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Technical Paper
June 2019

HYPACK Application in Topographic Surveys

I. INTRODUCTION

HYPACK® Hydrographic Survey software as the name suggests is a software package specializing in the collection, processing and reporting of Hydrographic Survey data from a wide range of instrumentation. One can make the assumption that HYPACK® is purely focused towards surveying underwater topography and structures. Although this assumption is correct in most survey applications, the software design enables the user to process and develop required outputs from both hydrographic and topographic surveys.

II. GEOREFERENCED TOPOGRAPHIC SURVEY

Topographic survey of a section of property was required for the development of an access road with the focus on landscape features, farming infrastructure and existing utilities. The survey technique used consisted of RTK method, which required walking the survey site, while recording the necessary data points from a Rover GPS on a handheld data collector.

A. Survey Equipment

The survey equipment selected for the RTK survey consisted of two Hemisphere S321 Smart Antennas and Data Collector. The configuration of the two Hemisphere S321 smart antennas and topographic survey was performed using Carlson SurvCE software installed on the data collector.

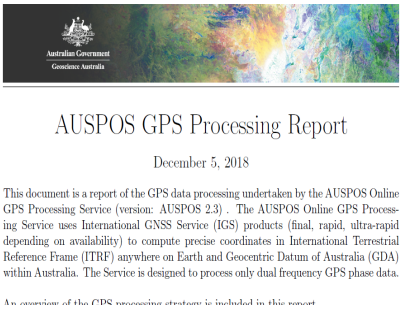
The first Hemisphere S321 or Base Station was setup precisely over a known survey marker using tripod and tribrach. The coordinates and elevation of the survey marker and height of GPS Antenna was entered into the SurvCE software to reference the survey against known datum.

The second Hemisphere S321 or Rover was setup on a survey pole with the exact height of the GPS antenna entered into the SurvCE software.

Fig. 1. Hemisphere S321 Smart Antenna

B. Survey Control

Two survey markers where established next to the proposed site using GPS static survey technique with a minimum of two hours of raw GPS data collected at each of the survey markers. The recorded files was converted to RINEX format, from where it was submitted to AUSPOS Online GPS Processing Service.



Australian Government
Geoscience Australia

AUSPOS GPS Processing Report

December 5, 2018

This document is a report of the GPS data processing undertaken by the AUSPOS Online GPS Processing Service (version: AUSPOS 2.3) . The AUSPOS Online GPS Processing Service uses International GNSS Service (IGS) products (final, rapid, ultra-rapid depending on availability) to compute precise coordinates in International Terrestrial Reference Frame (ITRF) anywhere on Earth and Geocentric Datum of Australia (GDA) within Australia. The Service is designed to process only dual frequency GPS phase data.

An overview of the GPS processing strategy is included in this report

Fig. 2. AUSPOS GPS Processing Report

Coordinates reported from AUSPOS GPS Processing Report shown in Figure 2 for both survey markers were in Geocentric Datum of Australia 1994 (GDA94). Elevation of survey markers were supplied in Australian Height datum (AHD).

C. Stakeout Survey Area

Defining the actual survey area on the ground is complex, especially if dense vegetation or significant landscape features are present at the measurement site.

Survey area provided by the client was plotted in Google Earth from where coordinates in WGS84 were obtained at each line break.

The coordinates obtained from Google Earth were entered into the SurvCE software. The "Stakeout" feature in SurvCE software was used to mark the perimeter of the survey area shown in Figure 3 based on the coordinate's entered.

Fig. 3. Stacking out Survey Area

D. Survey Data

The survey data collected on the data collector with SurvCE software were exported in CSV format with Point Name, Easting, Northing and Elevation as the main outputs.

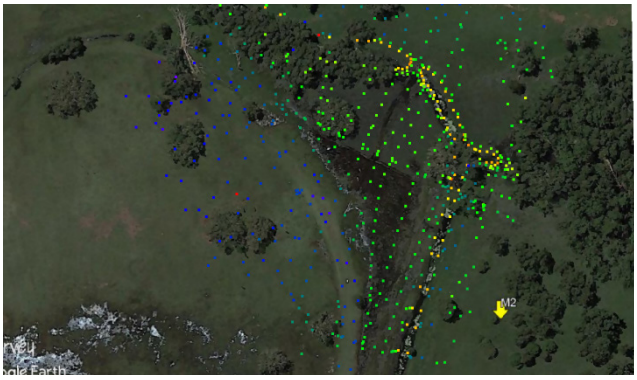


Fig. 4. Survey Data

The CSV data set was imported into the "Geodetic List Conversion" aprogram in HYPACK®, where an XYZ file was created.

This XYZ file of the survey points was then imported into HYPACK® and overlaid on the background map. (Shown in Figure 4)

E. TIN Model Development

The TIN Model program in HYPACK® is based on XYZ components, irrespective of whether they were derived from a hydrographic or topographic survey, or both.

The TIN Model that was developed from the survey points collected during the topographic survey is shown in Figure 5.

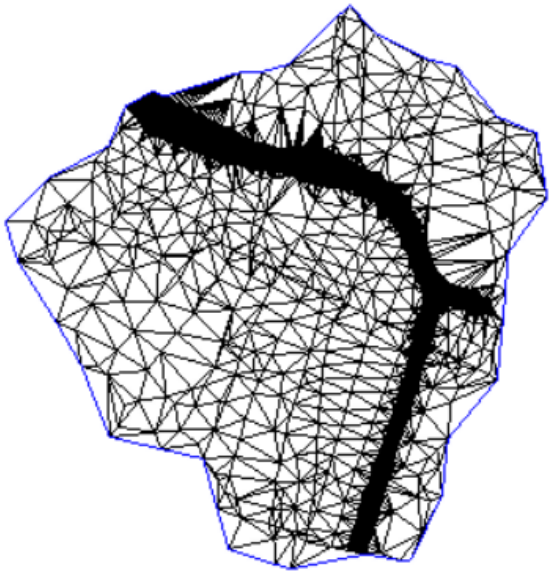


Fig. 5. TIN Model

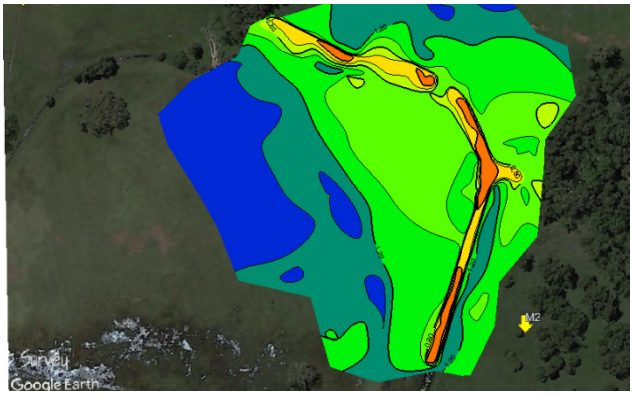


Fig. 6. Contour Map

Using the TIN Model above, a Contour map was also developed within the TIN Model program in HYPACK®

The differences in elevation at the survey area are depicted with contours and associated colors shown in Figure 6.

In addition to the topographic survey points, detailed surveys were also performed of landscape features, farming infrastructure and existing utilities.

The survey points exported from the SurvCE software were imported into AutoCAD to create the drawing shown in Figure 7.

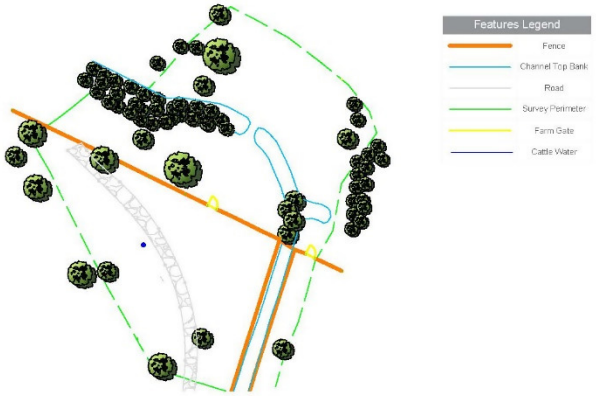


Fig. 7. Landscape Features

III. NON GEOREFERENCED TOPOGRAPHIC SURVEY

A Topographic survey was required of a number of waterholes around Brisbane. The dense vegetation around the waterholes restricted the use of a Rover RTK GNSS for performing the topographic surveys. Conventional survey technique using a Theodolite was selected as this is more suitable technique for areas with dense vegetation.

A. Survey Equipment

The survey equipment selected for the topographic survey consisted of Leica Total Station and Prism with survey rod.

The Leica Total Station shown in Figure 8 was setup precisely over a known survey marker using tripod and built-in infra-red light.

Fig. 8. Leica Total Station

The coordinates and elevation of the survey marker and height of Total Station were entered into the Total Station to reference the survey against local datum.

B. Survey Control

The surveys were not required to be referenced to a specific Geodetic Datum and, for this reason, a Local Datum was assigned. The coordinates and elevation of the survey marker over which the Total Station was setup consisted of the following for each of the waterholes. The Total Station was orientated to North before the survey commenced.

- X - 100.000m,
- Y - 100.000m
- Z - 10.000m

Two additional survey markers were established at each of the waterholes, for future reference, and the coordinates of each 'new' survey marker is based on total station measurements.

C. Survey Data

The survey data points that were collected on the Total Station were exported in CSV format with Point Name, Easting, Northing and Elevation as the main outputs.

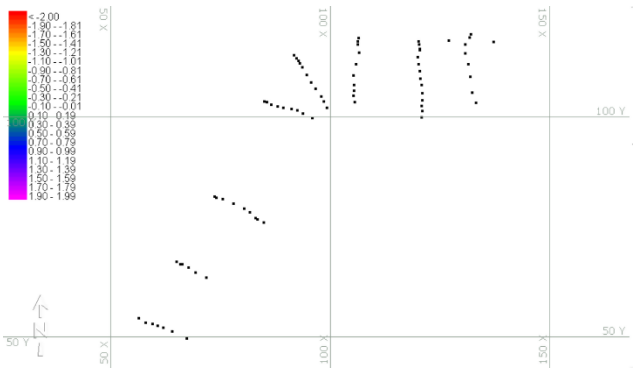


Fig. 9. Survey Data

The CSV data set was imported into the "Geodetic List Conversion" aprogram in HYPACK®, where an XYZ file was created.

This XYZ file of the survey points was then imported into HYPACK® and overlaid on the background map. (Shown in Figure 9.)

It is important to note that it was not possible to display the survey data against a georeferenced background image in HYPACK®, since the survey data was not georeferenced

NOTE: Since the non-georeferenced data points were collected with the instrument oriented to North, using the "XYZ Utility" program in HYPACK®, the XYZ data sets around the waterholes could be translated to 'actual' Geodetic Coordinates and plotted against georeferenced background images and exported to GoogleEarth from HYPACK®.

D. TIN Model Development

The TIN Model development in HYPACK® is based on XYZ components, irrespective if it was derived from georeferenced or non-georeferenced survey.

Even though the data was not georeferenced, a Contour map was also developed within the TIN Model program in HYPACK®

The differences in elevation at the survey area are depicted with contours and associated colors shown in Figure 10.

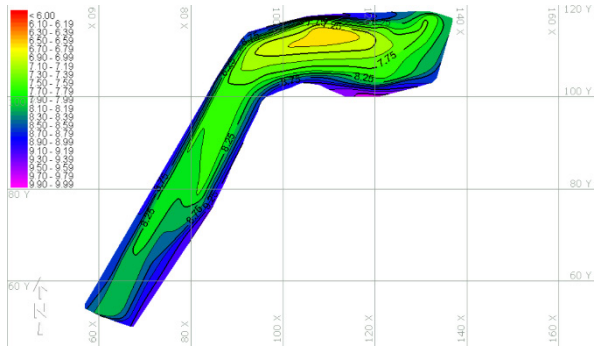


Fig. 10. Contour Map

IV. CONCLUSION

HYPACK® Hydrographic Survey Package can accommodate a wide range of data sets from hydrographic or topographic surveys referenced to either a Geodetic or Local Datum.

The data collection platform and datum used during the hydrographic or topographic survey will dictate the process involved in the collection, processing and reporting of survey data in the HYPACK® software.

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