

RECLAMATION

Managing Water in the West

Final Report ST-2014-01-5481

Concrete Core Logging App



Audrey Rager
MERL-2014-93



Research and Development Office
Bureau of Reclamation
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Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Executive Summary

This scoping study evolved from a Research Jam idea with the goal of answering the questions of whether Reclamation could effectively use tablet computers for logging concrete core in the field and laboratory. Tablets offer a cheaper and more portable alternative to laptop computers and, with the growing number of available apps, there is something available for most every task – note taking, data collection, photography, drawing, annotating drawings and photographs, file sharing, and access to standards.

Concrete core logging can be a complicated process. Personnel with varying degrees of experience are often tasked to log concrete core. Logging involves taking photos, making sketches, measuring core, and recording other pertinent data. Using a tablet app would enable loggers to organize all the data in one place. Photographs can be taken and labeled on the spot, rather than keeping a handwritten photo log and labeling the photos back in the office. Core loggers can make sketches directly on or adjacent to photos and notes. All data can be uploaded to a cloud or laptop computer, making generation of reports a much quicker process. Loggers will also be able to share the data with engineers in the office.

The original goal of this project was to write a tablet app that could enable U.S. Bureau of Reclamation personnel to more efficiently log concrete core in the field or lab. Initially, the app would focus on logging and describing concrete core in accordance with ASTM C856 (Standard Practice for Petrographic Examination of Hardened Concrete) and USBR-4856 (Petrographic Examination of Hardened Concrete). It could later be expanded to include procedures for logging rock core in accordance with Engineering Geology Field Manual, 2nd Edition, Volumes I and II, U.S. Bureau of Reclamation.

To accomplish this, the tablet app would have to have the following capabilities:

- Take photos and trim these photos to remove background so only the labeled concrete core sample and scale are showing.
- Accurate and detailed sketches on the tablet computer.
- Add the trimmed photos of core to the sketch and sketch or annotate on the photograph, if necessary.
- Add typed text to any photographs and sketches.
- Access standards, including but not limited to the following, in pdf or ebook format.
 - ASTM C856 (Standard Practice for Petrographic Examination of Hardened Concrete)
 - USBR-4856 (Petrographic Examination of Hardened Concrete)
 - Engineering Geology Field Manual, 2nd Edition, Volumes I and II, U.S. Bureau of Reclamation
- Share sketches, photographs, typed notes with office personnel via cloud or e-mail.
- Export sketches, photographs, typed notes to a Word Document or a pdf for integration into a final petrographic report.

Were the app to be modified in the future to include logging rock core, the following features would need to be added:

- Create forms to prompt the user to enter required data in compliance with the Engineering Geology Field Manual.
- Export data into a format that can be imported into core logging software at the office.

The scope of the project shifted from developing an app to evaluating existing tablet apps when it became apparent that a significant amount of time and money were needed for iOS training and app development. Many free and low-cost apps were downloaded and tested (Table 1). The purpose of the testing was: (1) to determine if any current apps could meet the needs for the proposed app and, (2) if so, try to model the useful features in these apps and integrate them into in one in-house, custom tablet app in the future.

Table 1 is a matrix showing the requirements for a concrete core logging tablet app that were met by existing tablet apps. No existing tablet app met all the requirements. However, a combination of existing tablet apps could be used to log concrete core according to ASTM C856 (Standard Practice for Petrographic Examination of Hardened Concrete) and USBR-4856 (Petrographic Examination of Hardened Concrete).

The tablet apps tested could be roughly divided into categories based on their strengths in (1) photography, (2) drawing, (3) note taking, and (4) reading pdfs and ebooks.

Recommendations

Photography Apps

The best tablet apps for photography are Skitch and InstaCollagePro. Both apps allow for taking photos or importing existing photos from the tablet's camera roll as well as crop and sketch on the photographs. Skitch allows the user to annotate photos and add markers, features that would be beneficial in creating figures to communicate results to office personnel and in a final report. InstaCollagePro has color adjustment and correction features that Skitch lacks. InstaCollagePro also allows the user to combine multiple photos in predefined frames, a feature that could be useful in producing final figures for a report.

Drawing Apps

Skitch has the most drawing functions of the apps reviewed. Most notably, it allows the user to directly add photos from the camera or camera roll into a drawing. Skitch also has a variety of pen sizes and colors as well as predefined shapes. However, the quality of the drawing functions in INKredible surpasses any of the tested apps. There are many more line types, sizes, and colors. The two best features of the INKredible app are palm rest protection and the zoom drawing feature. Palm rest protection allows the user to draw in more detail with a fine-point stylus while resting a hand on the screen. Using a stylus without palm rest protection leads to the screen scrolling, making it difficult to draw. The zoom drawing feature allows the user to zoom into a section of the drawing and sketch in more detail. This could be useful when drawing detailed relationships in

concrete core (e.g., cracks or mineral inclusions in aggregate, air-voids clustering around aggregate, etc.)

Note Taking Apps

Because it includes both type and handwritten text along with the ability to add photos and make drawings, Skitch is the best choice for note taking among the apps reviewed. Many of the other apps have additional features and associated complex menus that are of no value for logging concrete and get in the way of the process.

eReader Apps

Both iBooks and the Kindle Reader app allow the user to read pdf documents and ebooks on the tablet computer. Standards, forms, and reference books can be stored on the tablet computer for easy access in the field or lab. If a custom in-house tablet app for logging concrete core is developed, it need not include an ereader feature; these existing apps can be used.

Recommended Procedures for Using Existing Apps to Log Concrete Core

Either the Skitch or INKredible apps could be used to sketch the concrete core. When using INKredible, the drawings could be exported to the tablet computer's camera roll and later added to Skitch. Using Skitch, photographs of the core could be added to the sketch. These photos can then be cropped to show only the core, scale, and any labelling. Typed or handwritten text can be added along with arrows or other markers to point out any features of interest. Documents can be exported and e-mailed to office personnel and edited for use in reports.

Moving Forward

Someone experienced in logging concrete core according to ASTM C856 (Standard Practice for Petrographic Examination of Hardened Concrete) and USBR-4856 (Petrographic Examination of Hardened Concrete) should be able to use existing apps as outlined above for concrete core logging. However, there may be situations where any inexperienced person is called upon to log core. In this situation, it would be beneficial to have a tablet app that prompts the logger on the required steps and data that must be gathered and terminology that should be used. Developing an in-house app that includes forms and data dictionaries specific to the procedure could save time and money by improving the efficiency of the logging process and ensuring that all loggers comply with procedures. Such an app could later be modified for rock core logging following procedures in Engineering Geology Field Manual, 2nd Edition, Volumes I and II, U.S. Bureau of Reclamation.

Table 1. Matrix showing the requirements for a concrete core logging tablet app that were met by existing tablet apps.

Tablet App	< Take Photos	Crop Photos	Annotate Photos	Add Markers	Photo Color Correction	Combine/Overlay Photos	Sketch/Draw	Change Pen Size, Style, and Color	Insert Shapes	Palm Rest Protection	Take Photos or Add Photos	Directly Into Drawing	Multitasking Gestures	Paste Photo/Other Documents Into Sketch	Handwritten Notes	Typed Notes	Searchable Text	Searchable Handwriting	Take Photos or Add Photos Directly Into Notes	Access pdf	Access ebook	Export/File Sharing
Evernote	<									<												
iNKredible																						
Notability	<																					
Magical Pad	<																					
Penultimate	<																					
Sketches	<																					
Skitch	<																					
After Photo	<																					
FontCandy+	<																					
InstaCollagePro	<																					
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**Point of Contact: Audrey Rager, Geologist,
USBR-TSC-MERL, arager@usbr.gov, 303-445-2377**

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