Lab 2

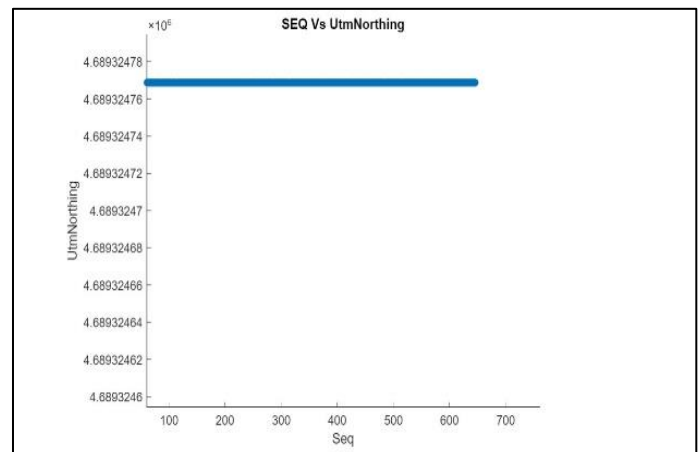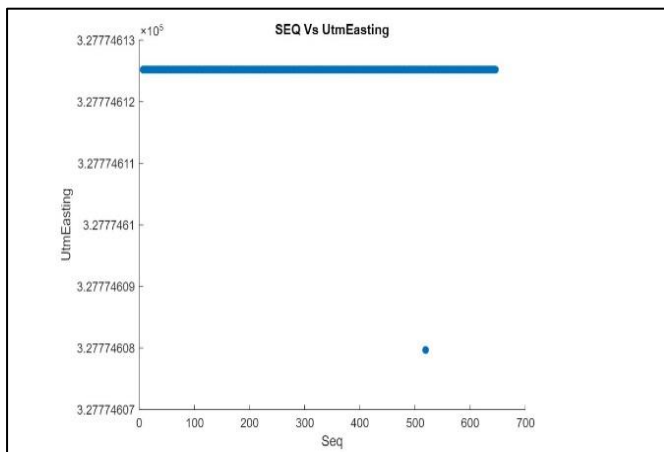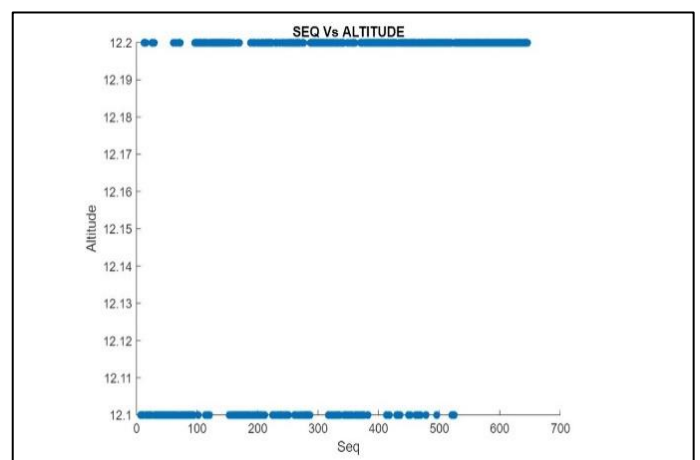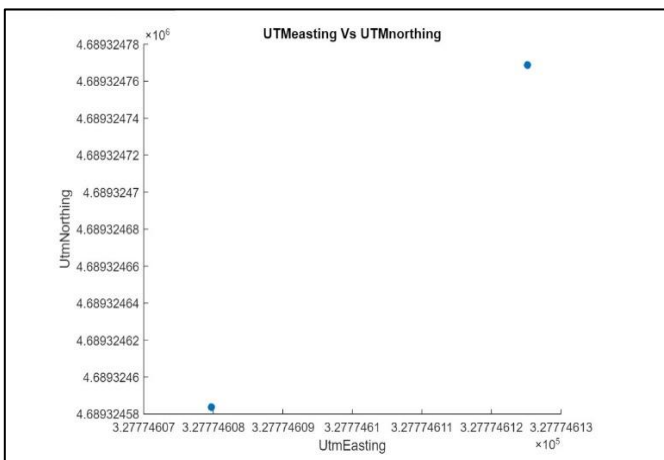**Analysis of open field data:**

Open field data: centennial commons

Static open field data:

Data collected in an open field in the centennial commons, Northeastern University. The total size of the data set is 6002 points Fix quality: 4, which indicates the RTK is in float mode.

Parameters: Latitude: 42.3371**,** Longitude: -71.0906**,** UtmEasting: 3.2777e+05**,** UtmNorthing:4.6893e+06**,** Fix Quality: 4, Minimum altitude=12.1000, Maximum altitude= 12.2000**,** Mean altitude = 12.1667

Moving open field data :

Data collected in an open field in the centennial commons, Northeastern University. The total size of the data set is 1400 points Fix quality: 4, which indicates the RTK is in float mode. The data is collected while moving in a rectangular fashion.
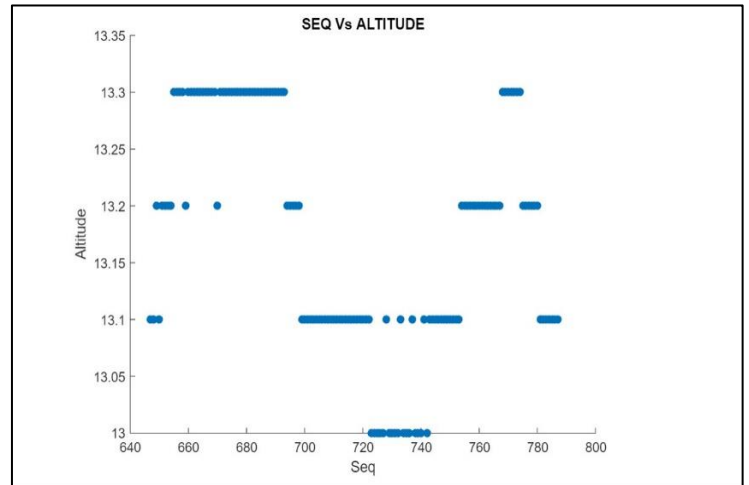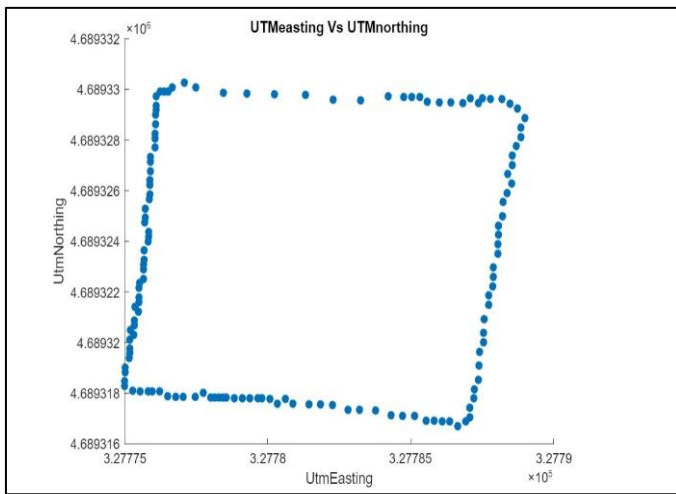
Parameters: Latitude: 42.3372, Longitude: -71.0906, UtmEasting: 3.2778e+05, UtmNorthing: 4.6893e+06, Fix Quality: 4, Max Altitude= 13.3000, Min Altitude= 13.1000 , Mean Altitude= 13.1738
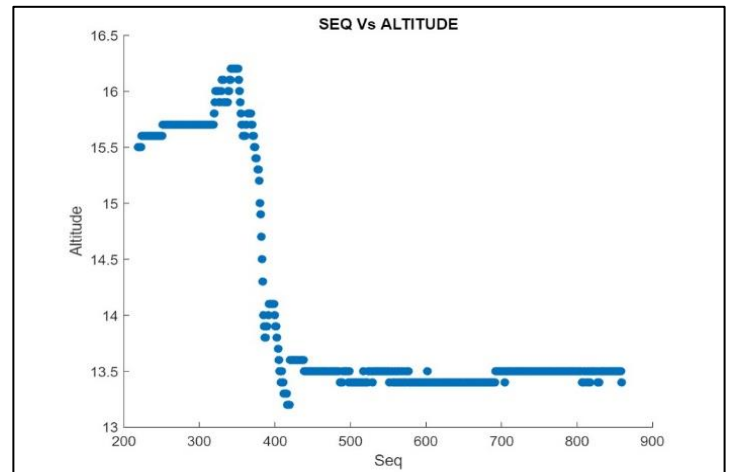

Building side data: West village quad

Static building side data:

Data collected in a building side area in the west village quad, Northeastern University. The total size of the data set is 4000 points Fix quality: 4, which indicates the RTK is in float mode.

Parameters: Latitude: 42.3372**,** Longitude: -71.0926**,** UtmEasting: 3.2761e+05, UtmNorthing: 4.6893e+06, Max Altitude=16.5000 Min Altitude: 15.5000, Mean Altitude:14.507

SEQ Vs UtmNorthing

SEQ Vs UtmEasting

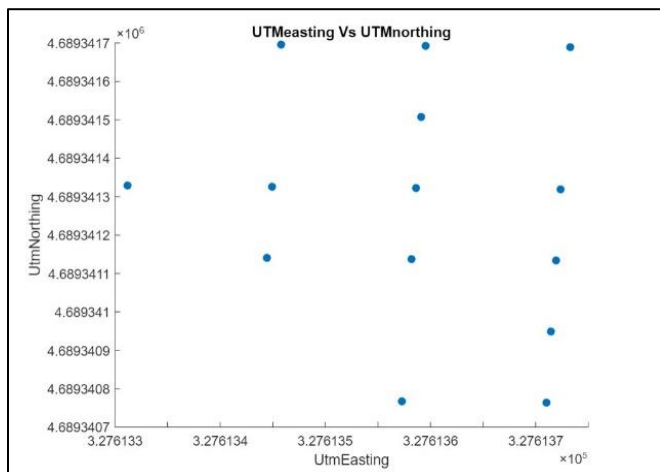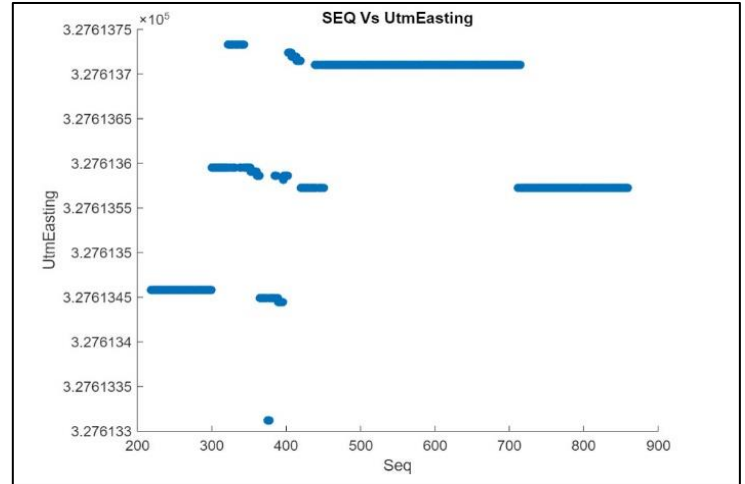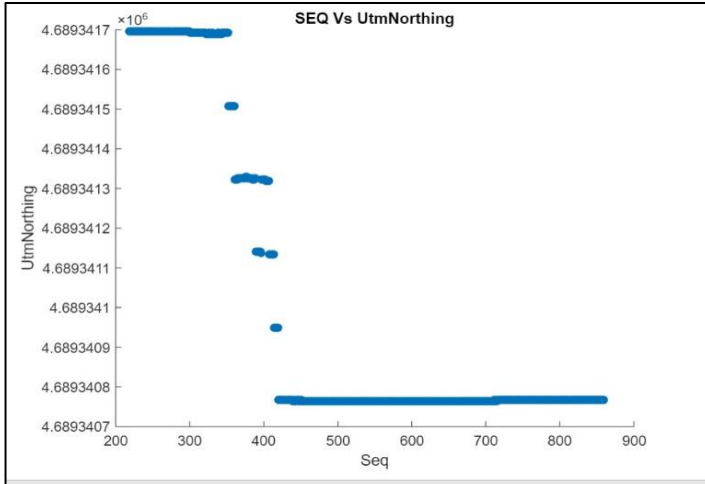**Building side data: West village quad**

Data collected in a building side area in the west village quad, Northeastern University. The total size of the data set is 4000 points Fix quality: 4, which indicates the RTK is in float mode. The data is collected while moving in a rectangular fashion.

Moving building side data : Latitude: 42.3373**,** Longitude: -71.0925**,** Min Altitude: 14.7000**,** Max Altitude= 17.1000, Mean Altitude = 150848, UtmEasting: 3.2762e+05, UtmNorthing: 4.6893e+06**,**

UTMeasting Vs UTMnorthing

SEQ Vs ALTITUDE
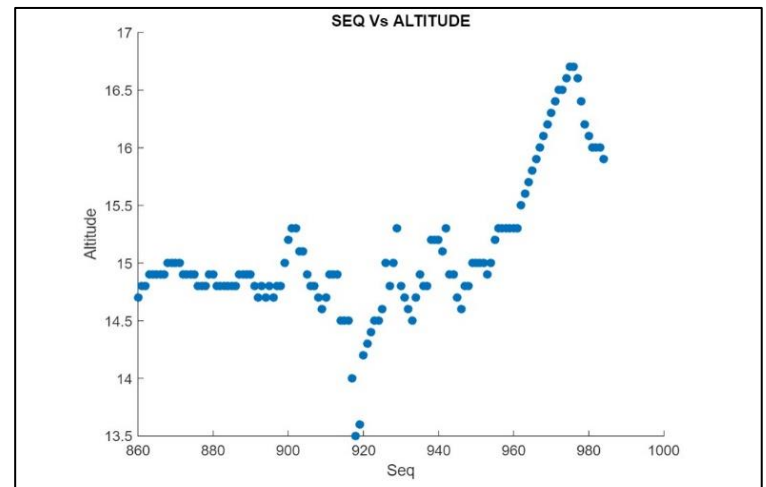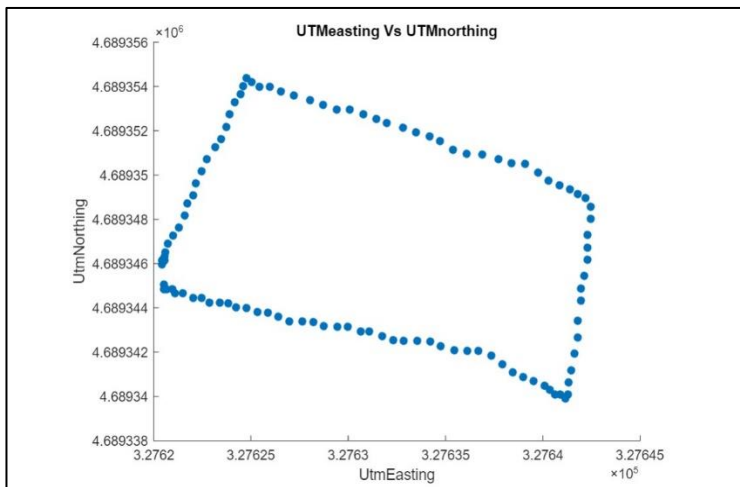
Analysis of stationary and moving data for open field and building side area.

The RTK GPS Data plot gives the UTM Northing vs UTM Easting value as shown in the above plot.

- The data plot for stationary point readings in the open filed shows readings that are fewer in number of points than that in the building side area. This is because there are several effects which disperse and make the data erratic in building side areas, that are avoided

when data is collected in an open field area. The several effects include multipath error (same signal bouncing off multiple obstructions), other obstacles, atmospheric conditions etc.

- In addition, the Kaalman filter in the GPS sensor presents better tracking while in motion than uncorrelated readings in the stationary data. This effect can be seen in the next plot for moving data.

- Further, when the stationary data is collected and the satellite configurations from which information is retrieved changes, the data first collected and the next data in the sequence might be a treated as a completely different point. All of this contributes to the data plot as shown above, even though the base and rover are completely stationary. But overall, the UTM Easting and Northing values fix around a constant mean point of 327228.5037 m and 4689744.9369m respectively as shown in above plots for stationary data in open and building side area.

- The effect of the Kalman filter as described in the first description of the dispersed plot points in the stationary point data values can be seen in the plot describing the structured motion data for open and building side area. We see that the Kalman filter helps track the data to give an approximate shape of the field. In the open space structure motion data, the points are quite accurate and precise in terms of tracing the field path. The West Village Quad track is occluded by buildings, trees, and other obstacles on all sides and hence the data does not provide much accuracy. But here too, the Kalman filter provided a good sense of the shape of the path traced.

- Further, some of the common factors that affect the GPS sensor readings are clock timing errors, prevalent atmospheric and environmental condition, the geometry of arrangement of the satellites in space etc. It can be concluded that RTK GNSS navigation is much more accurate and precise than simple GPS receiver navigation such as with the GlobalSatBU-353-S4 hardware.

Conclusion:

The RTK module performs best while moving in an open field. This can be used in field surveying areas where there is no obstruction due to trees and buildings. RTK does not work well under these obstructions. Also, the precision of the static data in the open field is much better than the readings around the buildings.