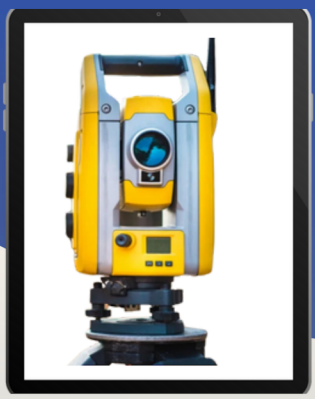
AUTOMATION SURVEY



PART : 1

LONGITUDINAL SECTION & CROSS SECTION PLAN

BY ZAIDI.FADLI.FUAD
Politeknik Kuching Sarawak

Authors

CHE KU AHMAD FUAD BIN CHE KU ABDULLAH
MOHD FADLI BIN CHE ADENAN
CHE ZAIDI BIN CHE HASSAN

POLITEKNIK KUCHING SARAWAK
MINISTRY OF HIGHER EDUCATION
KM22, JALAN MATANG,
93050 KUCHING, SARAWAK.

Phone No. : (082) 845596/7/8
Fax No. : (082) 845023
E-mail : poliku.info@poliku.edu.my
Website : http://www.poliku.edu.my/

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This eBook is the original work of, Che Ku Ahmad Fuad bin Che Ku Abdullah, Mohd Fadli bin Che Adenan and Che Zaidi bin Che Hassan.

HAK CIPTA TERPELIHARA DAN PENAFIAN

HAK CIPTA TERPELIHARA

Tanggungjawab hakcipta tidak ada kena mengena dengan maklumat di dalam E-Book ini. Penulis tidak bertanggungjawab ke atas sebarang kesilapan ataupun maklumat yang tidak dimasukkan walaupun langkah berjaga-jaga sudah diambil.

PENAFIAN

Penerbitan ini mengandungi pandangan serta pengalaman penulis dan juga sumber dari yang boleh dipercayai. Ia bertujuan membantu dan menyediakan maklumat berkenaan perkara yang dibincangkan. Penulis tidak bertanggungjawab ke atas mana-mana kerugian, kehilangan atau risiko yang ditanggung oleh perseorangan atau sebagainya, yang timbul akibat daripada penggunaan mana-mana kandungan E-Book ini sama ada secara langsung ataupun tidak langsung.

PREFACE

Congratulations and welcome dear readers.

This eBook is exclusively dedicated to Geomatics students at Polytechnic Malaysia.

Work in the field of land surveying or now known as Geomatics involves the process of collecting and collecting data obtained through measurement and observation in the field and this data is then processed through calculations. The end result of this measurement work is a measurement plan based on the requirements of the work or project. Appropriate work steps and work procedures to measure or analyze the work must be followed so that the end result of the work is the best and accurate.

It is hoped that this eBook can help in the surveying process that will be carried out by Polytechnic students in particular and all readers in general. This eBook will help readers understand how to use the total station tool, as well as learn how to process survey work data. here will show the results of the measurement work related to the length and cross-section measurement work until the result of the plan.

It is our hope that you become an excellent student in the field of geomatics and at the same time experience real life as a caliber Surveyor.

Thank you to everyone involved directly or indirectly in making this eBook a success.

ACKNOWLEDGEMENT

The success of completing our eBook, "Automation of Measurements, part one" focusing on Longitudinal Sections and Cross-Sections, would not have been possible without the extraordinary support and contributions of several individuals.

I would like to express my deepest gratitude to those who have provided unwavering help and have played a vital role throughout this project. Ideas and attention to detail have significantly improved the quality and accuracy of our work.

Thanks for the amazing help and great support. Your contributions have not only enriched this work but have also set a high standard for future projects. We hope to continue our cooperation and achieve further success together.

With the highest regards,

Editor CKAF
Geomatics Unit,
Civil engineering department,
Sarawak Kuching Polytechnic
May 2024

Automation Survey : Part 1

About Writers

Sr. Che Ku Ahmad Fuad bin Che Ku Abdullah

Master of Science in Geomatics Engineering, UTM
Bachelor of Science, Surveying & Geomatics, UiTM
Senior lecturer at polytechnic, 16 years experience in higher education.
Teach in Engineering Surveying, Cadastral Surveying and Geodesy

Mohd Fadli bin Che Adenan

Bachelor of Geomatics Engineering, UTM
Senior lecturer at polytechnic, 16 years experience in higher education.
Teach in Engineering Surveying, Survey Computation and Survey Adjustment

Sr. Che Zaidi bin Che Hassan

Master of Technical Education, UTM
Bachelor of Science, Surveying & Geomatics, UiTM
Diploma in Land Surveying, UiTM
Senior lecturer at polytechnic, 22 years experience in higher education.
Teach in Cadastral Surveying and Basic SurveyingPoliteknik Kuching Sarawak

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Chapter 1

INTRODUCTION

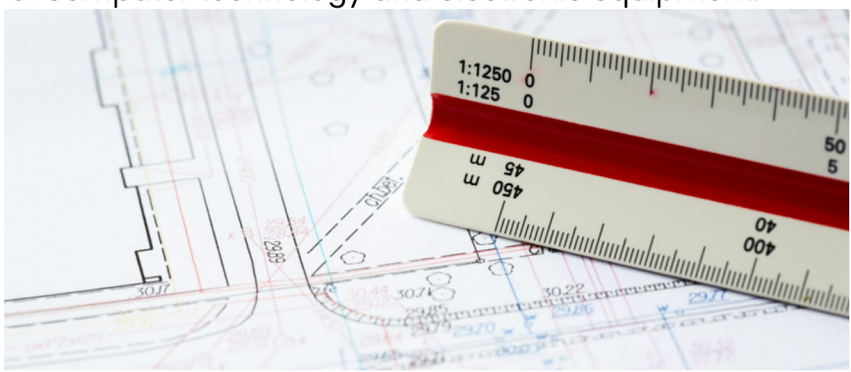
The way to get started is to quit talking and begin doing.

-Walt Disney

1.0 INTRODUCTION

1.1 Automation Survey

According to the 'Dewan Bahasa dan Pustaka', automation means a task execution system and automatic tools that enable various aspects and work processes to be done with little or no human effort. If linked to surveying then it can be defined as a method of collecting, processing and producing surveying information. The introduction of automation systems in measurement work is in line with the rapid development of computer technology and electronic equipment.



Today, the use of automation measurement systems has been practiced comprehensively by both government and private agencies. The speed of its use may be due to several factors including the decrease in the cost of automation systems and the sensitivity of users to the needs of automation. It is disadvantageous if the automation system is not fully practiced due to its advantages such as being able to store data in digital form that is easy to process, analyze and then export to other software such as geographic information system (GIS) software.

1.2 Longitudinal Section and Cross-sections

In the construction of roads, railways, underground pipelines of large diameter or similar, after establishing the proposed center line on the ground, levels are taken at regular intervals along the road and at right angles to it to obtain longitudinal and cross sections. This is shown in the figure 1.0

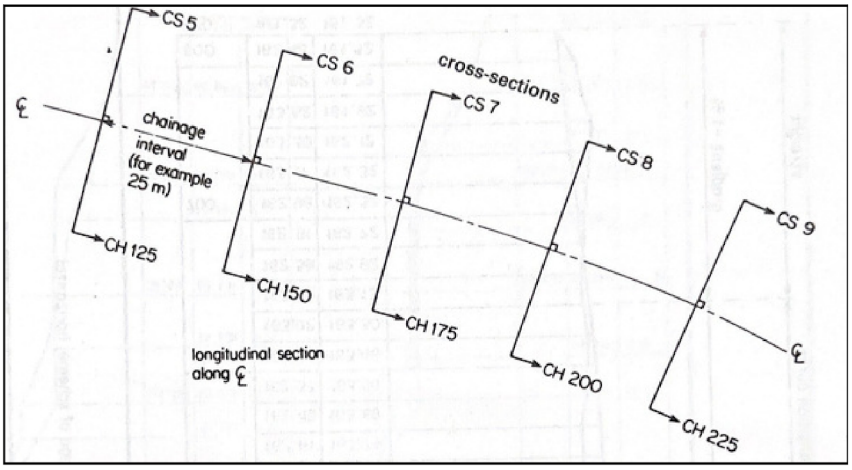


Figure 1.0: Long section and Cross-section layout
Sources; Surveying for Engineers J.Uren & W.F.Price 3rd edition

1.2.1 Longitudinal Section

Longitudinal sections are sections that follow some pre-determined line defining part of a new construction and are usually run along the center lines of the proposed work such as new roads, canals, railways, pipelines, or river. Longitudinal Section also known as Long Sections which is it is a section along the direction of road. Figure 1.1 shown the example of a Longitudinal section.

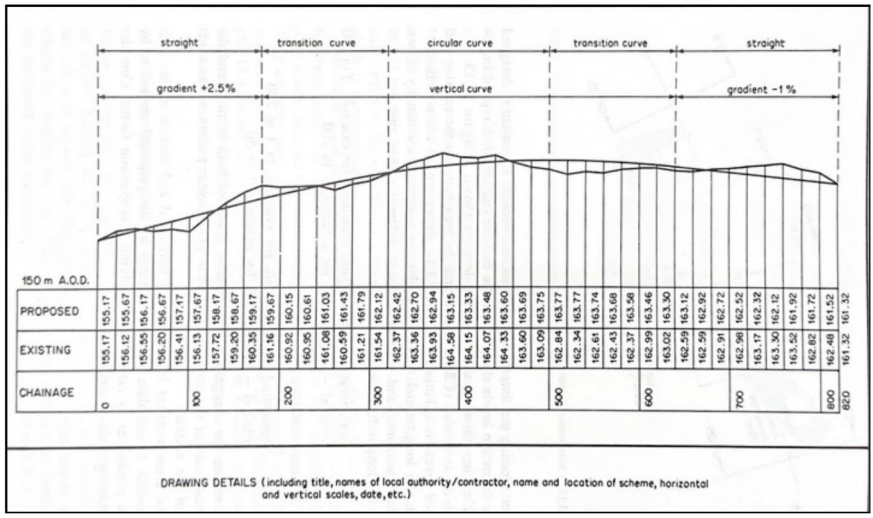


Figure 1.1: Example of a longitudinal section
Sources; Surveying for Engineers J.Uren & W.F.Price 3rd edition

1..2.2 Cross Section

Cross section is the section set common to a longitudinal section which is a cross section of a road. A cross section is a profile view of a surface at right angles to a particular route. For example, at right angles to the road, river, or railway. It plots elevation against the distance along a cross-section line.

The aim of leveling the cross-section is to reproduction of an accurate section of the ground which is to be covered by the construction works. Cross-section measurements are normally taken at a regular intervals along the route.

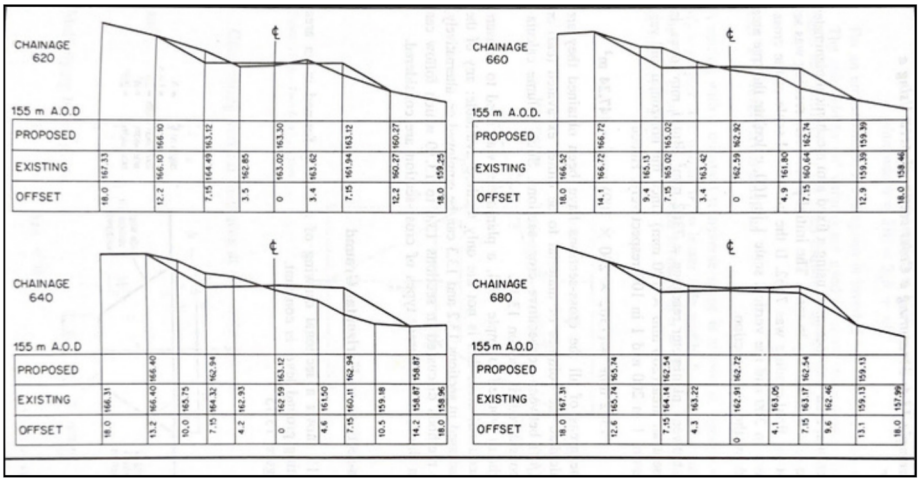


Figure 1.2: Example of cross-section
Sources; Surveying for Engineers J.Uren & W.F.Price 3rd edition

Chapter 2

OBJECTIVES

Knowledge without action is wastefulness and action without knowledge is foolishness .

-Al-Ghazali

2.0 OBJECTIVES

Automated survey technologies preserve consistency and neutrality for every customer interaction. They ensure that the customer feedback is unbiased, neutral and error-free, which leads to smarter and more informed decision making. The objectives of this eBook are to:

1. Illustrate data collection using Total Station
2. Show data transfer from Total Station to CDS
3. Produce longitudinal section, and cross section profiles using CDS

Chapter 3

INSTRUMENT & SOFTWARE

Do not allow your heart to take pleasure with the praises of people, nor be saddened by their condemnation

-Al-Ghazali

3.0 INSTRUMENT AND SOFTWARE

3.1 INSTRUMENT

A Total Station is an instrument used for surveying that combines electronic and optical elements. It integrates a theodolite and Electronic Distance Measurement (EDM) to measure vertical and horizontal angles, and slope distance and features an onboard computer for data collection and triangulation calculations. Modern total stations come equipped with advanced features such as a data processing module.

Figure 3.0: Basic Survey instrumentation; Total Station, Prism and Mini Prism

3.1.1 ADVANTAGES OF THE TOTAL STATION

1- Quick setting of the instrument on the tripod using laser plummet.
2- Onboarding area computation program to compute the area of the field.
3- Local language support.
4- Full GIS creation (using MapInfo software).
5- Automation of old maps.
6- Greater accuracy in area computation.
7- Graphical view of plots and land for quick.
8- Integration of database.
9- Area computation at any user required scale.
10- The field jobs are finished and the map of the area with dimensions is ready after data transfer.
11- It reduces the time & also measures up to 3 to 5 km distance.

Figure 3.1: Total station parts model Topcon GTS

3.2 SOFTWARE

Civil Design and Survey (CDS) is a specifically surveying software that used To produce plans, subdivision layouts, annotated contour plans, profiles, and section drawings directly to any Windows printing device. Besides that, CDS also can insert borders, text, and symbols onto the plan.

Figure 3.2: Civil Design & Survey (CDS)

Chapter 4

WORK PROCEDURES

"Your time is limited, so don't waste it living someone else's life."

-Steve Jobs

4.0 WORK PROCEDURES

4.1 DATA COLLECTION

4.1.1 OVERVIEW SURVEYING WORK USING TOTAL STATION

Surveying is a key profession in a wide range of activities and applications comprising construction, engineering and land development. It is the measurement and mapping of the natural environment which include land, structures, and other physical characteristics. Total station: it is an advanced surveying Instrument.

A theodolite, primarily used to measure angles with respect to the tilted vertical axis, combined with an electronic distance meter (EDM) and sometimes a microprocessor to compute the angle and distance at the same time, allows for precise distance and angle measurements. In the introduction we will see the basic work procedures of a survey using a Total Station.

4.1.2 Purpose of Using a Total Station

The purpose of using total station in surveying task is to achieve high precision and efficiency in measurement tasks. It enables surveyors to:

- Measure horizontal and vertical angles.
- Measure and calculate distances more accurately.
- Record and store data automatically.
- Perform real-time calculations to get the coordinates and elevations value.
- Enhance productivity with integrated software and ease to manipulate digital data.

4.1.3 PREPARATION STEPS

i. Understanding Project Requirements:

- o Review project specifications and requirements.
- o Identify the area to be surveyed and determine the scope of work.

ii. Site Survey (Reconnaissance):

- o Conduct initial site visits.
- o Identify and mark reference points and key features.
- o Assess potential obstacles and plan for accessibility.

iii. Inspection and Calibration of Equipment:

- o Check the total station and accessories for any damage or defects.
- o Make sure the instrument is calibrated and working properly.
- o Charge the battery and provide a backup power source.

4.1.4 SET UP A TOTAL STATION

i. Station Setup:

- o Choose a stable and safe location for the total station.
- o Set up a tripod over a known point or marked reference.
- o Install the total station on the tripod safely.

ii. Leveling the Instrument:

- o Use a tripod leg to roughly level the total station.
- o Refine the leveling using the built-in electronic or optical leveling tool.

iii. Orientation and Centering:

- o Center the instrument over the reference point using optical fall or laser fall.
- o Ensure accurate centering to avoid errors in measurement.

4.1.5 SURVEYING PROCEDURES

i. Initialization of Data:

o Start the total station with project-specific settings.
o Enter reference coordinates and elevation if available.

ii. Angle and Distance Measurement:

o Aim the total station at the target point using the sighting mechanism.
o Measure horizontal and vertical angles.
o Measure distance to target using EDM.

iii. Data Recording:

o Record the measured data electronically in the total station memory.
o Note any relevant observations and field conditions.

iv. Data Validation:

o Confirm measurements by taking repeat readings if necessary.
o Check consistency and accuracy in recorded data.

4.1.6 WORK PROCEDURES FOR DATA COLLECTION

The data collection process is done automatically and stored in the measuring device (Total Station). This provides an advantage in terms of simplifying the process of manipulating the data obtained and ensuring data security.

The following figure shows the procedure for recording data into the Total Station

1) Click on [CORD] and press [F4] to go to page2. To set Back sight point go to BS [F2]. HT [FI] to set total station height and prism height. OCC. is set total station coordinate.

2) First, we need to input total station point coordinate. Point can be input from list, click on LIST [F2] and choose needed point coordinate. Also coordinate can be input manually.

3) Measure and input the height of total station. Then press ENT [F4] to confirm.

Click link here:
(Data Collection) Total Station Setting

4) The next page will remind you to set Back sight, input known BS coordinate and click on ENT [F4] to confirm. Aim on target and lock clamping screws.

5) Set Back sight point angle and chose YES [F4) to confirm. Check target in telescope, click on [F4) again.

6) Input target height and press ENT [F4].

7) Check survey Back sight point coordinate error with input Back sight point coordinates. Click on [F4) to measure coordinates.

8) Back to page I and click MEAS [F2) to measure point coordinates. Click ALL [FI) to record this point. MODE is same to distance measurement options, include: measure 1 time, measure 3 times, repeat survey, taking.

4.2 DATA DOWNLOAD

After collecting data in the field, the data will be transferred to the computer for further processing. Here is shown how to transfer data from the measuring equipment (Total Station) to the computer.

i. Pen drive is inserted in the respective slot in the external interface hatch at total station to obtain the data that have been observed.

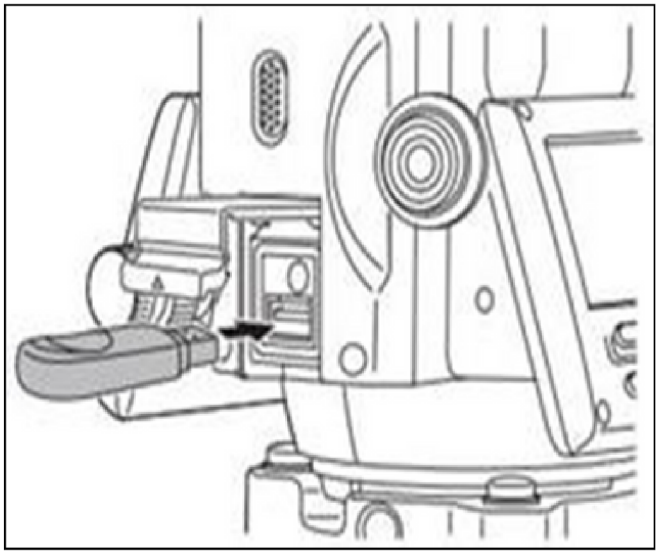
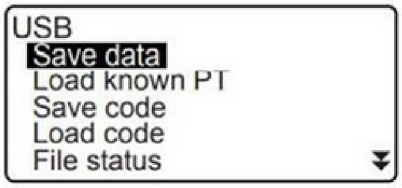


Figure 4.0: Inserting pen drive to USB slot
Sources; (Manual-Topographic Survey By Total Station by Civil Design)

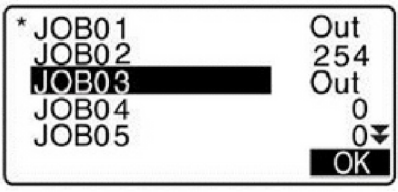
ii. <USB> is pressed on the screen status.

iii. <T type> is selected. Then press enter for selection

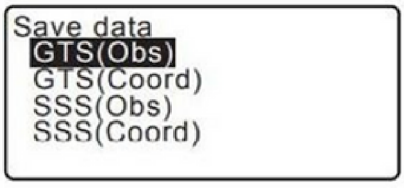
iv. <Save Data> is selected in the USB mode

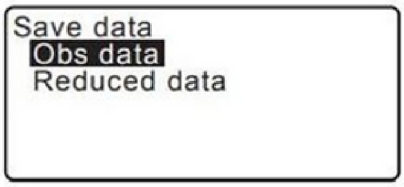


v. JOB is selected and pressed enter until 'OUT' displayed beside the JOB name. Then OK is clicked.

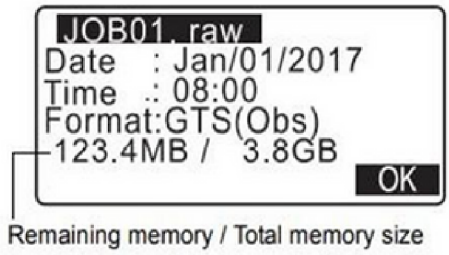


vi. The output data is selected.





ii. Then, (F4) is pressed to save data in USB drive



Click link here:
Transfer Data Process

4.3 DATA PROCESSING

The data that has been transferred earlier will then be processed to produce the final result for a survey work which is the Plan. CDS software is used for that purpose. The following shows how to process data using CDS software.

4.3.1 Create NEW FILE

i. CDS software is opened in laptop/computer.

ii. File Options is clicked and select New to create new file.

iii. JOB is named based on preferences of the job.

iv. "Entry" option is clicked and "Data Collectors" selected then Import Raw Data is clicked.

v. "Topcon" is chosen as Total Station and "FC5, GTS6" as GTS-239N raw data format. After that, Browse is clicked then the raw data is selected and transferred from the Total Station.

vi. The warning will be shown as below. Clicked OK and YES, then it will show the topography surveying result as shown in Figure 4.1.

Figure 4.1: Warning appears when CDS New File is registered
Sources; (Manual-Topographic Survey By Total Station by Civil Design)

vii. If the topography details being taken using the same JOB in the same total station. Append Stadia does not require.

viii. Step "iv" to "vii" is repeated to insert another data. Then, "option" is clicked, "Append stadia/precision data" and survey number of data is selected.

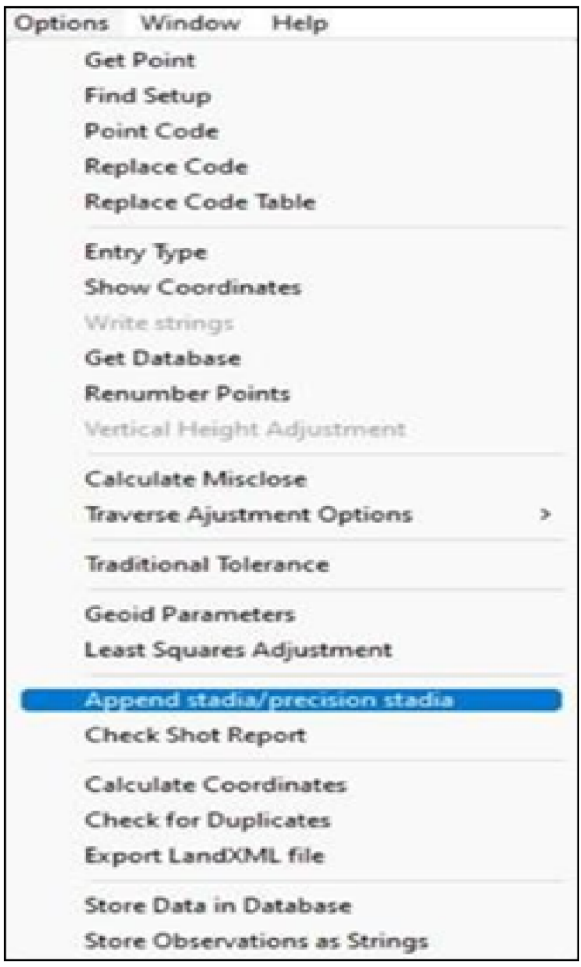


Figure 4.2: Menu to Append stadia/precision stadia on CDS
Sources; (Manual of Civil Design & Survey Software)

ix. i.After the stadia have been attached together. The coordinate and reduced level of the traverse stations at the top of the data is inserted.

x. Options and Coordinate are clicked to show the coordinate. After the coordinate, have been calculate, Store Data in Database.

xi. Minimize is clicked.

xii. After that, Z and E is pressed on the keyboard to zoom where the point are.

4.3.2 GENERATE CONTOUR

xiii. Adding string, String and add is selected.

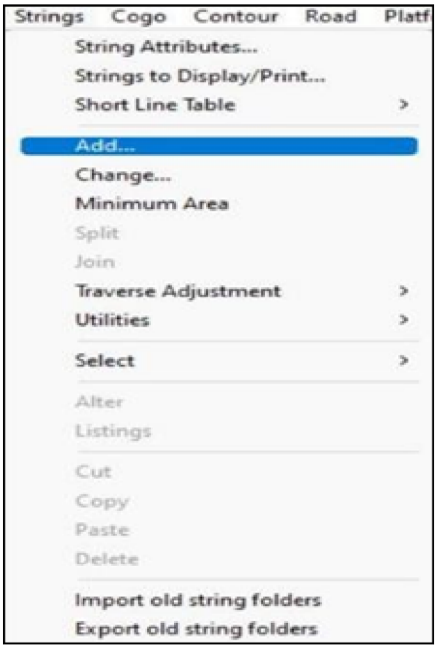
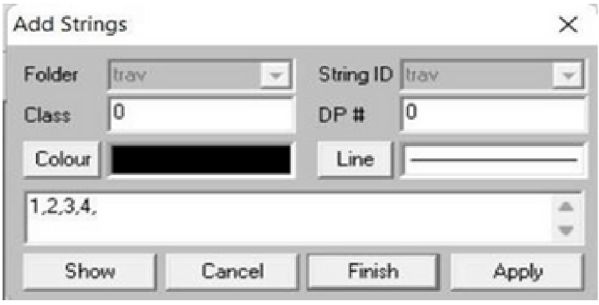
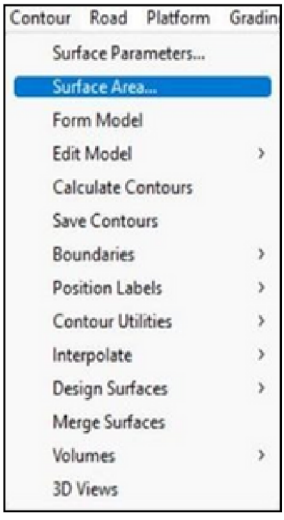


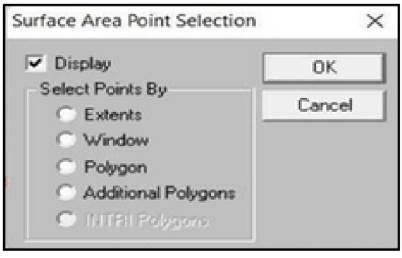
Figure 4.3: Menu to Add string on CDS
Sources; (Manual of Civil Design & Survey Software)

xiv Station numbers is typed to form traverse line from point to another point. Then, **'Finish'** is clicked.



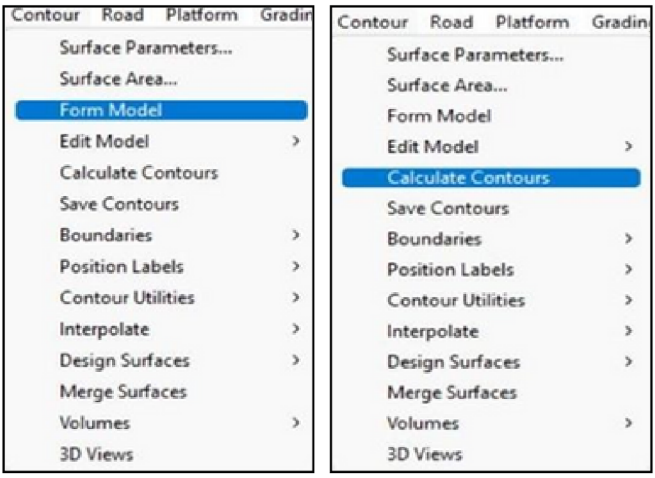
xv. **'Contour'** is clicked to create a contour and **'surface area'** is selected to set the area of the points. After that, press **'Display'** and **'OK'**





xvi In the same option of Contour **"Surface parameter"** is selected, Major Contour Interval is set based on the preference and go to **"Modes – Display"**, Display is selected by **'Mode'** and then to open it any layer is clicked.

xvii **"Form Model"** is selected to form the triangle then **"Calculate Contour"** is selected.



Then, the result will be shown as below.

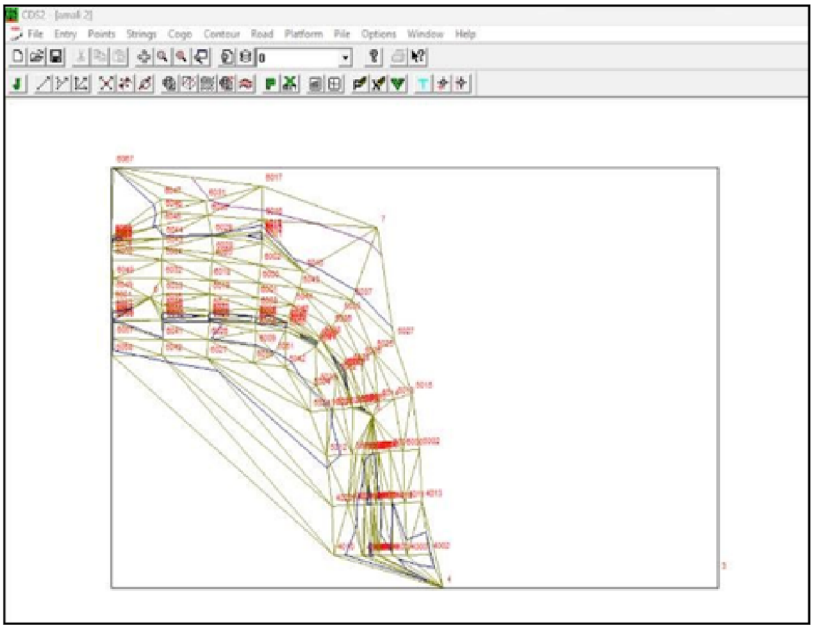


Figure 4.4: Example of a Contour generated in CDS
Sources; (Manual of Civil Design & Survey Software)

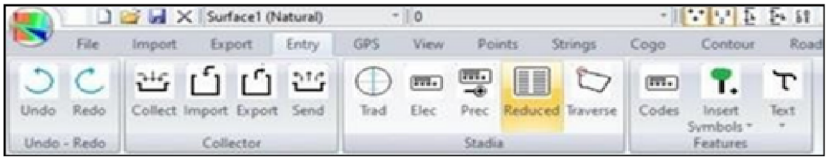
4.3.3 PRODUCE LONGITUDINAL AND CROSS SECTION

Longitudinal Section

i. CDS Software is opened to key in the data for longitudinal section and cross section.

ii. New Job is created and rename as the preference.

iii. Go to “Entry” and select “Reduced Levels” and click for “Level Sheet”. Put ‘1’ inside “Level Number” box as level sheet number 1. Then “Enter Road Number for Level Sheet Entries: 1”. Click OK



Longitudinal Section

iv. The line is connected from **CH0** until **CH100** before filling the blank column in the sheet. And the line drawn 15 meters to the left and right of the chainage.

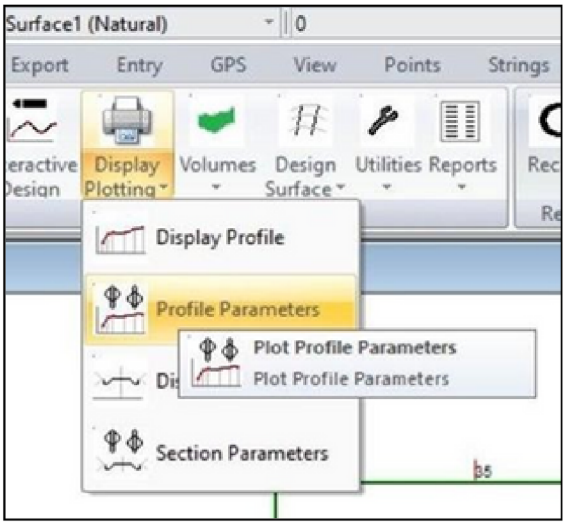
v. The line for each point is drawn. Then, the line from chainage to the intersection of the line 15 meters with the point line is drawn. e. After that, the line is selected, then right click the mouse, and select **"properties"** to get the distance of the first point from the chainage. Start with the left side of the chainage.

vi. The data is key in to the column of the sheet. The data is filled a from the first chainage until the last chainage. Start with the middle of the chainage on the left and lastly the right of the chainage. Offset for the middle of the chainage will be 0.000 and the left will be negative, and the right is positive. RL is Reduced Level of each point that have been generated in CDS.

vii. Go to Options. **"Store Database"** is selected.

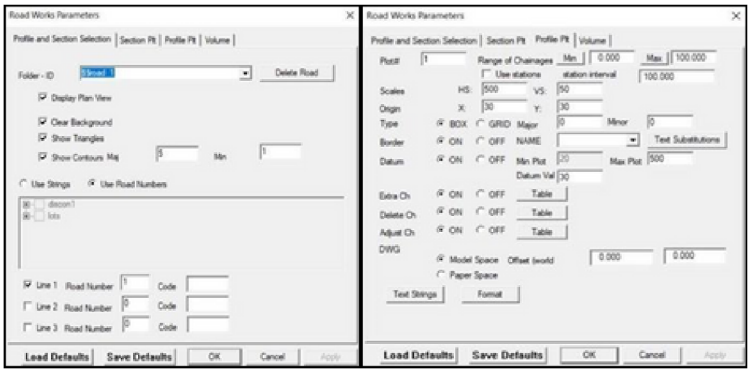
Longitudinal Section

viii. Go to **"Road"**, then **"Profile Parameters"** is selected to set the parameters for longitudinal section.

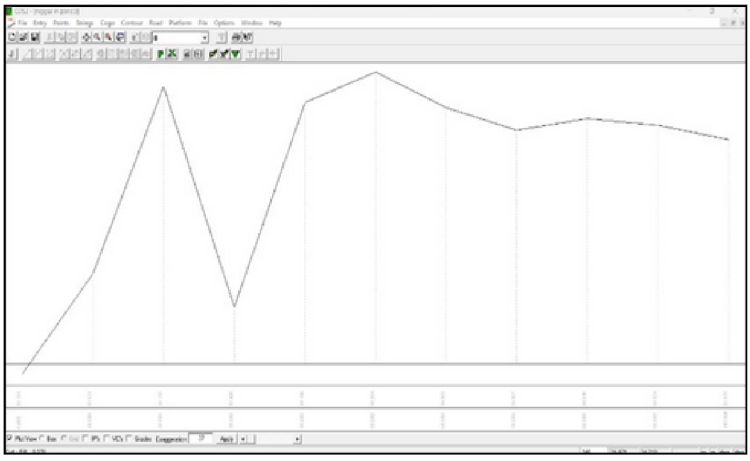


ix. On the **"Profile and Section Parameters"**. Click **"Use Road Numbers"** and go to **"Profile Plt"** to set longitudinal parameters. ON THE **"Range of Chainages"**, click **"Min"** and **"Max"**. The scales can be set any number depends on the job preferences. On **"Datum"** click ON to set the datum or OFF for it automatically set it. Then Click OK.

Longitudinal Section

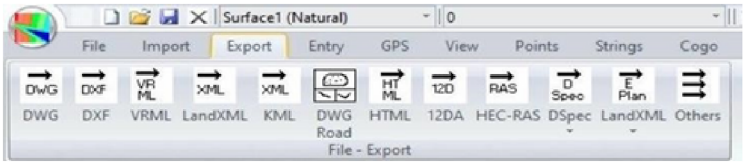


x. Repeat step ix) and select **“Display Profile”**. Click ‘**Plot View”** and **“IP’s”**



xi. Go to **“Export”**. Then click **“DWG”** to export the longitudinal section to AutoCAD.

Longitudinal Section



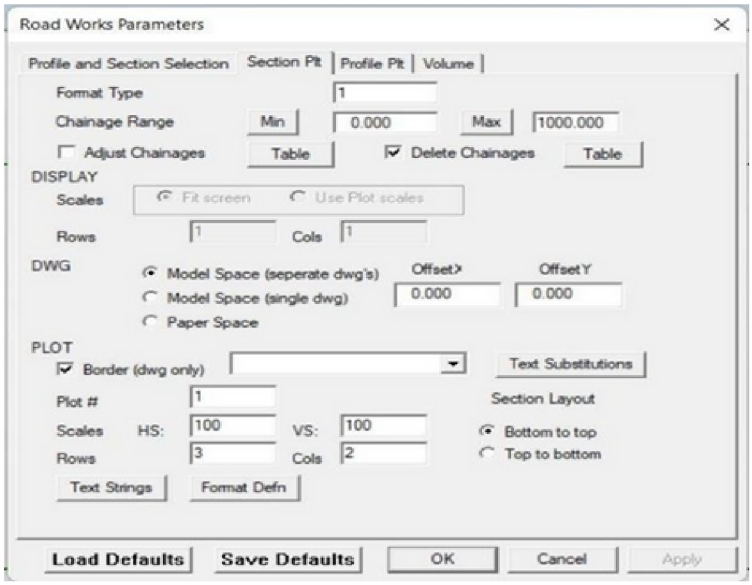
xii. Edit and plotting the plan based on the format requirement.

Figure 4.5: Example of a Long section result in CDS

Cross-Section

xiii. Repeat step ix) and select **"Section Parameters"**.

xiv. Click **"Min"** and **'Max"**. Set scales **"HS'** and **"VS"** 1000, to make the drawing in scale 1:1000. Then click OK.



xv. Step xi) is repeated and select "Display Section". Click on "Plot View".

xvi. After that, the step xii) until xiv) is repeated.

Cross-Section

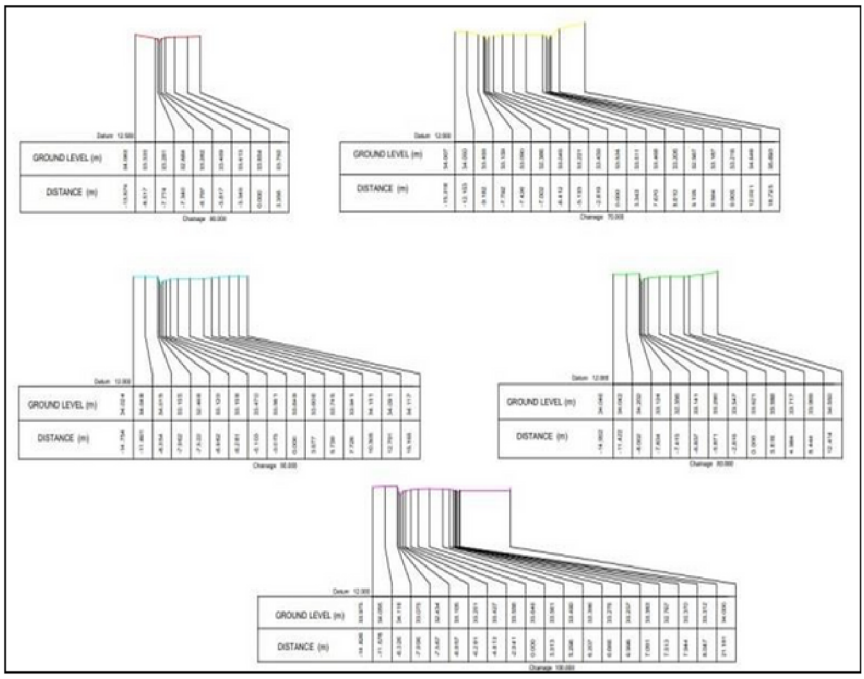


Figure 4.6: Example of a Cross-section result in CDS

Quiz Activity

Watch youtube, read Notes & answer all questions in Quizizz

QUIZ LINK Link:
http://surl.li/ugnhb

CONCLUSION

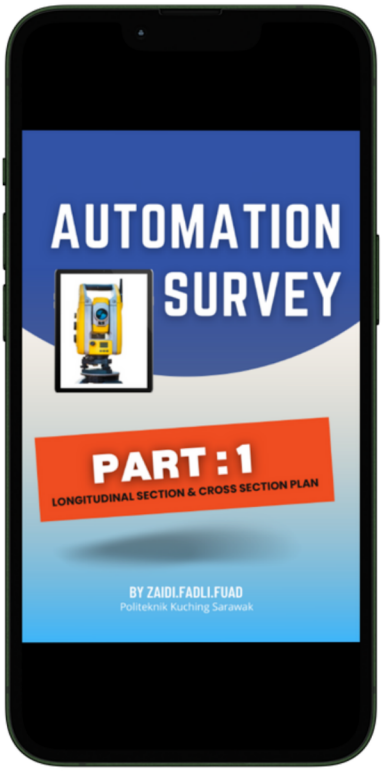
In "Survey Automation Part: 1," we explored the journey of modern surveying, from data collection to the creation of detailed plans. Using a Total Station, we demonstrated how surveyors can accurately measure land features. This data is then transferred to powerful software like Civil Design and Survey, where it is processed to generate long section and cross section plans.

We highlighted the seamless integration of these tools, showcasing how automation enhances accuracy and efficiency. By following the steps outlined in this eBook, surveyors can effectively gather, transfer, and process data, leading to precise and comprehensive survey plans.

As we move forward, the advancements in automated surveying promise to simplify and refine the surveying process even further. Stay tuned for more insights and techniques in the next part of our series.

Interactive eBook

For an interactive look, please assess using QR code.



or https://tinyurl.com/yc5vjms9

References

CHCNAV - Shanghai Huace Navigation Technology Ltd. (2018). CHC CTS-112R4 user manual (Version 1.0).

Foresoft Pty Ltd. (n.d.). Civil design & survey user manual.

Mat Amin, Z. (2011). Lecture note engineering surveying III automation survey. Universiti Teknologi Malaysia.

Mathivanan, V. (n.d.). CC103: Engineering surveying 1 chapter 2. Www.academia.edu. Retrieved June 6, 2024, from http://www.academia.edu/5874898/CC103_Engineering_Surveying_1_Chapter_2

Processing long & cross section using CDS | PDF. (n.d.). Scribd. Retrieved June 6, 2024, from https://www.scribd.com/document/522962443/Processing-Long-CrossSection-Using-CDS#

Sonni Sondang. (2021, April 21). Autocad Civil 3D create long section & cross section from 2 surface [Video]. YouTube. https://youtu.be/Fnj_p6Z9-74

Uren, J., & Price, B. (2018). Surveying for engineers. Bloomsbury Publishing.

YouTube. (n.d.). Www.youtube.com. Retrieved June 6, 2024, from https://www.youtube.com/watch?v=vocKkZphtoI

Yasmin, N. (2023). Introduction to AutoCAD 2024 for civil engineering applications. SDC Publications. ISBN: 978-1-63057-607-3

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