Survey

Management System

RE-CALCULATION MACRO

FOR

SURVEY TRAVERSE LEDGERS

SURV-GEN-20030715

Revision: draft B

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Date Originated	15-July-03	Approval Date	
Deployment Date		Archive Date	
Next Revision Date		Printed	

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1 PURPOSE

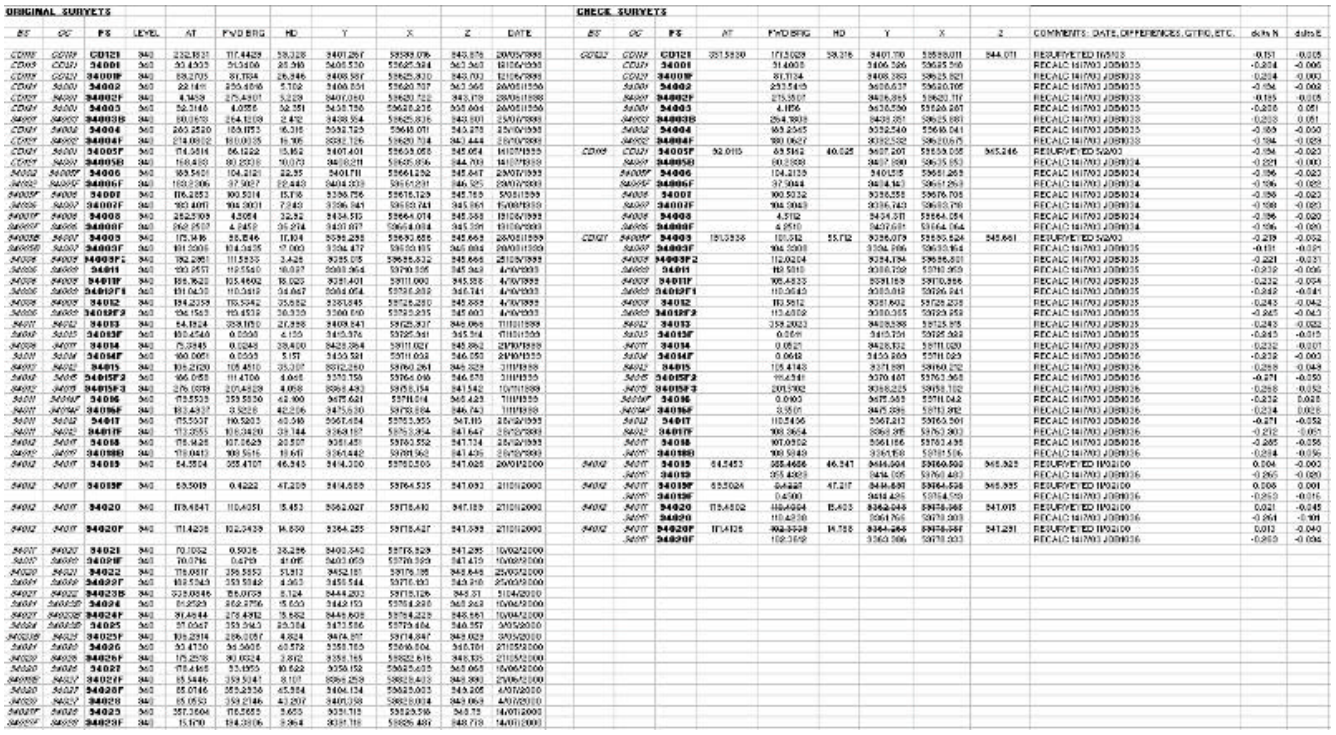
This procedure describes a macro that has been made up to enable the re-calculation of survey station coordinates within a traverse ledger, to be more easily performed.

2 SCOPE

This document applies to general mine surveying, and SSI v4.1 software.

3 DEFINITIONS

Traverse Ledger	Listing of survey traverse station details. The document displays the most up to date coordinates, based off original surveys, resurveys, recalcs, and other check surveys such as gyro readings.



Original Surveys

Check Surveys

4 PROCEDURE

THE SURVEY TRAVERSE LEDGER

A Traverse Ledger will typically display originals survey data in columns such as:

| *BS* | *OC stn from* | **FS** new stn | LEVEL | Angle Turned | FWD BRG | Hz Dist | Y | X | Z | DATE |

Next to this is often all the check and re-calculation surveys and comments regarding the station:

| *BS* | *OC* | **FS** | LEVEL | AT | FWD BRG | HD | Y | X | Z | COMMENTS | delta N | delta E |

The macro is an aid to calculating the second part of the ledger.

The Leica has the ability to have the vertical angle continuously updated, or stay fixed after a distance measurement.

THE TCL MACRO

This macro is for Surpac v4.1 Surveying Module

The purpose of the macro is to easily be able to recalculate station coordinates in an underground survey traverse ledger.

This is especially the case when a resurvey only uses a few stations, and all others not part of the resurvey, need to be recalculated.

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

CAUTION: The macro does not do heights, any RLs calculated are false.

Run the macro entering the data, and a .inp file will be generated.

CAUTION: Copy or create a new dummy database to do the recalcs - avoid using an actual control database.

Process the .inp as if it were a Geodat 600 input file.

The .inp file will be in the format:

50= (job name and number)
2= (station occupied)
3=0 (false instrument height)
62= (back-sight station)
21=0.0000 (false bs reading)
5= (point number from 1 to ...)
9= (horizontal distance)
8=90.0000 (false vertical angle)
7= (angle turned)
6=0 (false target height)
4=STNabc (forward station, where abc is name)
loop back to 2= for every input station

CAUTION: Author takes no responsibly for any damage that may unintentionally be caused through its use.

5 REFERENCES

Surpac Help Notes	Surveying – geodat.htm
Example Traverse Ledger	ug survey traverse ledger.xls
DOME WA Safety Bulletin #57 dated 10/11/200	Mine Surveying – Risks in Loss of Accuracy and Integrity.htm

6 DOCUMENT REVISION HISTORY

Revision Events

Rev.	Author	Changes	Date
Draft A	OG	Initial draft	15/07/03
Draft B	OG	DOME WA Safety Bulletin #57 dated 10/11/2000	15/07/03

7 APPENDICES

```
# keyboard_traverse_recalc_input.tcl
#
# Author;       O.Glockner    Date: 14/07/2003
# Direction by;      O.Glockner
#
#   Introduction
#   ~~~~~~~~~~~~
#
#   This macro is for Surpac v4.1 Surveying Module
#
#   The purpose of the macro is to easily be able to recalculate station coordinates in an
#   underground survey traverse ledger.
#
#   This is especially the case when a resurvey only uses a few stations,
#   and all others not part of the resurvey, need to be recalculated.
#
#   This macro provides a keyboard entry of this data, creating an .inp file,
#   as if it were done with a Geodat 600 data recorder.
#
#   CAUTION: The macro does not do heights, any RLs calculated are false.
#
#   Run the macro entering the data, and a .inp file will be generated.
#   CAUTION: Copy or create a new dummy database to do the recalcs - avoid using an actual control database.
#   Process the .inp as if it were a Geodat 600 input file.
#
#   The .inp file will be in the format:
#
#   50=          (job name and number)
#   2=           (station occupied)
#   3=0          (false instrument height)
#   62=          (back-sight station)
#   21=0.0000     (false bs reading)
#   5=           (point number from 1 to ...)
#   9=           (horizontal distance)
#   8=90.0000     (false vertical angle)
#   7=           (angle turned)
#   6=0          (false target height)
#   4=STNabc      (forward station, where abc is name)
#   loop back to 2= for every input station
#
#
#
#
#   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 responsilbity 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 Traverse Recalc-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
      -label "Job Number - File ID"
      -legacy_action
      -max_length 32
      -null false
      -translate none
    }
  }
}

# Creates form in memory
SclCreateGuidoForm form_handle $form {
}


# display the form
$form_handle SclRun {}

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



#Enter Recalc Details
set writeFile [open "$writefilename$writefile_id.inp" "w"]

# write the header lines to the string file
puts $writeFile "50=$writefilename$writefile_id"


set form2 {
  GuidoForm sampleform {
    -default_buttons
    -label "Traverse Ledger recalc details"
    -help_url geodat.htm
    -layout BoxLayout Y_AXIS

    GuidoScrollPane resectionScrollPane {
      -border etched true
      -height 10
```

```
        GuidoTable resectionTable {
            -instances 1 1 999
            -interactive true

            GuidoField bs {
                -display_length 16
                -format none
                -label "BS Stn"
                -translate upper
            }

            GuidoField oc {
                -display_length 16
                -format none
                -label "Occ Stn"
                -translate upper
            }

            GuidoField fs {
                -display_length 16
                -format none
                -label "FS Stn"
                -translate upper
            }

            GuidoField at {
                -display_length 16
                -format float
                -label "Angle Turned"
                -translate lower
            }

            GuidoField hd {
                -display_length 16
                -format float
                -label "Horiz Dist"
                -translate lower
            }
        }
    }
    GuidoPanel warning {
        -layout BoxLayout Y_AXIS

        GuidoFiller warning1 {
            -height 0.5
        }

        GuidoLabel warning2 {
            -label " This macro creates a Geodimeter style .inp file, which can then be processed using SSI v4.1, as
if it were done with a Geodat 600 data recorder."
        }

        GuidoFiller warning3 {
            -height 0.5
        }


        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
        }


        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
        }
      }
    }
  }

SclCreateGuidoForm form_handle $form2 {
}


# display the form
$form_handle SclRun {}

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


set numberStn [array size oc]

for {set i 0} {$i < $numberStn} {incr i} {
    puts $writeFile "2=$oc($i)"
    puts $writeFile "3=0"
    puts $writeFile "62=$bs($i)"
    puts $writeFile "21=0.0000"
    puts $writeFile "5=[expr {$i+1}]"
    puts $writeFile "9=$hd($i)"
    puts $writeFile "8=90.0000"
    puts $writeFile "7=$at($i)"
    puts $writeFile "6=0"
    puts $writeFile "4=STN$fs($i)"
}

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

DEPARTMENT OF MINERALS AND ENERGY WESTERN AUSTRALIA

Safety Bulletin

No:	57
Date:	10/11/2000
Subject:	MINE SURVEYING - RISKS IN LOSS OF ACCURACY AND INTEGRITY

Details:

BACKGROUND

The maintenance of accuracy and integrity in carrying out mine survey work and in preparation, maintenance and checking of plans is of paramount importance in relation to the safety and efficiency of operations.

This is particularly the case for underground mines, but is also of importance in surface mines, in open pit wall stability monitoring, in open pits intersecting old underground workings, and surface controls over existing underground workings.

The history of mining disasters includes a number of inrushes into underground mines, and also cases of subsidence and collapse into workings, where deficiencies in surveying, or in maintenance and interpretation of plans were factors.

The most recent such event in Australia was at Gretley Colliery in NSW in 1996.

In some measure, a factor which has contributed to an identified decline in performance standards has been the evolution of semi-automated electronic surveying equipment (total station etc) which, while it affords great efficiency and convenience, can lead to oversights and errors which were more readily checked on and detected with the earlier more simple and document based procedures.

However the problem goes deeper than this. In part it stems from lack of in-depth training in some fundamental sound practices. In some cases turnover of staff and lack of continuity at handover, as well as Long Distance Commute regular handovers, creates the opportunity for oversights.

ISSUES AND DEFICIENCIES IDENTIFIED

Surveying Professionals on the Mines Survey Board have advised of a range of deficiencies from their own experience and that of colleagues in carrying out contract and check surveying at mines in Western Australia.

These problems are not normally found at the larger (and longer term) established operations, but are often readily identified at smaller mines, which may also be a function of lack of resources, and of mentoring by experienced survey professionals.

Commonly found deficiencies and oversights are listed as dot points.

Survey Practice

- In most cases there is a lack of hard copy records

- The Origin for coordinates and R.L. do not exist.
- There are no Traverse Sheets.
- There is no evidence that surveys are checked.
- There is no filing system.

- No hard copy of survey procedures and standards is available. In some cases no procedures and standards are observed.
- A lack of basic fundamentals in regard to underground surveying techniques is evident.
- No evidence of re-traversing, plumbing down rises and spirit levelling was available.
- Site plans are, as a rule not up to date.
- Major surface control is not closed and balanced.

Shortfalls in Instrument Maintenance and Controls

- Instrument calibration and adjustment.
- Instrument service schedule 'up to date'.
- Prism constant calibration.
- Atmospheric calibration (ie, p.p.m. correct).
- Control registers up to date, closed and adjusted.
- Traverse equipment adjusted including optical zeniths and plummets.

This does not imply that there is any serious lack of competency in most persons carrying out survey work.

It does, however, show that controls and checks on standards of practice and verification of precision and integrity are lacking in some cases, and the process needs to be better managed, with adequate monitoring and mentoring by professionals with in-depth experience.

It is for these reasons that mine surveying remains a registered occupation (requiring statutory appointment) under the Mines Safety and Inspection Act 1994.

As an example, it is essential to have available a comprehensive and accurate set of current working plans available at underground mines at all times, so that should a mine emergency arise, plans for emergency response (mines rescue) teams are immediately available.

Cases have been found where the surveyor is away and the required information is stored electronically, in a computer not readily accessed.

RECOMMENDED ACTIONS

Registered Mine Managers and Authorised Mine Surveyors should thoroughly audit all aspects of surveying and plan preparation and maintenance at each mine.

The problem of running 'lean and mean', which has presented itself in a variety of forms at current mining operations, must not be allowed to put at risk the integrity of surveying upon which safety in mining operations depends.

Registered Managers should ensure that where an Authorised Surveyor is to leave an operation, the validation of all plans and records is ensured so that integrity is maintained at handover.

Failures and oversights can have and have had, catastrophic consequences.

This Safety Bulletin will be sent to the tertiary institutions providing training in surveying, to highlight the need for awareness and capacity in these critical functions.

CONCLUSION

The Board has resolved that an audit of surveying functions and practices will be developed which can be added to the series of High Impact Function Audits carried out by the Department's mining inspectorate.

It is the intention of the inspectorate to progressively outplace auditing and the survey audit will certainly lend itself to being carried out by competent third party auditors.

To assist surveyors in the industry to achieve and maintain surveying standards the Board has proposed to develop a Guideline titled **"Mine Surveying Standards and Procedures".**

Following circulation of the draft to the professional surveying institutes, the Guideline will be provided to MOSHAB for endorsement and distribution.

J M Torlach
STATE MINING ENGINEER