraisers also have the option to sketch a property on site. By clicking "View" to access "Sketch Manager," the appraiser is presented with a list of sketches associated with the current parcel and can click the associated "Edit" button to view or modify the sketch (figure 7). All sketch manipulation is done via a third-party product, MobileSketch™ Pro from Apex Software. The application automatically calculates area as different regions of the structure are completed. Sketches, like photos, are automatically associated with the property they represent and are uploaded with property data to the CAMA system. Once the upload has taken place, sketches made in the field can be viewed and edited on the appraiser's desktop PC.

When the day's field work is completed, the appraiser can upload the new data at the office by docking the handheld to the PC, opening the CAMA application, and selecting the option, "Import Parcels from Handheld." All parcel attributes that have been edited in the field are now uploaded to the CAMA database, along with all changes to photos and sketches.

Field Use Experience

Maine
The Maine Revenue Service's Property Tax Division is responsible for conducting property appraisals in the Unorganized Territory of the state. This assignment poses a significant challenge to appraisers. Covering more than half of the entire area of the state (from the New Hampshire border to New Brunswick, Canada, and from the very northern tip of the state to some offshore islands), it has few roads or well delineated property lines. Appraisers have traditionally set out for their destinations with quantities of property cards in their cars, searching for poorly marked roads and trails. They often had to leave their cars and hike in to find the camps and cabins they needed to inspect. Replacing the stacks of property cards with a small handheld unit was in itself an improvement.

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It took some time, however, for the appraisers, many with decades of paper-and-pencil experience, to acquire the new skills necessary to conduct their appraisals with the handheld. With paper cards, appraisers had all the property inventory specifics in front of them. When using the handheld, they needed to mentally organize the inspection process, covering, for example, all of the exterior features before proceeding to the inside of the house, then entering all the data related to the first floor before going to the second. Initial training was done in the office; then supervisors spent a day in the field with the appraisers to make sure the new procedures were becoming ingrained.

Appraisers quickly became productive using the new methods, and feedback was mainly positive. Sketching took the most time to master, perhaps because with the previous CAMA system, the MRS staff had used a drawing program that created rectangles and straight lines but did not calculate areas. They, therefore, had no need to close an area. For the handheld application to work properly, they now had to learn the rudiments of sketching on a small 3.7-inch screen. This took some effort, although ultimately the results were good.

Because of the rugged terrain in which the MRS appraisers operate, their handheld units were outfitted with a DeLorme Blue Logger global positioning system (GPS). This device displays a property's geocoordinates on the handheld's screen and they are automatically stored in the database. The GPS has proven to be a welcome enhancement, making it possible on subsequent inspection trips to locate properties much more quickly than in the past.

Vermont
The appraisers working with APAS were already very experienced using the MicroSolve CAMA system which has a data structure similar to that of the handheld program. Therefore, there was little need for training in data collection on the handheld, beyond an initial orientation to the device. Since appraisers moved their own data to the handheld, they were given a minimal refresher course on using filters to select properties for downloading.

There were two areas, however, where it became apparent that the appraisers could benefit from additional training. First, they needed help with certain details of how to use and navigate the handheld. Operations such as docking the handheld, establishing a "guest" link between the handheld and the workstation, moving around the handheld and running programs, and checking battery use were all given further explanation so that the appraisers could operate their handheld systems most productively.

A second area that required additional training was sketching. In the

past, appraisers and data collectors typically field-sketched the structures on cards, then passed the information to data-entry personnel for completion. Now they were being asked to complete an electronic sketch by themselves and in the field. Although they were familiar with using Apex sketching software to edit sketches on the desktop, they had never been responsible for producing a finished sketch. This required training on the use of Apex's Mobile Sketch™. It also required practice.

Once the fundamentals of sketching were understood, experience proved to be the greatest teacher. In addition, appraisers frequently shared their discoveries of techniques that improved their efficiency at sketching.

They all agreed that certain properties were not conducive to sketching on the handheld device. Very large dwellings, with multiple sections, story heights, and porches were too cumbersome to sketch on the handheld system, due to the size of the screen. Sketches of these property types, it was agreed, were best completed on the larger screen of the desktop workstation.

Once training was completed and the devices were taken into the field, some appraisers quickly became more comfortable using them. For example, soon after adoption, the two more technically oriented members of a four-person team were soon as productive as ever, even factoring in the more demanding sketch tool, whereas the two others were initially less productive than they had been with paper and pencil.

Apex on the handheld has a very steep learning curve. The company has announced that training videos are in preparation. These should go a long way toward speeding the acclimation process.

Handheld Uses and Benefits for Appraisers

The handheld-based system demonstrated its worth over previous methods in a number of ways. Following are some of the key areas.

Property Revisit Reduction

The handheld system, with its built-in edit checks, ensures a much higher rate of accurate form completion while the appraiser is still on site. When paper forms are used for data collection, the appraiser measures the structures and records the information in the field, and then submits the collected data to clerical personnel for input. However, if all the relevant data is not collected, cannot be easily understood, or is input incorrectly, the forms must be returned to the data collector for interpretation or completion, sometimes by a site revisit. Because the handheld's data input application verifies entries while the appraiser is still in the field, it reduces the occasions when site revisits are necessary for data correction.

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Time and Cost Savings

There are three areas in particular where the use of this handheld system resulted in time and cost savings for data collection.

As mentioned previously, because the software makes sure that all the necessary data is collected and entered correctly before the appraiser leaves the site, it means that most properties need only be visited once.

The sketching application saves time and money because it allows the appraiser to complete the property sketch and to calculate the square footage of the dwelling at the time of the visit. Even though this approach is more time consuming during the property visit, it obviates the need for interpretation of the field sketch by data-entry personnel, and ensures that

the sketch will close. While the handheld introduces these efficiencies for simple sketches, more complex sketches which require greater screen space than the handheld provides are best completed on a desktop system.

Possibly one of the greatest time savings, however, results from taking digital photos with camera and software integrated into the handheld system. With other implementations, digital images are taken of each property, recorded by Parcel ID on a picture form, and then downloaded to the desktop computer at the end of each day. After the photos have been downloaded, the image files are renamed to match the parcel identification code so the data-entry staff can match and link the pictures to the correct record. With the handheld system, any photos taken are immediately linked and appropriately named by the handheld system. This results in significant savings in time for both the appraisers and the office staff.

Multiple Database Updates

When an appraisal firm is conducting simultaneous reappraisals for many different towns which use property cards, it faces the challenge of keeping each town's property records current when the record updating is typically handled on the firm's own data entry systems which are generally at a different location. With the handheld system, the updated property data can be uploaded directly to the town's own systems so the town's records are always current. An added benefit is that the town's non-appraisal staff can update identifying information (owner name and address, map number, and so forth), while property characteristics are being reviewed in the field because their work will not be overwritten by incoming data from the handheld.

Data Verification Assessments

For reappraisal projects that do not require full interior and exterior inspections, only data verification and implementation of new tables and values, the handheld system serves as a useful tool. The existing data can be

downloaded onto the handheld and taken into the field for review, thus avoiding the need to transport boxes of files and papers. Since sketches and pictures are also downloaded and visible on the handheld screen, appraisers find it much easier to locate properties. Necessary changes to data characteristics can be completed on the handheld system at the time of each visit, thereby increasing production.

Homogeneous Data Collection
By the same token, in every reappraisal project, there are certain types of structures where data can be collected quickly. Examples are mobile homes in mobile home parks, travel trailers in campgrounds, camps on lakes, and dwellings in a development. Where there is homogeneity of property types, a handheld system can increase the efficiency of the data collection process by facilitating repetitive input of identical data elements.

Appointments
Using a handheld system, appraisers with appointments for interior property inspections are able to select and download quickly only those properties requiring data collection. As an added benefit, the appointment schedule, along with names, addresses, and phone numbers, can all be stored on the handheld providing the appraiser with one source of necessary information. In the near future, the appraiser will be able to locate the property by using a geographic-information-system-based mapping system loaded onto the handheld.

Property Owner Review
During the appointment, the appraiser can also use the handheld system to review existing data with the property owner. This allows the property owner to see exactly what is included in their file. Any errors can be corrected at the time of the visit. Also, the appraiser can review existing sales information in the same area as the property. Any opportunity to educate and inform taxpayers will yield benefits in the long run by building confidence and good will among property owners that

the appraiser is making every effort to treat them in a fair and equitable manner.

Data Quality Studies
Vermont's Division of Property Valuation and Review has recently encouraged towns to undertake data quality studies before embarking on statistical updates, or updates without interior inspections. The handheld system works well for verification of data for selected properties in a data quality study. The pre-selected parcels can be downloaded onto the handheld, the properties inspected, and any changes made on the spot. The system also records the date of the changes and allows notes to be placed in the record.

Future Potential
Our year-long experience has shown the handheld system's usefulness in the arena of data collection. As more hardware and software features are added, many of the following scenarios could add to its functionality in the near future.

All-in-One-Handheld, Phone, GPS, Camera
Greater options are emerging that integrate cell phone, camera, and GPS into handhelds operating in the Windows Mobile™ environment. With advances in screen dimensions for these devices, users will have a smaller version of their desktop PC in the palm of their hand. All these capabilities will be integrated in a user-friendly, seamless way to allow capture of more information than has been possible with a single device.

Wireless Access to Central Database
As available wireless bandwidth increases, appraisers will be able to use their handhelds to connect wirelessly from the field to the central assessment database to check parcels in and out. This connectivity would make it possible to check in a parcel, and then receive a value calculation back to the handheld. That way the heavy lifting remains with the central server, but the results are available instantaneously to field personnel.

E-mail Delivery of Parcel Data
Appraisers will be able to single out data, photos, and sketches for a given property and e-mail that information to associates at the touch of a button. This expands the opportunities for collaboration when appraisal staff is geographically dispersed.

Voice Recognition
Of great potential is voice-recognition software that will be able to respond to user speech to control the software and to transcribe verbal input into computer text. Within a few years, third-party software is expected to allow reliable voice-recognition of this nature, which will resolve many issues associated with text entry on smaller devices.

Conclusion
The early experience of APAS and the Maine Revenue Service, Property Tax Division with the handheld computer as a data collection tool has been positive. Field appraisers have achieved a productivity level matching that of appraisers using paper and pencil, and the time-consuming process of re-entering the data into the computer has been eliminated.

Enhancements such as the attached cameras have eliminated the need to log photo names separately and manually attach the photos to the property record, while the inclusion of GPS units has permitted the addition of the geocoordinates of properties into the data records. These enhancements add significantly to the value of the handheld as a field assessment tool

Edgar Clodfelter is president of Automated Property Assessment Services (APAS), LLC, based in Adamant, Vermont.

Randy Link is president of Clearpath Innovations, Inc, based in Auburn, Maine.

Thomas E. Walker is Property Appraiser, Maine Revenue Service, Property Tax Division.