

## Preparation of topographic map using GIS and Auto CAD techniques in cause of Mizan Tepi University Tepi Campus

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### Abstract:

*Topographic survey is used to find the necessary data for the construction of a graphical portrayal of topographic features. The graphical portrayal from the gathered data forms a topographic map. A topographic map is a two dimensional presentation of a three dimensional land surface. It helps to get horizontal distance, angle, and elevation and show the character of natural and manmade features by using conventional sign. It is use contour lines to show changes in terrain and elevation, and area often overlaid with a wide variety of information, such as roads and streets, trails, land-use boundaries, tree and vegetation cover, and camping and hiking information to show how the lay of the land interacts with other natural and human-made features. It also used for outdoor activities, engineering, energy exploration, natural resource conservation, environmental management, public works design, and commercial and residential planning. Any engineering project starts its work based on the collected topographic map of a given area. Example: to build the foundations of different engineering structures, planning new infrastructure network, information concerning landscape elements etc. This study used different surveying software and instruments to prepared a topographic map. Some of the instruments used to prepare this topographic map the research group used GPS instrument (Trimble R8 receiver and TSC2 5800 controller) and among the surveying software GPS, GIS, Civil Survey (S8) etc. Topographic mapping in general have different significance in establishment of high accuracy vertical and horizontal control networks, It shows the boundary, natural border lines and reliability when caring out measurements and estimations, It provide comprehensive, precise and complex information concerning landscape elements, depicts true nature of terrain by map elements obtained using instrumental and field investigation.*

**Keywords:** *GPS, GIS, Topographic Map, civil survey software (softdesk 8), trimble r8*

## **I. INTRODUCTION**

Maps have been an integral part of the human story for a long time. From cave/wall paintings, ancient maps of Babylon and Greek philosophers, through the Age of Exploration, and on into the 21<sup>st</sup> century, people have created and used maps as the essential tools to help them define, explain and navigate their way through the world. Maps are used extensively throughout society.

Topographic survey is the method of determining the positions on the surface of the earth, of human made and natural features. It also is used to determine the configuration of the terrain. The purpose of a topographic survey is to find the necessary data for the construction of a graphical portrayal of topographic features. The graphical portrayal from the gathered data forms a topographic map. A topographic map helps to get horizontal distance, angle, and elevation and show the character of natural and manmade features by using conventional sign. It is a two dimensional presentation of a three dimensional land surface. Topographic maps are differentiated from other maps in that they show both the horizontal and vertical position of the terrain. Through a combination of contour lines, colors, symbols, levels, and other graphical representations, topographic maps, portray the shape and Location Mountains, forests, rivers, lakes, cities, roads, bridges, and many other natural and manmade

features. They also contain valuable reference information for surveyors and mapmakers, including bench marks, base lines and meridians, and magnetic declination. Topographic maps are used for civil engineers, environmental managers and urban planners, as well as by outdoor enthusiasts, emergency services agencies, and historians.

For this study, the selected site plan which include maximum features that are seen on the earth's surface as possible. The area surveyed is found in Mizan-Tepi University (Tepi campus). The area is covered by different natural and man-made features like trees, road, building, drainage, footpath, manholes, marsh area, electric pole etc. And, used ground method of topographic surveying by using different surveying instruments to collect data and to process the data, used surveying software then produced a good topographic map of the area. The Great Trigonometric Survey of India, started by the East India Company in 1802, then taken over by the British Raj after 1857 was notable as a successful effort on a larger scale and for accurately determining heights of Himalayan peaks from viewpoints over one hundred miles distant. 1913 saw the beginning of the International Map of the World initiative endeavoring to map all of Earth's significant land areas at 1:1 million scale on about one thousand sheets covering four degrees latitude by six or more degrees longitude. Excluding

boundaries, each sheet was 44 cm high and (depending on latitude) up to 66 cm wide. Although the project eventually foundered, it left an indexing system that remains in use.

By the 1980s, centralized printing of standardized topographic maps began to be eroded by databases of coordinates that could be used on computers by moderately skilled end users to view or print maps with arbitrary contents, coverage and scale. For example the Federal government of the United States' TIGER initiative compiled interlinked databases of federal, state and local political borders and census enumeration areas, and of roadways, railroads, and water features with support for locating street addresses within street segments.

### **1) Statement of the problem**

Any engineering project starts its work based on the collected topographic map of a given area. In Mizan Tepi University, Tepi campus first phase construction is completed using the oldest topographic map of the campus to build the foundations of different engineering structures. Although there is topographic map of Tepi campus as it is indicated above it is outdated and it has no practically purpose full for the current usage of the activity of the university, as it is understood by the research members for current planning of the campus infrastructure like electric line distributions, temporary construction like student and teacher

lounge, current land deformation analysis, foundation of geospatial products, information concerning landscape elements and selecting new pipe line routes demands a new updated topographic map of the campus. Because of the listed reasons developing an updated and proper topographic map is necessary.

## **II. LITERATURE REVIEW**

### **a. Definitions of Topographic Map**

Topographic maps produced and published by government agencies usually include both physical and cultural features, making the maps useful in municipal planning, civil engineering, watershed and other environmental studies, design of communication systems, and outdoor recreation, among others. Research results from past twenty years clearly show an influence of topography and wetland on stream water chemistry. The influence of topography is important because it controls the water subsurface contact time (Beven and Kirkby, 1979; Wolock et al., 1990; Dillon and Molot, 1997; McGuire et al., 2005). Since the beginning of 1990's many methods for deriving attributes from elevation data have been developed for use in hydrological applications. These attributes can be divided in two groups: primary and secondary topographic attributes. Topographic map shows the configuration of the terrain and the location of natural and man-made objects. Topographic maps

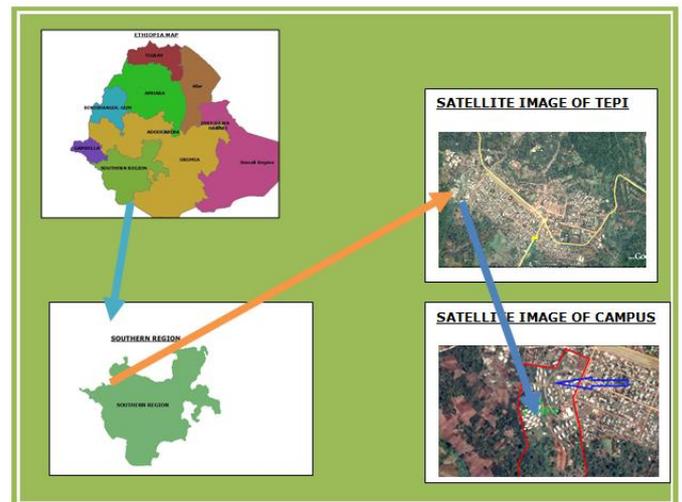
are detailed, accurate graphic representations of features that appear on the Earth's surface. These features include:

Topography is of great significance in hydrology, affecting soil water content, flow paths and residence times (Nyberg, 1995), and subsequently the chemical composition of surface waters (Beven, 1986; Wolock et al., 1989). Mean slope, based on a DEM with 50 m grid, was a variable that correlated with headwater chemistry in a previous study in the same region as in this paper (Andersson and Nyberg, 2008)

### III. METHODOLOGY

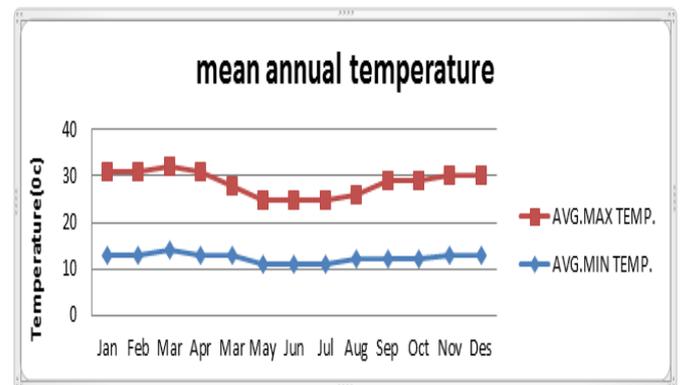
#### a. Description of the study area

Study area is located in south nations and nationalities of Ethiopia Mizan Tepi University, Tepi campus. The Southern Nations, Nationalities and People's Region (SNNPR) is located in the Southern and South-Western part of Ethiopia. Astronomically, it roughly lies between 40 43' - 80 58' North latitude and 34o 88'- 39o 14' East longitude. It is bordered with Kenya in South, the Sudan in South West, Gambella region in North West and surrounded by Oromiya. Tepi is a town in southern Ethiopia. Located in the Sheka Zone of the Southern Nations, Nationalities, and People's Region (SNNPR), this town has a latitude and longitude of 7° 12' N 35° 27' E with a mean elevation of 1,097 meters above sea level.



**Fig. location map of the study area**

**Temperature:** Based on the meteorological map of Ethiopia, the project corridor is classified as hot or locally termed as "Qola" Zone. Generally, the entire project route has temperature ranging between 12°C – 18°C. The mean annual temperature of the project area is indicated in table 1.1 below.



*Fig. Graph shows mean annual temperatures*

#### **Rainfall**

The mean period of beginning of "Kiremt" rain for the project area is from June to September. October is the mean month for the end of "Kiremt" rain for the entire project area. The mean annual rainfall vary from 1000 to 1800 mm. The mean monthly rainfall is presented in Table below.

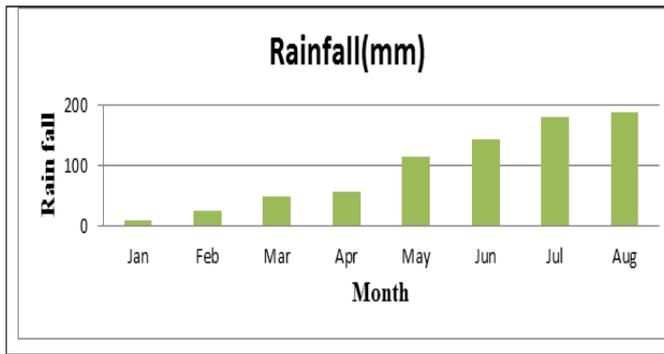


Chart 1.1 Mean monthly rainfall of the study area

## [2] Data Collection

Before collect the topographic data of the features reconnaissance the terrain of target area, since the project need accuracy, precision, and correct decision of instrument is preferable to meet the need.

### Data Type and Source

The study has both primary and secondary data source. The primary data has been collected from field using the necessary equipments such as GPS. In this case preliminary survey and discussion among the research group was conducted. Secondary data is mainly obtained from published and unpublished books Google earth, aerial photograph and satellite image of the project or study area. Those materials have been finding from different sources. Mainly found from internet, EMA, and other materials.

**Material used :** Now days there are high accuracy surveying instruments which are used in surveying works. One of these is electronically instruments such as GPS. For this project GPS instrument is

used to collect detail data since, it has high accuracy than other instrument.

- GPS (Controller, GPS receiver, pointer, and antenna).
- Arc GIS, AutoCAD, Soft desk 8, Google Map, Map Source and Excel are also

Some of the instruments used for run post processing kinematics are:-

### R8 Rover

Assemble the range pole and twist on the R8 receiver. Use the bipod to hold the pole with receiver in the upright position Twist on the radio antenna Make sure you have a battery in the unit Power up receiver Place the TSC2 bracket on the pole Remember if you use a quick release



## Method

The study begins with the selection and identification of a problem to be studied. Once, the

title has been select to be done, that follows the following steps to complete. The overall project procedure contains the following steps:-

communication. The map reader sees the entire graphic image at once. These includes in the output map:

- Clarity
- Order
- Balance
- Visual Contrast
- Unity and Harmony
- Visual Hierarchy.

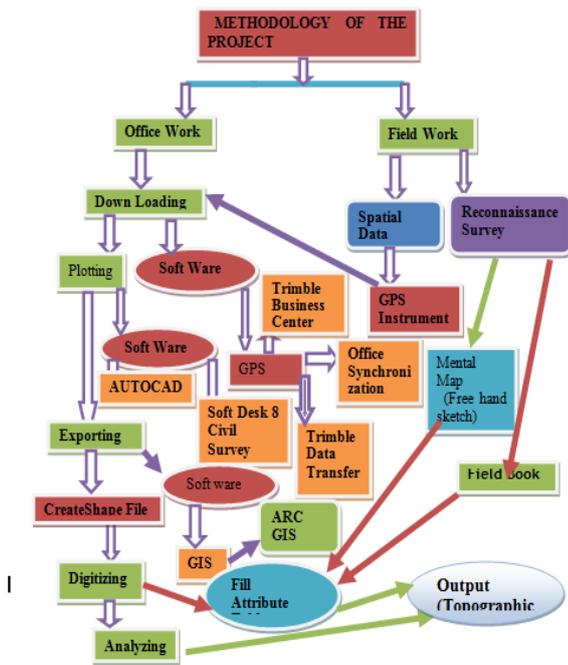


Fig. flow chart of the study

A well-designed map should achieve all of these goals.

### Data analysis method

#### A. Office work

Downloading

Exporting data from the Computer to another software package

Windows Explorer

#### B. Soft Desk Civil Survey

- Starting up soft desk (S8)
- Double click on soft desk (8) → start from scratch → metric→ ok
- Or Start → all programs → soft desk(8) → click on soft desk 8 icon → start from scratch → ok .... Met rice means unite used in the project is meter. English means the unite you used in the project is feet inch
- File → Save as → give the path of directory → save ...without save as soft will not start.

## vi. Results and Discussions

### Map Design Process

The map design process begins with consideration of the purpose of the map and collection of relevant data. Often secondary sources such as census data can be used, but data from air photo interpretation, analysis of satellite imagery, field surveys, or questionnaires may also provide the basis for a map. The map design process is especially important because maps are a synoptic form of

- AEC → soft desk programs → create project  
→ create project dialog box is opened (give project name (surveying) and description (third year) → ok
- *Select open as single user* → ok
- Append: modifies the point number as they are added to the current point database. Since the data collected for our project were filtered, imported the so many times and used overwrite import method at starting time of the project and then merge to import the other filtered data.

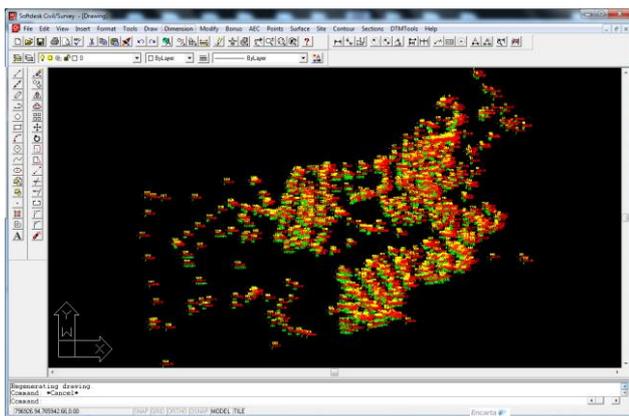


Fig: Imported points from file

### C. Loading with Arc Map

1. Add the feature class or table into which you want to load data to Arc Map, click Editor, and then click Start Editing.

2. Click the target layer drop-down arrow and click the feature class or subtype into which you want to load data.
3. Click the Load objects Record set Document command.
4. Navigate to the record set document from which you want to load data.
5. Click Next.
6. Click the drop-down arrow in the Matching Source Field list and click the field from the record set document that matches to the target field.
7. Repeat step 6 until matched all the fields need to load from the record set document.
8. Finish loading the data.

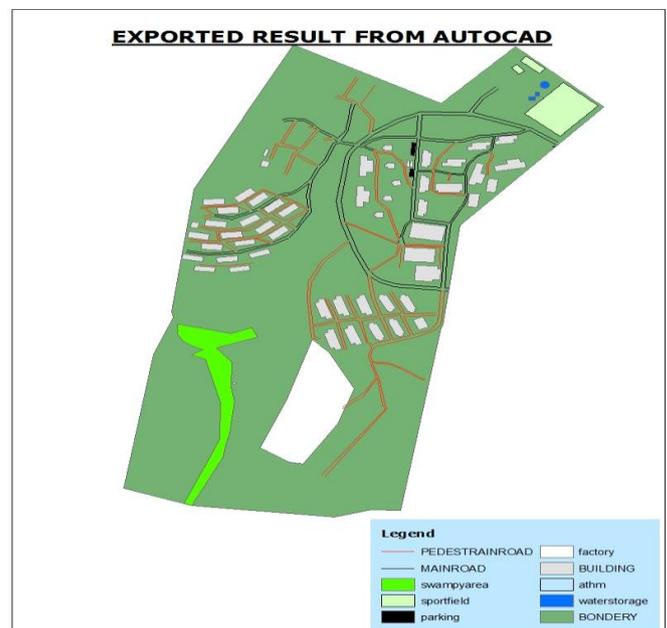


Fig result from the AutoCAD

**Generating TIN slope:** From the Arc GIS Spatial Analyst toolbar, create a slope raster for an entire area, enabling you to get an impression of the steepness of the terrain, and use the output for further analysis. The output measurement units for slope can be in degrees or percentages. The Z-factor is the number of ground X, Y units in one surface Z unit. The input surface values are multiplied by the specified Z-factor to adjust the input surface Z units to another unit of measure.

direction a hill faces. It is measured clockwise in degrees from 0 (due north) to 360, (again due north, coming full circle). The value of each cell in an aspect dataset indicates the direction the cell's slope faces. Flat areas having no down slope direction are given a value of -1. Tin aspect can be drawn by two methods which are drawing tin by aspect and drawing tin aspect using the arc GIS spatial analyst toolbar. The TIN faces are rendered with colors to indicate the direction that they face

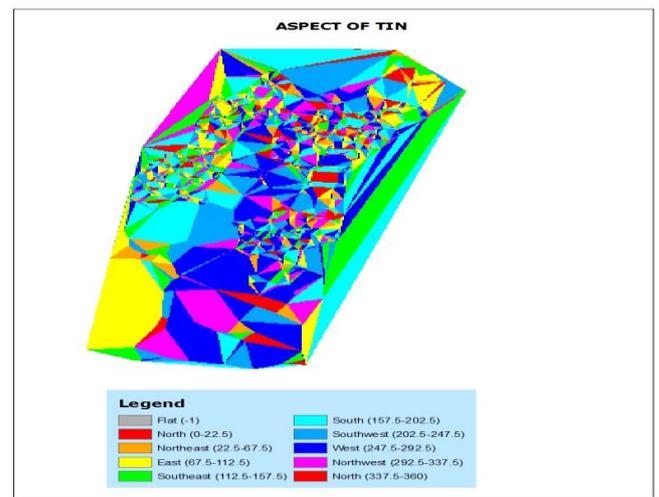
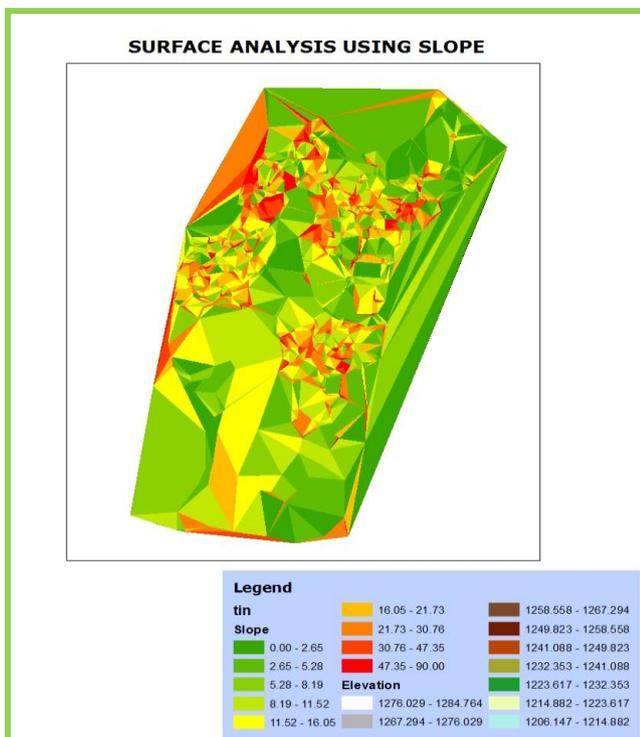


Fig. Aspect map of the study area  
 Generally by considering all the map design elements discussed above the prepared topographic map of the project area which is Mizan-Tepi University particularly Tepi campus is as follows.

Fig. Surface analysis using slope  
**Determining aspect in 3D Analyst**

The compass direction that a topographic slope faces, usually measured in degrees from north. Aspect can be generated from continuous elevation surfaces. Aspect identifies the steepest down slope direction from each cell to its neighbors. It can be thought of as slope direction or the compass



enough time to completed senior project within one semester.

- ❖ Appropriate schedule for collecting data should be developed to minimize uncomfortable situation. The difficulties on processing data i.e. due to the computers highly affected by virus to solve this problem it must be bought the antivirus.
- ❖ The paper and drawing prepare need to be printed but there is no printing aid. During the project time hard work is a means to success.
- ❖ Requirements needed for the project like supply of instruments and adequate time schedule should be greatly improved by the department to enhance convenience.
- ❖ GPS and GIS are the two key advanced sources for preparing topographic map.

### Reference

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