



Hit the Easy Button: Making Real-Time High-Accuracy GPS Collection Accessible to Construction Crews

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AGENDA

- What does “real-time high-accuracy” GPS actually mean??
- Recent changes in the tools and techniques used to perform mapping
- How do construction crews fit into the data collection puzzle
- Why is PG&E interested in improving the data collection process
- Technology Overview
- PG&E pilot project
- Lessons-learned and next steps

WHAT DOES REAL-TIME AND HIGH ACCURACY MEAN?

- High Accuracy
 - Sub-Meter
 - Sub-Foot
 - Centimeter
- Real-Time
 - Spatial positions are corrected on-the-fly using Real Time Kinematic (RTK)
 - Combines a GNSS base station with rover receiver to achieve higher accuracy
 - No post-processing / differential correction

HIGH ACCURACY GPS = PROFESSIONAL SURVEYOR?

- Traditional GPS technology was complicated and required extensive training to use
- Required technical competence to configure and use the mobile collection tools
- Until recently, high accuracy GPS was expensive (~\$30K per unit)
- Modern technology has allowed GPS receivers to communicate with consumer grade devices (smart phones and tablets)
- Integration with other devices makes the data collection process simpler
- Deploying RTK base stations has become simpler and more cost effective

WHY DO WE NEED REAL-TIME & HIGH ACCURACY GPS?

- Regulations require operators to capture more precise and detailed data about assets during construction
- Damage prevention is strengthened by the ability to quickly and accurately locate existing assets
- Emergency response is aided by accurate maps
- Helps with the automation of back-end GIS data integration
- Increases your ability to accurately track items from inventory

WHY DO CONSTRUCTION CREWS NEED HIGH ACCURACY GPS?

- Reduces the need to hand draw as-built sketches and fill out material documents
- Brings automation to the field data collection process
- Data must be collected before backfill when the assets are still exposed
- Construction process shouldn't be delayed by the mapping process

PG&E'S INVESTMENT IN HIGH ACCURACY GPS

- Prevent pipeline damages
- Improve emergency response time
- Create complete in ground asset management
- Streamline mapping inefficiencies

PG&E'S GPS PROGRAM

- Program highlights
 - New construction
 - Existing and deactivated assets
 - Locates
- PG&E required technology that was:
 - Simple to use
 - Accurate
 - Reliable
 - Integrated

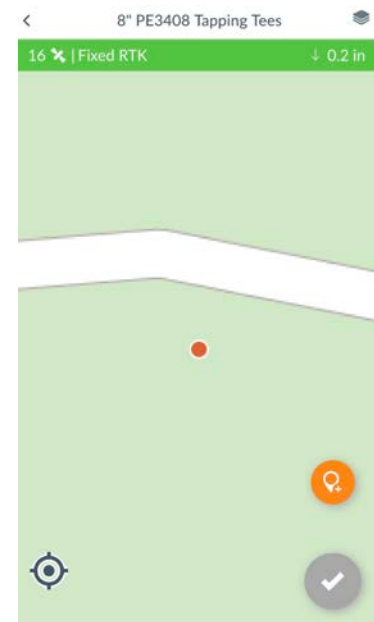
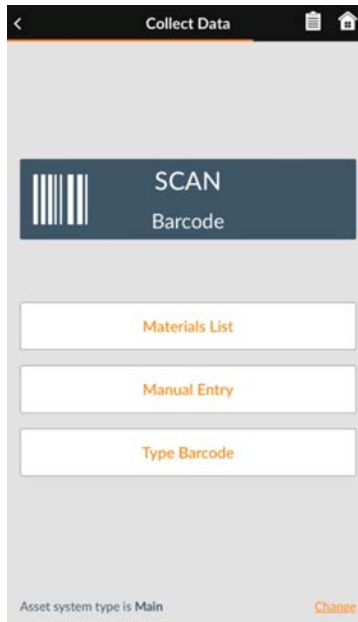
TECHNOLOGY OVERVIEW

- Mobile application for iOS, Android, and Windows
- Facilitates the collection of all construction data
 - Maps and as-builts, material traceability, joint traceability, OQ verification, and general forms
- High accuracy GNSS receiver that connects to a mobile device via Bluetooth
- RTK approach for obtaining accuracies up to 1cm
- Barcode Scanning
- ArcGIS Feature Services are the primary mechanism used to transfer collected data

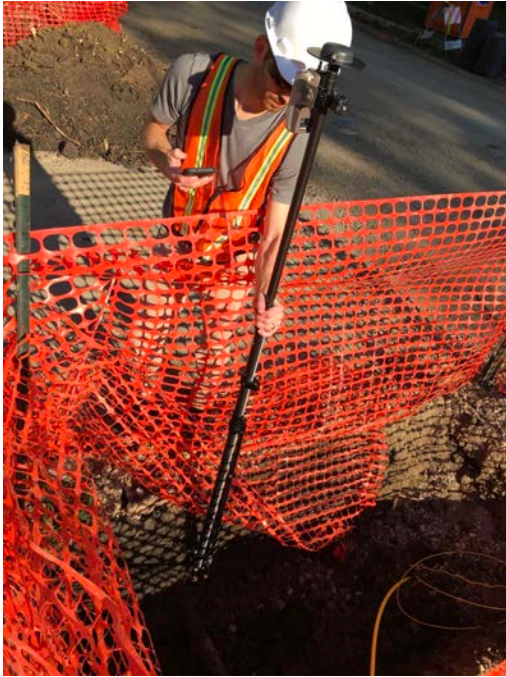
SIMPLE TO USE

- User interface and user experience are designed for construction crews
- Connecting to RTK base stations is automated
- Big, easy to understand buttons
- Only useful numbers and symbols are present on the primary user interface
- Workflow-driven

USER INTERFACE



HARDWARE



ACCURACY & RELIABILITY

- PG&E has established requirements for system accuracy and reliability
- Accuracy:
 - 90% of the data < 6-inches
 - 99% of the data < 12-inches
- Reliability:
 - PG&E required 99% uptime

INTEGRATION

- Real time high accuracy GPS reduces the need for additional back-end tools and processes for improving spatial accuracy
- Barcode scanning automated the process of creating features and populating attributes
- Fusion machines can transfer data via Bluetooth
- Data is centrally managed in a cloud environment
- Integrations between cloud and enterprise are built for transferring data

PILOT PROJECT

# users	20
# teams	4
Teams	Maintenance & Construction General Construction Construction Inspection Construction Contractors
Duration	6 months
Location	Bay Area California

RESULTS

Total Feet Collected	18,000 ft
Total Fittings Collected	815
Average Accuracy	4.63 in
% Under 6 Inches	91%
Back-End Snapping	Automated process scripted via python for finding and eliminating topology errors

WHAT HAVE WE LEARNED SO FAR?

- GPS and RTK applications settings must be pre-configured
- Feedback to the user regarding their current GPS accuracy is very important
- On-screen GPS indicators must be simple and intuitive
- Providing GPS quality trend indicators in the application can increase an end-user's confidence in the mapping process
- It is important to train end users on the impact that buildings, trees, and other large objects can have on the data collection process
- The automation of the topology / snapping process is an important step in achieving full GIS integration

NEXT STEPS

- Further integration with GIS workflows
 - Improved snapping functionalities to help automate the data integration process
 - Improved mechanisms for transferring data from cloud to enterprise
- Finish implementation of the functionality which will enable the application to connect to the nearest RTK base station
- Analysis and recommendations for the implementation of RTK base stations throughout PG&E service territory

thank you.