University of Calgary Geodetic Control Network

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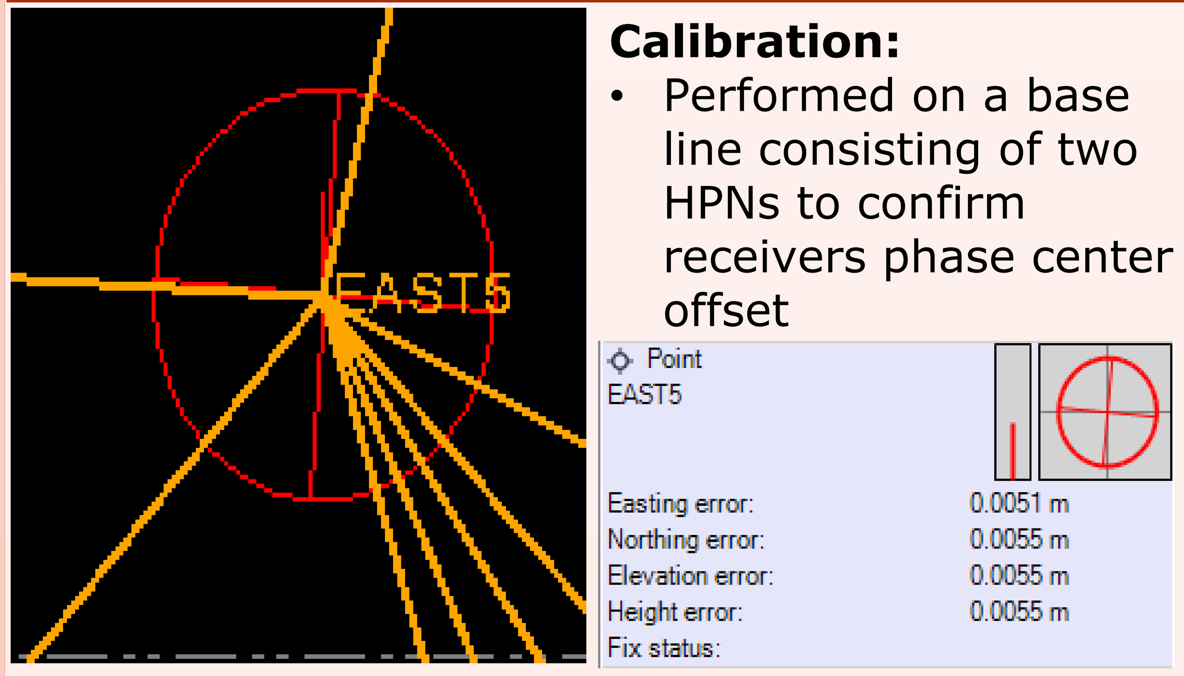
Overview

- Existing control networks that are used in numerous geomatics engineering courses have a need to be continuously updated and upgraded.
- The primary goal of this project is to plan, design, and carry out a geodetic survey that will restore lost and establish new vertical and horizontal control.

Survey Methods:

- Static GNSS
- Precise Leveling
- High Precision Traversing

Static GNSS



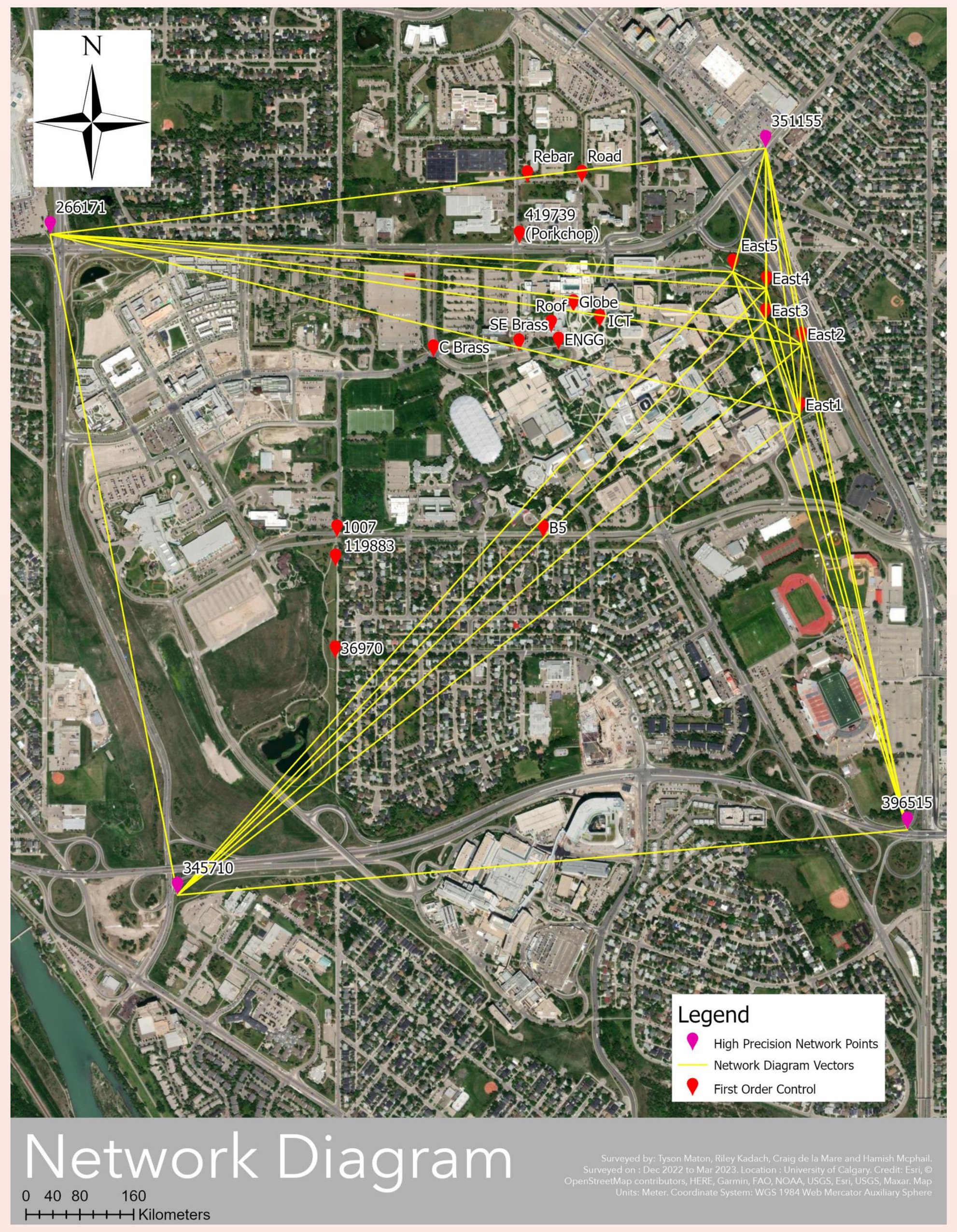
(Trimble Business Center, 2023)

Calibration:

- Performed on a base line consisting of two HPNs to confirm receivers phase center offset

Methodology:

- Two sets of observations performed for one hour, one in morning and one in afternoon due to deadtime in early afternoon
- Receivers also setup on four HPNs and other points within the network to improve geometry



Objectives

Static Objectives:

- The primary objective of Static GNSS was to obtain horizontal coordinates for first order control points.

Order	Horizontal Precision
First	2(d + 0.2)cm
Second	5(d + 0.2)cm
Third	12(d + 0.2)cm
Fourth	30(d + 0.2)cm

(Rueger J.M. 2003)

Leveling Objectives:

- To transfer precise heights of first order precision(3mm√L) from the Calgary High-Precision Survey Network (HPN) to multiple points on campus.

Traversing Objectives:

- To survey in lower order control points (third or fourth order).
- To make observations from the first order control monuments to the high target.

Precise Leveling

Calibration:

- Performed using Princeton Test to determine the collimation error angle.
- Collimation error angle is then used for error propagation for the level loops.

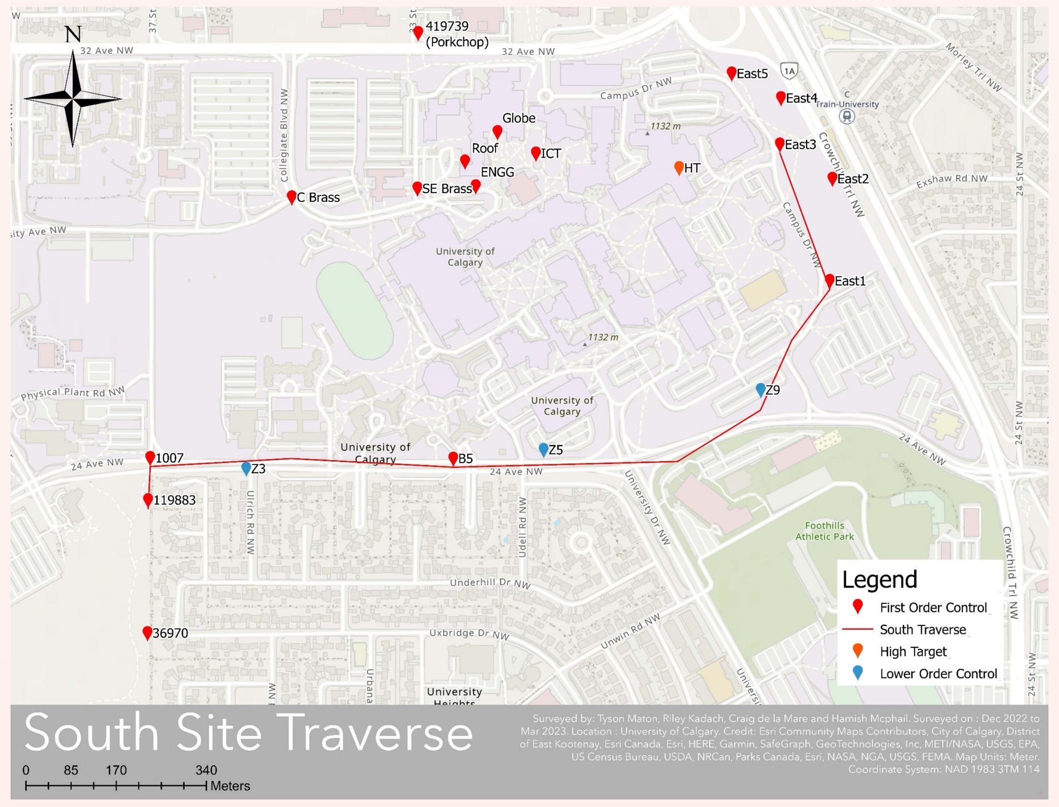
Methodology:

- Using the Leica LS15, heights were obtained by observing the invar rods in order of backsight-foresight-foresight-backsight (BFFB).
- Heights transferred to control points using ASCM 419739 as a start point reference and end point to complete a loop.

High Precision Traversing

Calibration:

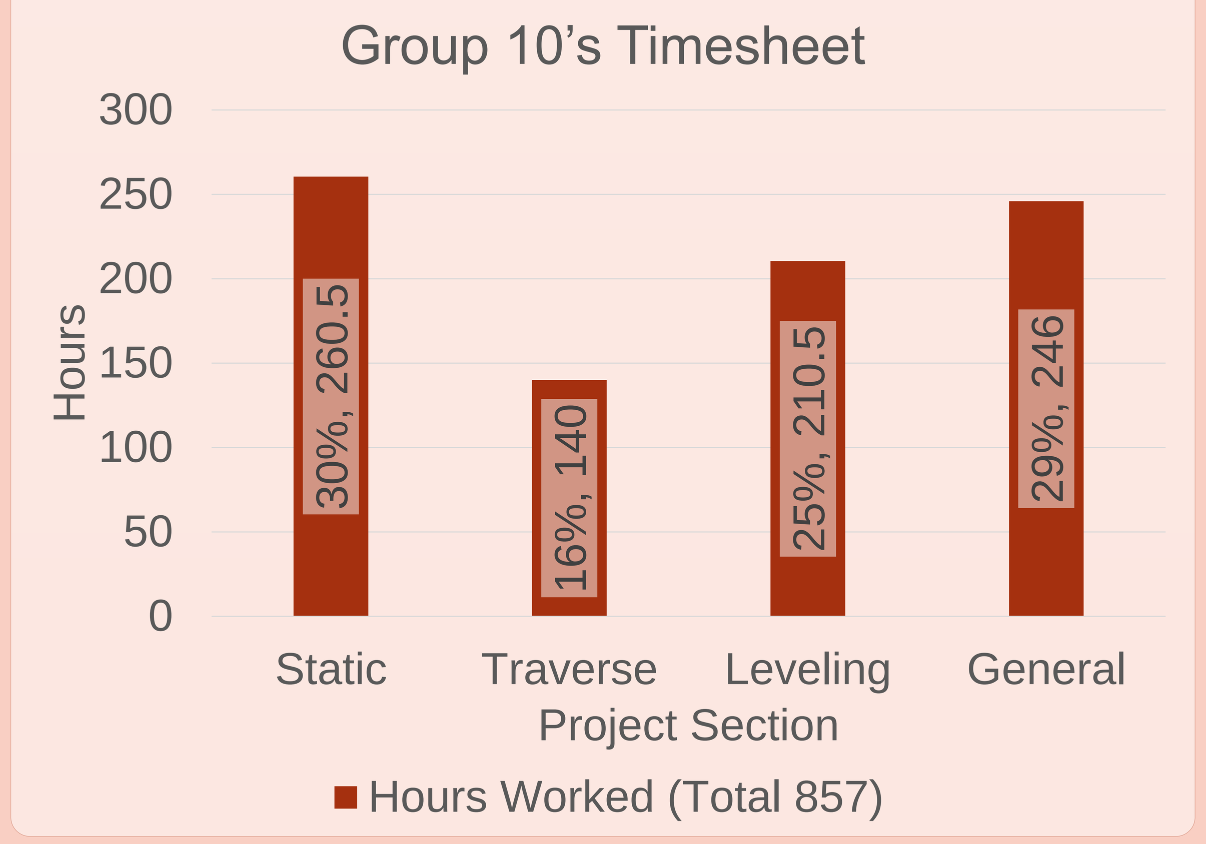
- Performed on Springbank baseline to compute a zero error and scale factor of the Leica TS30.



Methodology:

- Expected misclosure and predicted precision of the monuments were computed by the group through error propagation to the predicted traverse routes.
- Forced centered traverse with multiple redundant rounds was used to observe the lower order control monuments.
- Observations for the high target were taken from first order control.
- Least-Squares Adjustment was applied to the high target observations.

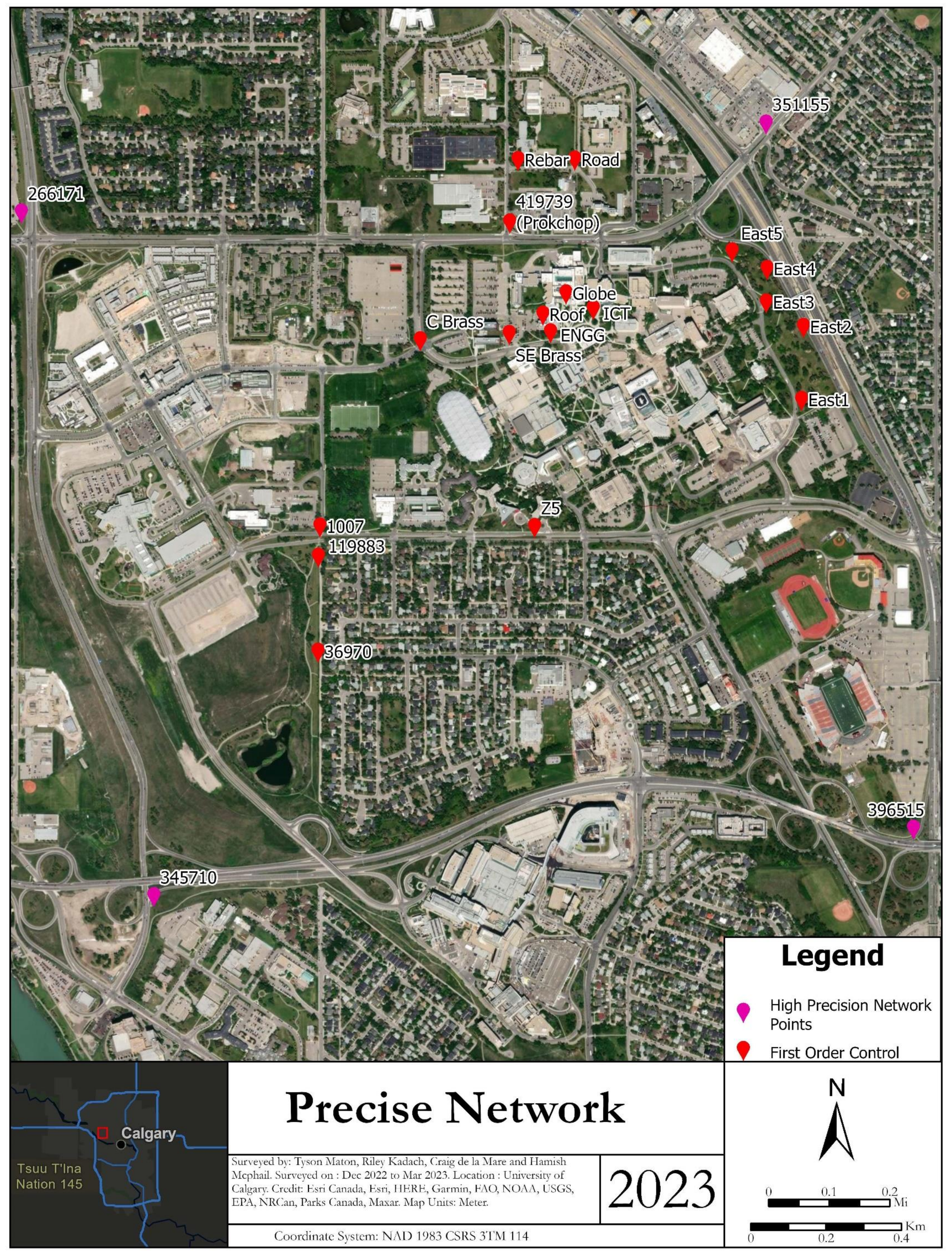
Hours



Results

- Monuments all over campus for future geomatics engineering courses to use and be expanded if more space is needed.
- Precisions of the Level loops that were achieved:
  - Loop 1: -2.89mm
  - Loop 2: 2.49mm
  - Loop 3: -0.18mm
  - Loop 4: 0.72mm
- Precisions of the traverses that were achieved:
  - Traverse South: 1:139,000
  - Traverse North: 1:27,800

Final Map



Conclusion

- Design was successful in creating integrated and sustainable geodetic control that will serve future surveying and cadastral courses in the Geomatics Engineering Department.
- Gained invaluable experience such as leadership and project management with each group member leading a section.

References

J.M Rueger, 2003. *Electronic Surveying Instruments a Review of Principles Problems and Procedures*. School of Surveying and Spatial Information Systems The University of New South Wales.

Trimble Business Center, 2023.