PRECISION POSITIONING:

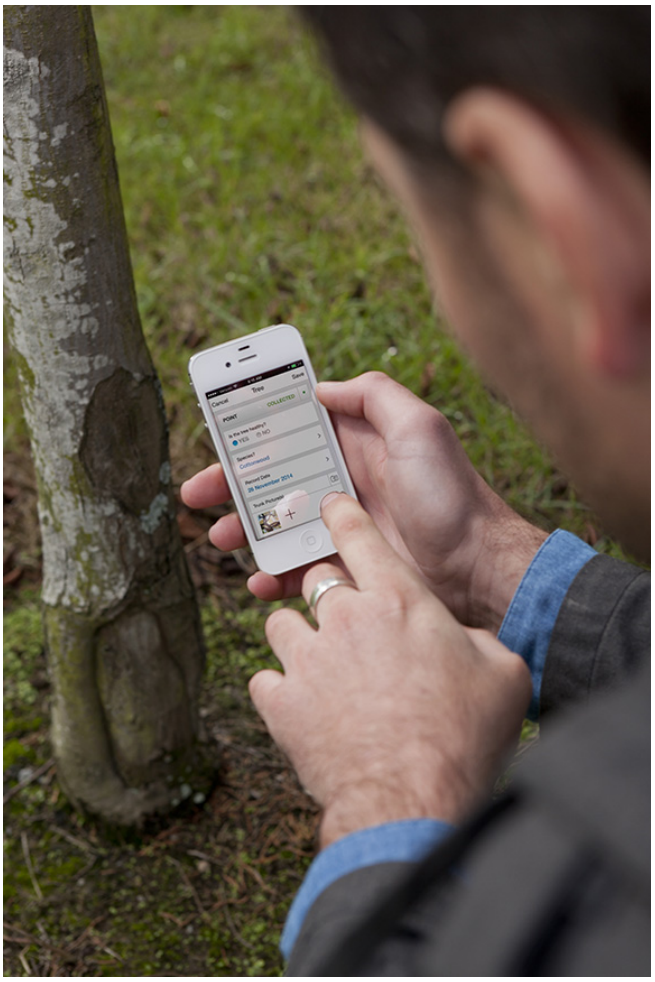
ADDRESSING THE MOBILE DEVICE ACCURACY ISSUE

ABSTRACT

In recent years, mobile devices, such as smartphones and tablets, have become an essential part of how people communicate and get their information. The use of these devices has grown rapidly and they now serve as a way for businesses across many industries to work smarter. Location accuracy from these devices, however, has long prevented them from being a viable solution for GIS work in the field; after all, their GPS accuracy only had to be good enough for basic navigation and turn-by-turn directions. The introduction of new receiver devices that pair with smartphones or tablets has opened the doors to higher accuracy positioning that can be achieved with such a combination, resulting in a new, cost-effective solution for Mapping and GIS professionals.

Trimble

Mapping and GIS professionals are likely aware of the increasing use of consumer mobile devices, smartphones or tablets in the field. Many are also familiar with the ability to obtain positioning data for field assets on their personal smart devices. When a company incorporates a Bring Your Own Device (BYOD) environment, IT departments are challenged because in certain geospatial applications, a mobile device's positioning capabilities—approximately a 5–6 meter range—is often not accurate enough for GIS professionals to efficiently and effectively locate an asset and collect data.



A GIS field technician collects data using a smartphone.

A traditional company-issued purpose-built embedded handheld device for data collection is designed to meet most accuracy demands in almost any environment. While these devices are the most appropriate technology option for some applications, they tend to be expensive and might be too much of a tool for many of the new positioning tasks and workflows where a smartphone or mobile device might be "good enough."

So what does a mapping or GIS professional do when they need better accuracy on their mobile device? Now, there are solutions available that pair smart devices with external puck-like receivers to help dial-in the accuracy for a fraction of the cost of a traditional embedded handheld receiver. Trimble's R1 GNSS receiver is specifically designed to meet this need.

Requirements and Accuracy

Receivers that offer positioning technology while pairing nicely with mobile devices have the potential to help mapping and GIS professionals locate assets and work smarter by supporting their daily GIS workflows. It is critical for these solutions to perform in a range of environments. At a minimum, a receiver must meet the following requirements[1]:

- The device must be rugged and protected against moisture or dust ingress to properly function even in snow, ice, rain or dusty environments.
- It must be able to take a fall, which it will likely experience during use in rugged, hard terrain, and should be equipped with protection from the effects of shock, drop and vibration.
- It must last the duration of a full workday in order to allow the professional to complete all of his or her daily workflows on a single battery charge.

However, a smart device may be just the right tool for many of the new GIS applications and workflows. Thanks to the accessory market, a lot of the shortcomings of an off-the-shelf consumer-grade smartphone can be addressed for use in professional environments. For example, protective cases can protect against weather, shock or impact—some of them even offer additional battery capacity; and screen covers can help reduce glare to improve sunlight visibility. With a smart device in hand, GIS and mapping professionals not only have access to GPS

[1] Most professional, company-owned handhelds are designed to meet the requirements outlined above and have a reputation for providing high-accuracy positioning data. As previously mentioned, these devices are still the only viable solution for environments where it would not make sense to take a smart device—such as a remote location in rough terrain where the device may not perform.

positioning data, but they are able to access and complete other work-related tasks from the same device, such as email, internet access and voicemail.

The most critical component that smart devices are still unable to address is location accuracy, which many mapping and GIS professionals require in order to successfully complete their job.

When Do Mapping and GIS Professionals Need More Accuracy?

A typical smart device, under ideal conditions, has a positioning accuracy range of only 5–6 meters. In many cases, this is good enough. To obtain positioning data, smartphones and tablets running iOS or Android use the "Location Services API".

Location Services allows location-based apps to easily use location information derived in a hybrid system using cellular network information, Global Positioning Services (GPS) networks and even Wi-Fi access point data to determine the location of the device.

Accuracies can vary; assisted GPS or A-GPS (GPS augmented with cellular technologies) allows the device to identify location with up to 5–6 meters, Wi-Fi positioning can determine a location with an accuracy of about 74 meters, and cellular only positioning—the triangulation of a location based on cell towers—only offers about a 600 meter range for location.

Location Services	Typical Accuracy Achieved
Assisted GPS (A-GPS)	5–6 meters
Wi-Fi	74 meters
Cellular	600 meters

Keep in mind, though, that cellular positioning is not an option when there is no cellular network available. In remote or industrial settings, this could potentially cause issues in determining an accurate location when A-GPS is not available. In water/wastewater, for example, when a GIS professional working in a remote ditch is looking for a valve or a meter and there isn't a cellular network connection, accuracy levels provided by the smartphone may not be sufficient.

But even with perfect network availability, the 5–6 meter accuracy provided by a smartphone or tablet often is not enough. Picture a professional looking for a specific access panel or manhole cover while the ground is covered by snow. Accurate location is important to find that access panel or manhole cover quickly and reliably.

In this situation, using the Trimble® R1 GNSS receiver would address the accuracy limitations of a smartphone or tablet. This small, compact professional-grade receiver provides sub-meter location data directly to the smart device via Bluetooth®. By simply pairing the device with their smartphone or tablet, GIS professionals can get the accuracy needed to quickly and reliably locate their asset, collect data and move on to the next task.

The Trimble R1 receiver connects wirelessly to a smart device via Bluetooth connectivity.

Accuracy with the Trimble R1 GNSS Receiver

The Trimble R1 offers 44-channels with parallel tracking supporting multiple satellite constellations, including GPS, GLONASS, Galileo, Beidou and QZSS.

Additional accuracy can be achieved by taking advantage of Satellite Based Augmentation Systems (SBAS) signals, which will help achieve higher accuracy in many locations around the world by accessing augmentation systems such WAAS, EGNOS, MSAS and GAGAN.

Virtual Reference Stations (VRS) and RTX (Real Time eXtended) correction services are also supported by the R1 to achieve sub-meter accuracy in real-time, without the need for post-processing.

The Trimble R1 integrates with the workflows of various mapping and GIS software including Trimble TerraFlex™, Trimble TerraSync™, and Trimble Positions™ software, as well as third-party applications.

Trimble R1 GNSS Receiver Features

The R1 GNSS receiver is designed to be compatible with a variety of smart devices and, due to its wireless Bluetooth connectivity, can be easily shared among multiple devices. As the investment into accuracy is made with the receiver, that investment is not lost when the smartphone or tablet gets damaged or when it is simply time for an upgrade of the smart device. The replacement device quickly and easily pairs with the Trimble R1 to take advantage of its higher accuracy.

The Trimble R1 receiver can be shared among multiple devices.

Additional features that make it especially convenient to use in the field include:

- **Small Size** – Mapping and GIS professionals are highly mobile. The R1 GNSS receiver can fit in a vest, jacket pocket, pouch, or be clipped onto a belt when traveling between sites. It can also be pole-mounted and used with an external patch antenna located on top of a range pole for workflows that require a pole. It is designed for easy storage and handling when not in use. This allows the professional to collect data and then easily carry it to the next location.
- **Lightweight** – It is designed to be carried around all day with ease. With a small footprint, the Trimble R1 weighs in at only 187 g (0.4 lb) and measures 11.2 cm x 6.8 cm x 2.6 cm (4.4” x 2.7” x 1.0”).
- **Rugged** – The device is tested to comply with MIL-STD-810, a military test standard for shock, drop and vibration, plus an IP-65 Moisture and Dust Ingress Protection rating.
- **Battery Life** – The battery life ensures performance in the field for a full work day.
- **External Antenna Port** –The Trimble R1 also offers an accessory part for external data if the device needs to be mounted on top of a vehicle, a pole, etc.

Each of these features is important, especially when seeking a device that can withstand the elements where GIS professionals often work. The Trimble R1 is designed to deliver accuracy in a small, lightweight and rugged form factor.

The Trimble R1 receiver can be transported in a vest, jacket pocket, or clipped to a belt when not in use.

Summary

The use of BYOD devices is continuing to grow in the mapping and GIS industry. Many organizations already issue smart devices to their employees to use for communication, among other work-related activities. In some applications and with the right accessories, smart devices can be suitable for GIS tasks. However, there are many applications and workflows that require higher accuracies than those offered by smart devices today. Trimble has designed the R1 GNSS receiver to bridge the gap between the accuracy of a consumer-grade smart device and those achieved by professional handhelds or receivers. The R1 GNSS receiver offers a sub-meter positioning solution for specific workflows that address these needs in the mapping and GIS workspace. As a rugged, compact device that can be seamlessly paired with a smartphone or tablet, it offers a convenient solution for highly mobile mapping and GIS professionals. Essentially, the Trimble R1 GNSS receiver makes accuracy personal.