

UC

# Automating Geotechnical Boring Data Collection

Using Survey123 and ArcGIS Online

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# About Me

- 13 years experience in Engineering/Consulting
- Enrolled in Penn State Masters Degree Program
- Work for Wood Rodgers, Inc. – Engineering/Consulting firm in Reno
- Support multiple disciplines company wide

# Presentation Overview

- Problem Statement
- Existing Workflow
- Updated Workflow
  - Survey123
  - ArcGIS Online
  - Python
  - Web interface
- Issues Encountered



# Problem Statement

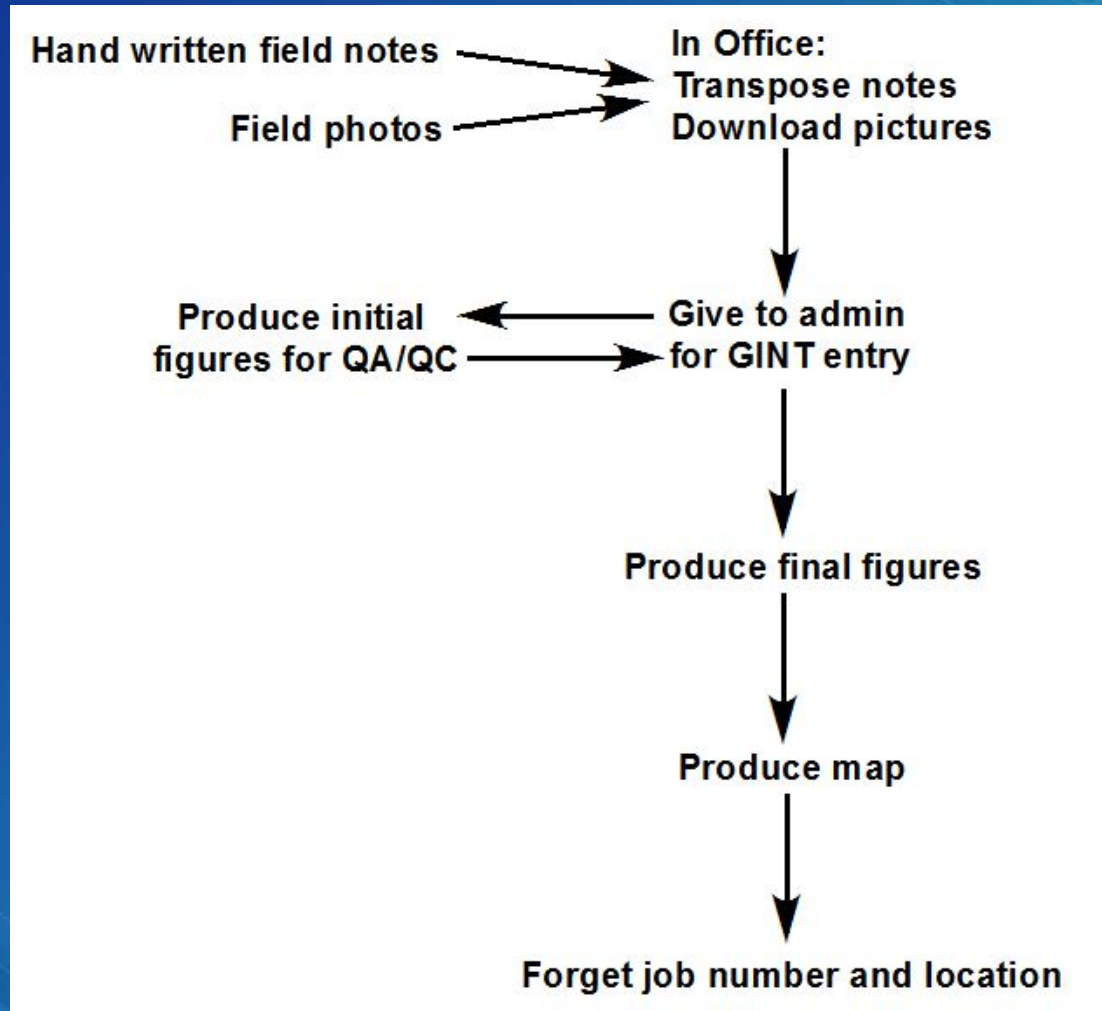
- Geotechnical data collection workflow needs to be improved
  - Reduce manual data entry
  - Standardize field data collection
  - Reduce QA/QC time
  - Develop a database of past projects

# Existing Workflow

1. Hand written notes from the field
2. Photos collected using camera or phone
3. Return from field and transpose so they are legible/not so muddy
4. Give to admin for entry into GINT for processing
5. Return to investigator for QA/QC
6. Re-enter into GINT
7. Produce report and maps
8. Done?
9. Forget job number and location



# Workflow Diagram





# Problems with Current Workflow

- **Transcribing hand written notes is time consuming and error prone**
- **QA/QC process potentially involves multiple iterations since data entry is not done by the person who collected the data**
- **No spatial record of where work was performed**
- **Photos have multiple ways of getting lost**

# Goals for Updated Workflow

- Reduce data entry time
- Standardize intermediate and output products
- Create a spatial reference database of all exploration locations





# Updated Workflow

- Collect field data using smart device in the field running Survey123
- Collected data is sent directly to the Cloud
- Automated Python script:
  - Pulls data from Cloud to SDE database
  - Creates Microsoft Excel file that can be directly consumed by GINT
- Report generated from GINT
- Once QA/QC process complete, web app to store final location and report

# Survey123 for ArcGIS

- Free app from Esri
- “Data centric” data collection
- Advantages for complex data collection:
  1. Allows branching
  2. Allows required questions
  3. Support internal calculations
  4. Offline use
  5. Collects Locations
  6. Collects named photos



# Survey123 Interface

The screenshot displays the Survey123 mobile application interface. At the top, the status bar shows 'AT&T', the time '8:27 AM', and '100%' battery. The app header is green with a close button (X) on the left, the title 'My Survey' in the center, and a menu icon (three horizontal lines) on the right. The main form area is white and contains several input fields: 'Job Number', 'Project Name', 'Hole Size (inches)', 'Contractor Name', and 'Equipment Used', each with a corresponding text input box. Below these is a 'Date' field with a dropdown menu showing 'April 26, 2017' and a clear button (X). The 'Test Pit ID' field contains 'TP-' and has a clear button (X). A section titled 'Ground Water Levels (ft)' contains two more input fields: 'At Time of Excevation' and 'At End of Excevation'. At the bottom right of the form area is a green bar with a white checkmark icon, indicating a save or confirm action.

# Photo Management

AT&T 8:27 AM 100%

**My Survey**

**Photos**

Site Photo

Test Pit Photo

Stockpile Photo

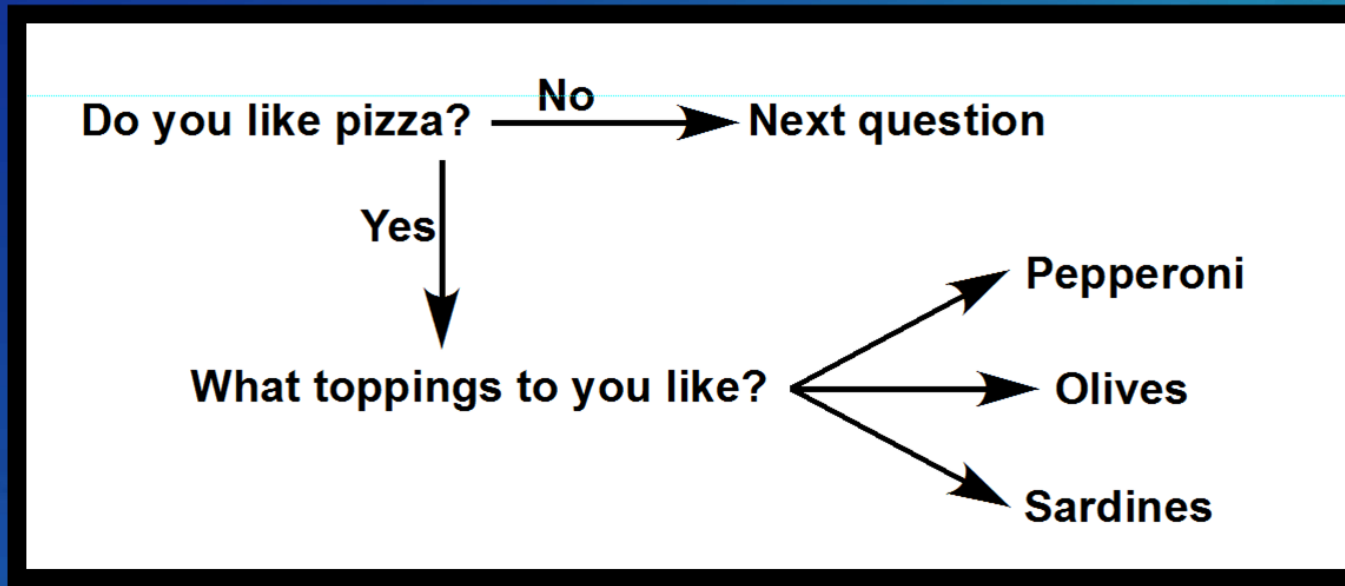
Generic Photo #1

Generic Photo #1 Comment

Generic Photo #2

Generic Photo #2 Comment

# Branching in Survey123



# The Cloud

- Data collected using Survey123 is stored in ArcGIS Online
- Within ArcGIS Online:
  - Can be viewed as a table or map for initial QA/QC
  - Raw data will always live here





# Python Scripts python™

- Bridge between ArcGIS Online and local environment:
  - Run daily
    - Populate records in a local GDB
    - Store photos in network location
    - Write to Microsoft Excel file with specific format and multiple tabs for direct input into GINT

# Saving for Posterity

- Once the Geotechnical Report is finished the data is stored in SDE
  - Accessible online or on desktop
- Need easy interface for non GIS users to upload finished product
  - Solution is to build a custom web interface

# Web Interface

- Custom web interface:
  - Java Script
  - Flask
- Functionality:
  - Creates points in SDE for each boring location using coordinates from initial data collection
  - Attaches photos from initial data collection
  - Populates fields with job number, job name and collector name
  - Attaches final PDF report

# Web Interface Example

wr - Planning Dept - GIS Portal

## Geotech Exploration Locations

**Office:**

**E-mail:**

**Input Excel File:**  
Please enter the Excel file exported from GINT

**Test Pit PDF (from GINT):**  
Please enter the profile PDF exported from GINT

**Photo Path:**  
Please enter the path to the photos

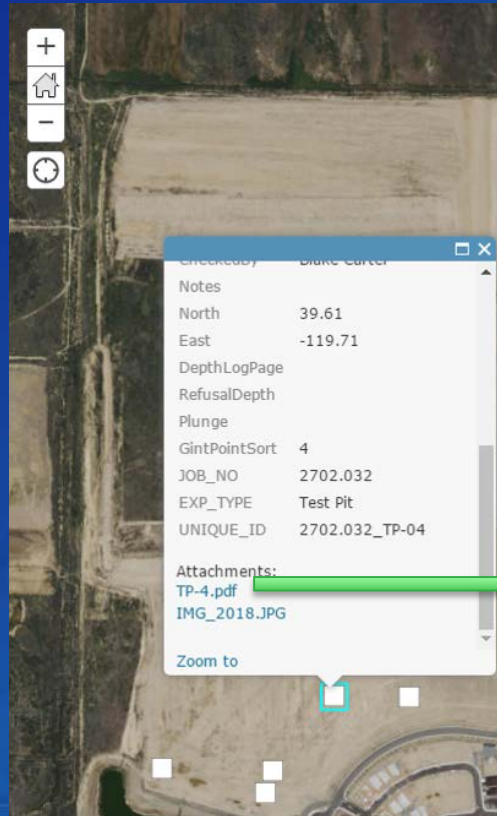
**Lab Results:**  
Please enter the path to the lab results

**Database Location:**  
Please enter the path where you would like to store the local database

# Final Web Map

- Stored on GIS Portal
- Result of the web tool is a sharable web map with points for each boring
  - This means no questions about past boring and drilling locations
  - Report is attached for easy access
  - Easy to find the job number for further research

# Final Web Map Example



DEPTH (ft)		GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RD)	BLOW COUNTS (N VALUE)	DRY UNIT WT. (pcf)	IN-SITU MOISTURE CONTENT (%)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
										LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0			FILL - SILTY SAND WITH CLAY, (SC-SM) loose to medium dense, moist, brown dark brown, compacted fill										
2.5				GB 4A			122.9	10.9					
5.0			SANDY FAT CLAY, (CH) stiff, moist, light brown	GB 4B			89.0	23.0					
7.5			CLAYEY SAND, (SC) medium dense, moist, brown										



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**TEST PIT NUMBER TP-4**  
PAGE 1 OF 1

CLIENT Tanamera Development PROJECT NAME Pioneer Meadows Apartments  
 PROJECT NUMBER 2702.032 PROJECT LOCATION Sparks, Nevada  
 DATE STARTED 2/11/16 COMPLETED 2/11/16 GROUND ELEVATION 4479 ft TEST PIT SIZE 24 inches  
 EXCAVATION CONTRACTOR Stampede Construction GROUND WATER LEVELS:  
 EXCAVATION METHOD Deere 310J AT TIME OF EXCAVATION --- No Free Water Encountered  
 LOGGED BY Don Demosthenes CHECKED BY Blake Carter AT END OF EXCAVATION --- No Free Water Encountered  
 NOTES: AFTER EXCAVATION --- No Free Water Encountered



# Issues Encountered

- Hard for field workers to use iPads in some situations
  - Bright sun makes the screen hard to see
  - Muddy hands make iPad impossible to use
- General resistance to change
  - Paper is a hard habit to break



# Goals Met

- No more hand writing notes reduces manual data entry to once per job
- QA/QC time is reduced since the data is user entered
- Now have a functional spatial database of all projects that can be accessed by non GIS users



# Questions?

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