

Southern Cross Operations Management System

FREE-STATION CALCULATIONS (FROM FIELD SHEETS) PROCEDURE

SURV-GEN-20030603

Revision: draft A

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1 PURPOSE

This procedure describes the a routine for post processing a free-station resection using SSI-v5.0, from field notes.

The routine is not for any specific brand of survey instrument or data recorder, but rather for field book recorded angle and distance measurements.

2 SCOPE

This document applies to Surpac Vision 5.0-D Beta, for both underground and surface free stations or resection.



3 DEFINITIONS

Resection or Free Station	Resection is a method for determining the unknown 3D position of an occupied station by measuring angles and distances to stations whose 3D coordinates are known. SURPAC allows you to enter observations to multiple known stations, and uses a least squares solver to find the best coordinates for the unknown station based on all the data. The least squares solver uses several parameters related to the precision of the observed measurement (measured angle and distance standard deviations etc).
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4 PROCEDURE

Free-Station Observations (Field)

Record resection or free-station observations to a field sheet.

SURPAC supports both single and double face resection (for face left and face right observation pairs). In double face resections, the face left observation must come first (and the face left observation must have a vertical angle between 0 and 180 degrees), and the

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face right observation to the same station second. The readings pairs are meaned before being used in the least squares solver. Note: You cannot mix single face and double face observations in the same resection calculation.

The first resection observation must be to the nominated backsight station;

The resection observations must be to stations taken in clockwise order;

You are allowed a maximum of 20 resection observations to calculate the coords of a resection station, or 20 pairs of readings for double face observations;

You must have horizontal angle and vertical angle readings for resection observations, but the slope distances are optional. If the slope distances do not appear or are set to 0.0 in the raw data file then only the angles will be used in the least squares solver for the resection station coordinates. You can have some resection observations with and some without slope distances in the same resection calculation. For double face resection you can also have face left with a slope distance and face right without a slope distance (or vice versa).

If angles and slope distances are present then resection observations to a minimum of two known stations are required.

If only angles are present then resection observations to a minimum of three known stations are required.

If an underground database is used and the new resected station is stored in the database, then the nominated backsight station is stored as the 'station from' and the reverse bearing from the new station to the nominated backsight station is stored as the 'reverse bearing'.

Processing the Observations

The post processing uses Surpac SSI-v5.0 and a "keyboard_free-station_input.tcl" macro.

This macro provides a keyboard entry of this data, creating an .inp file as if it were done with a Geodat 600 data recorder.

The least squares solver uses several parameters related to the instrument accuracy of the particular data recorder (measured angle standard deviations etc). These parameters are set in SURPAC using the Data Recorders - Geodat 600 - Configuration function.

1. Start up SSI-v5.0 in the relevant folder.
2. Run the macro and key in the observations.
3. Process the resulting .inp file in the surveying module as if it were a Geodat 600 file.

5 REFERENCES

Surpac Help Notes	Surveying – geodat.htm
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6 DOCUMENT REVISION HISTORY

Revision Events			
Rev.	Author	Changes	Date
Draft A	OG	Initial draft	3/06/03
Draft B			

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7 APPENDICES

DECLINE _____ LEVEL _____ AREA _____ WORK _____ DATE _____ BY _____	BOOK No. _____ PAGE No. _____ 	FILE NO PAGE NO 	CALC. BY CHD. BY
--	--	--	---

DOUBLE FACE RESECTION - MUST BE IN CLOCKWISE ORDER

NEW STN _____ H.I. _____

Residuals from measurements: _____

Main Bs stn _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

RES STN 1 _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

FR HA _____ VA _____ SD _____ HS _____

RES STN 2 _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

FR HA _____ VA _____ SD _____ HS _____

RES STN 3 _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

FR HA _____ VA _____ SD _____ HS _____

RES STN 4 _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

FR HA _____ VA _____ SD _____ HS _____

RES STN 5 _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

FR HA _____ VA _____ SD _____ HS _____

RES STN 6 _____ N _____ E _____ RL _____

FL HA _____ VA _____ SD _____ HS _____

FR HA _____ VA _____ SD _____ HS _____

Comments: _____

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```
# keyboard_free-station_input.tcl
#
# Author;   Robert Barr   Date: 17/01/2003
# Direction by;   O.Glockner
#
# Introduction
# ~~~~~
#
# This macro is for Surpac v5.0 Surveying Module
#
# Free-station or Resection is a method for determining the unknown 3D position of an occupied point
# by measuring angles and distances to stations whose 3D coordinates are known.
# Surpac Vision 5 allows you to enter observations to multiple known stations,
# and uses a least squares solver to find the best coords for the unknown station based on all the data.
#
# This macro provides a keyboard entry of this data, creating an .inp file,
# as if it were done with a Geodat 600 data recorder.
#
# The least squares solver uses several parameters related to the instrument accuracy
# of the particular data recorder (measured angle standard deviations etc).
# These parameters are set in SURPAC using the Data Recorders - Geodat 600 - Configuration function.
#
# The observations must be in clockwise order and the first station must be the nominated backsight station.
#
# The macro is also suitable for entering double face resections (face left and face right observation pairs) for use in
# SURPAC.
# For these, the face left observation must come first (and the face left observation must have a vertical angle between 0 and
# 180 degrees),
# and the face right observation to the same station must immediately follow it.
#
# The paired readings are averaged by SURPAC before being used in the least squares solver.
#
# Note: You cannot mix single face and double face observations in the same resection calculation.
#
#
# This macro is Beerware, absolutely free for use.
# If you are so fascinated by it, or find it very useful, and want to pay for it (or even if you don't),
# you are encouraged you to buy the production team a beer (or twenty four) when you next meet them.
#
# Standard disclaimer
# ~~~~~
#
# This program is distributed as beerware. This software is provided "as is",
# without any guarantee made as to its suitability or fitness for any particular use.
# It may contain bugs, so use of this tool is at your own risk.
# Author takes no responsibility for any damage that may unintentionally
# be caused through its use.

# Form Definition for entering file names

set form {
    GuidoForm sampleform {
        -default_buttons
        -label "Keyboard Free-Station Geodat 600 .inp File Creator Macro V1.01"
        -help geodat.htm
        -layout CentreLineLayout vertical Left

        GuidoField writefilename {
            -display_length 26
            -format none
            -label "File to Create - Loc"
            -legacy_action
            -max_length 252
            -translate none
        }
        GuidoField writefile_id {
            -display_length 6
            -format integer
        }
    }
}
```

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```
-label "Job Number - File ID"
-legacy_action
-max_length 32
-null false
-translate none
}
}
}

# Creates form in memory
SciCreateGuidoForm form_handle $form {
}

# display the form
$form_handle SciRun {}

if {"$_status" == "cancel"} {
    puts "Macro Cancelled"
    return
}

set form2 {
    GuidoForm sampleform {
        -default_buttons
        -label "Free-Station Data Entry"
        -help_url geodat.htm
        -layout CentreLineLayout vertical Left

        GuidoField newStationName {
            -display_length 16
            -format none
            -label "New Resection Station Name"
            -legacy_action
            -max_length 16
            -translate upper
        }
        GuidoField mainBSStation {
            -display_length 16
            -format none
            -label "Main Backsight Station"
            -legacy_action
            -max_length 16
            -null false
            -translate upper
        }
        GuidoField instrumentHeight {
            -display_length 6
            -format float
            -label "Instrument Height"
            -legacy_action
            -null false
            -translate none
        }
    }
}

SciCreateGuidoForm form_handle $form2 {
}

# display the form
$form_handle SciRun {}

if {"$_status" == "cancel"} {
    puts "Macro Cancelled"
    return
}
```

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```
}

#Enter New station coordinates
set writeFile [open "$writefilename$writefile_id.inp" "w"]

# write the header lines to the string file
puts $writeFile "50=$writefilename$writefile_id"
puts $writeFile "2=$newStationName"
puts $writeFile "3=$instrumentHeight"
puts $writeFile "62=$mainBSStation"

set form3 {
    GuidoForm sampleform {
        -default_buttons
        -label "Resection Observations"
        -help_url geodat.htm
        -layout BoxLayout Y_AXIS

        GuidoScrollPane resectionScrollPane {
            -border etched true
            -height 10

            GuidoTable resectionTable {
                -instances 1 1 999
                -interactive true

                GuidoField stn {
                    -display_length 16
                    -format none
                    -label "Station"
                    -translate upper
                }

                GuidoField ha {
                    -display_length 16
                    -format float
                    -label "HA"
                    -translate lower
                }

                GuidoField va {
                    -display_length 16
                    -format float
                    -label "VA"
                    -translate lower
                }

                GuidoField sd {
                    -display_length 16
                    -format float
                    -label "SD"
                    -translate lower
                }

                GuidoField hs {
                    -display_length 16
                    -format float
                    -label "HS"
                    -translate lower
                }
            }
        }
    }
}

GuidoPanel warning {
    -layout BoxLayout Y_AXIS

    GuidoFiller warning1 {
        -height 0.5
    }

    GuidoLabel warning2 {
```

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```
-label " This macro creates a Geodimeter style .inp file, which can then be processed using Vision v5, as if it were
done with a Geodat 600 data recorder."
}

GuidoFiller warning3 {
  -height 0.5
}

GuidoLabel warning5 {
  -label " The observations must be in clockwise order and the first station must be the nominated backsight station."
}

GuidoFiller warning6 {
  -height 0.5
}

GuidoLabel warning7 {
  -label " Enter angle data as degrees.minutesseconds (e.g. 207 27 57 as 207.2757)"
}

GuidoFiller warning8 {
  -height 0.5
}

GuidoLabel warning9 {
  -label " For double face readings, the face left observation must come first, and then the right face"
}

GuidoFiller warning10 {
  -height 0.5
}

GuidoLabel warning11 {
  -label " Ensure there is not a blank line at the end of the table"
}

GuidoFiller warning12 {
  -height 0.5
}
}
}
}

ScICreateGuidoForm form_handle $form3 {
}

# display the form
$form_handle ScIRun {}

if {"$_status" == "cancel"} {
  puts "Macro Cancelled"
  return
}

set numberStn [array size stn]

for {set i 0} {$i < $numberStn} {incr i} {
  if {$i == 0} {
    puts $writeFile "21=$ha($i)"
  }
  puts $writeFile "5=[expr {$i+1}]"
  puts $writeFile "9=$sd($i)"
  puts $writeFile "8=$va($i)"
  puts $writeFile "7=$ha($i)"
  puts $writeFile "6=$hs($i)"
  puts $writeFile "4=RES$stn($i)"
}
```

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```
# close the new file
close $writeFile
# Tell people what to do
puts ""
puts ""
puts "*****"
puts "Created Geodimeter resection file $writefilename$writefile_id.inp"
puts "Refresh work directory to view results file"
puts "*****"
```

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