RTK Networks: Single Baseline and Network Solution Options

Introduction

In the past, RTK level correction was obtained by using either a personal base station or a single CORS base station. Recently, advancements in technology have allowed the development of RTK networks (commonly referred to as RTNs) where multiple base station (e.g. CORS) data is supplied or processed concurrently to provide a networked solution. The differences between single baseline solutions and networked solutions will be discussed in this publication. For comprehensive definitions of terms and acronyms used in this document see GPS/GNSS Related Terminology at www.AlabamaPrecisionAgOnline.com.

Single Baseline vs. Network Solutions

For all RTK guidance operations, either a single baseline or network solution is being utilized to obtain GPS/GNSS correction data. Basically, a single baseline solution uses one base station to obtain correction data. This single base station can be a personal base station setup on-farm or a CORS station maintained by ALDOT, Trimble™, etc. and is accessible either by radio transmission or cellular modem via the internet. For radio transmitted data, it is recommended that the rover unit be within 6 miles or line-of-sight to ensure adequate signal integrity. For data accessed via the internet, it is recommended that the rover be within a 20- to 25-mile radius of the base station being accessed. The distance in this scenario is a function of satellite commonality. In other words, the rover and the base station must be able to see the same constellation of satellites (minimum of 5) for accurate correction data and to achieve RTK quality.

On the other hand, a Real-Time Network (RTN) is typically made up of multiple base stations that work concurrently to provide correction. Typically, five or more base stations are needed to derive a network solution, but as few as three may be used in some instances. If a rover happens to be located within a cluster of base stations but outside of the 20-25 mile recommended radius of any one station, the value of an RTN can be fully appreciated. In addition to offering accurate correction outside of the single baseline recommended distance, a RTN provides increased reliability over a single baseline solution. If one base station goes down in the cluster, another station can typically take its place without interruption from the rover’s perspective.

Different manufacturers provide slightly different concepts to a RTN. Trimble® offers a Virtual Reference Station (VRS) in which an autonomous position defined by the rover and is used as the location of a “virtual” base station. The rover thinks it is operating in the immediate vicinity of a real base station, but in fact, the VRS Now™ service is modeling error experienced at the location of the VRS and broadcasting it over
the internet as if it were from a single, real base station. However, Leica Geosystems™ operates their RTN differently. They offer several solutions (MAX, Auto-MAX, and iMAX) with iMAX being compatible with older receivers and Auto-MAX using two-way communication to establish a master station. Basically, a master station is determined, either by the user or automatically, which is typically the closest base station to the rover. Data from multiple stations are used to derive a network correction at the server then broadcasted to the rover in the case of iMAX or the rover unit computes the network correction in the case of MAX or Auto-MAX.

Figure 1 illustrates a single baseline solution and a RTN solution. Black dots represent base stations (e.g. CORS) with the surrounding blue circles representing the recommended area of operation (20-25 mile radius) for a single base station. The green area represents a RTN made up of all five base stations. The orange triangles represent GPS/GNSS rover units in the field. Rover A is within the recommended radius of a base station and is operating on a single baseline solution in order to achieve highest accuracy. Rover B is outside the recommended radius of any one base station, so a RTN solution is best to achieve highest accuracy and reliability.

Accessing Single Baseline Solutions and RTNs

For information on accessing a single baseline solution check out RTK Networks: Real-Time Data Correction Protocols and visit http://aldotcors.dot.state.al.us. Single baseline solution access through ALDOT is a free service. Access to the ALDOT RTN is currently free, but requires a username and password from ALDOT; visit the website listed above for more information. Privately maintained RTNs typically require a subscription fee. Contact your equipment sales representative for more information.

Additional Information

Visit www.AlabamaPrecisionAgOnline.com and check out GPS Correction Services for Alabama.

Disclaimer

The mention of trade names and commercial products is for informational purposes and does not necessarily imply endorsement by the Alabama Cooperative Extension System.

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