TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

PULCHOWK CAMPUS

DEPARTMENT OF CIVIL ENGINEERING

B.E SURVEY CAMP 2081, III/I:2078 BATCH

SUBMITTED BY

GROUP 3

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PULCHOWK,LALITPUR

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We would like to express our deepest gratitude to Survey Instruction Committee, IOE Pulchowk Campus for their invaluable support and guidance during our recent survey camp held from 2081/01/03 to 2081/01/12 for 10 days. Your dedication and expertise have significantly enriched our learning experience. We would like to thank our teachers Mr. Bharat Bahadur Dhakal, Mr. Narayan Basnet, Mr. Abhimanyu Lal Singh, Mr. Pradip Koirala, Mr. Jaya Ram Maharjan, Mr. Bishnu Prasad Sharma, Mr. Birendra Kumar Shrestha and Mr. Thaman Bahadur Khadka for providing insightful lectures and crucial understanding of survey techniques and all the working staffs and store keepers for their prompt assistance with the equipment and technical issues we encountered throughout the camp. Also, we are thankful to T.U. administrator who provided us the working space and homely environment. Your collective efforts have not only enhanced our academic knowledge but also inspired us to pursue excellence in our future endeavors. We are truly grateful for the opportunity to learn from such dedicated and experienced professionals.

Furthermore, we are grateful to our peers who collaborated and shared their knowledge and experiences throughout the survey camp. Your teamwork and dedication significantly contributed to the depth and quality of this report.

Finally, we would like to thank our families and friends for their encouragement and support throughout this process.

Thank you once again to everyone who made this survey camp and report possible.

B.E Survey Camp 2081

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CHAPTER1:INTRODUCTION

1.1 BACKGROUND

Surveying is the art and science of determining the relative position of a point on, above or beneath the surface of the earth by means of angular and linear measurements. It is the most important subject matter before and during all engineering works like civil engineering works such as designing and constructing highways, water supply systems, irrigation projects, buildings, etc.

The main objective of surveying courses allocated for civil engineering students is to promote the basic knowledge of different surveying techniques relevant to civil engineering works in their professional practice. The completion of all surveying courses including ten days of survey camp work organized by the Department of Civil Engineering. "Survey Instruction Committee" of Pulchowk campus. IOE will give better enhancement to students to use all surveying techniques covered in lecture classes.

Students of civil Engineering studying in the third year (2078 batch) were on survey camp 2081 in two shifts, the first shift was from 3rd Baishakh to 12th Baishakh 2081 at TU Kirtipur, Kathmandu. The survey camp is part of the course of the third year, first part (III/I) civil engineering study.

This is a detailed report of the works, which were performed by group no. 3 having five members, during the camp period. It briefly explains the working procedures and techniques used by this group during that camp period. In addition, it also contains observations, calculations, methods of adjustment of error, the main problem faced during work and their solution, results of all calculation, and their assessments with some comments presented in a concise form.

The work done during the camp duration can be categorized into:

1. Topographical survey
2. Bridge site survey
3. Road alignment survey

1.2 CLASSIFICATION OF SURVEYING

Surveying is primarily classified as under:

1. Plane surveying

2. Geodetic Surveying

1. **Plane Surveying** is that type of surveying in which the mean surface of the earth is considered as a plane and the spherical shape is neglected. All triangles formed by survey lines are considered plane triangles. The level line is considered straight and

all plumb lines are considered parallel. In everyday life, we are concerned with small portion of earth's surface and the above assumptions seems to be reasonable in light of the fact that the length of an arc 12 kilometers long lying in the earth's surface is only 1cm greater than the subtended chord and further that the difference between the sum of the angles in a plane triangle and the sum of those in a spherical triangle is only one second for a triangle at the earth's surface having an area of 195 sq. km.

2. **Geodetic Surveying** is that type of surveying in which the shape of the earth is taken into account. All lines lying in the surface are curved lines and the triangles are spherical triangles. It therefore, involves spherical trigonometry. All Geodetic surveys include work of larger magnitude and high degree of precision. The objective of geodetic survey is to determine the precise position on the surface of the earth, of a system of widely distant points which form control stations to which surveys of less precision may be referred. Surveys may be secondarily classified under no. of headings which define the uses, or purpose of resulting maps.

CLASSIFICATION BASED ON THE NATURE OF THE FIELD

There are three types of surveying based on the nature of the field which are as follows:

1. **Land Surveying**: It can be further classified as: i) Topographical survey ii) Cadastral Survey and iii) City Survey. It generally deals with natural or artificial features on land such as rivers, streams, lakes, wood, hills, roads, railways, canals, towns, water supply systems, buildings & properties etc.

2**. Marine Surveying**: Marine or hydrographic survey deals with bodies of water for the purpose of navigation, water supply, harbor works, or for the determination of mean sea level. The work consists of measurement of the discharge of streams, making a topographic survey of shores and banks, taking and locating soundings to determine the depth of water, and observing the fluctuations of the ocean tide.

3**. Astronomical Surveying**: The astronomical survey offers the surveyor means of determining the absolute location of any point or the absolute location of and direction of any line on the surface of the earth. This consists of observations of the heavenly bodies such as the sun or any fixed star.

CLASSIFICATION BASED ON OBJECT

Based on an object, there are four types of surveying which are as follows:

1. Geological Surveying

2. Mine Surveying

3. Archaeological surveying

4. Military surveying

CLASSIFICATION BASED ON INSTRUMENTS USED

Based on the various types of instruments used, surveying can be classified into six types:

1. Chain surveying

2. Compass surveying

3. Plane table surveying

4. Theodolite surveying

5. Tacheometric surveying

6. Photographic surveying

CLASSIFICATION BASED ON METHODS USED

Based on the methods adopted, surveying can be categorized into:

1. Triangulation surveying

2. Traverse surveying

1.3 ERROR AND ACCURACY IN SURVEY

BASED ON THE SOURCE OF ERRORS

- Instrumental error

Such errors arise due to faulty adjustment and imperfection of the instrument with which measurement is being taken. E.g. incorrect graduation of steel tape.

- Personal error

Personal errors are caused due to inability of the individual to make exact observations due to the limitations human sight, touch, and hearing.

- Natural error

Natural errors may arise due to natural phenomena such as temperature, humidity, gravity, wad, refraction, and declination 1.g. length of steel tape varies with temperature

TYPES OF ERROR

- **MISTAKES**

Mistakes are errors that arise from inattention, inexperience, carelessness, and poor judgment or confusion in the mind of the observer. These are often called blunders often resulting from fatigue or the inexperience of the surveyor.

❖ ACCIDENTAL ERRORS

Accidental errors are those which remain after mistakes and systematic errors have been eliminated and are caused by a combination of reasons beyond the ability of the observer to control.

❖ COMPENSATING ERROR

This type of error occurs in both directions and is both positive and negative Therefore, the resultant will be compensating and automatically canceled Some examples are:

- Inaccurate bisection
- Inaccurate centering
- Careless in marking chain lengths

❖ SYSTEMATIC ERRORS

A systematic error may always be the same under the same condition and it will have the same size and sign. For example, in the case of a tape. If the tape of a length short is stretched to N time, then the total error in the tape will be N times x. The reasons for the systematic error are

- Variation of temperature
- Variation of humidity
- Variation of pressure

1.4 SALIENT FEATURES

Name of the Project: Detail survey. Design and Complete report of SURVEY CAMP -2081

Location of the Project area: Tribhuvan University, Kirtipur

Project Duration: 10 Days (3rd Baishakh-12th Baishakh)

WORK SCHEDULE

Date	Field Work
3rd Baishakh 2081	**Recci+ Major traversing**
4th Baishakh 2081	**Major Traversing + Recce**
5th Baishakh 2081	**Fly leveling**
6th Baishakh 2081	**Detailing/ Computation**
7th Baishakh 2081	**Detailing + Plotting**
8th Baishakh 2081	**Bridge Survey**
9st Baishakh 2081	**Bridge Survey/ Major traversing**
10th Baishakh 2081	**Road alignment**
11th Baishakh 2081	**Road alignment**
12th Baishakh 2081	**Evaluation + Detailing**

DESCRIPTION OF WORK

TRAVERSING

- No. of Major Stations: 24 (including CPI & CP2)
- No. of Minor Stations: 5(loop 1) + 7(loop 2)
- (Map of traverse plot. See Appendix)
- Perimeter of Traverse: 2121.811m

  (Details of the data taken are in the observation sheet)

DETAILING

- Plot No.: 04
- Hard Features in Plot Area: Central Department of Geology, Central
- Department of Mathematics and Statistics, Central Department of Microbiology, Central Department of Hydrology and Meteorology, Isolated Buildings, etc.
- (Map of the plot: See Appendix)

ROAD ALIGNMENT

- Starting point of the road: TU Road
- Length of Road: 718.324m
- No. of Intersection points: 17
- Cross Section: 5m and 10m towards the left and right of the road at regular intervals along the centerline of the road

BRIDGE SITE

- Bridge Span: 64.160m
- Area Surveyed for Topographic Map: 150m upstream of bridge and 50m downstream of bridge.
- Cross Section: 150m upstream of the bridge and 50m downstream of bridge at regular intervals

(Bridge Site/ Road Alignment Plot: See Appendix)

1.5 OBJECTIVES OF SURVEY CAMP

The main objectives of the survey camp are as follows:

- Horizontal Control and Vertical Control survey practices with respect to the national grid system and produce a topographic map in the coordinate system
- Analytical resection intersection for the transfer of coordinates through the National grid system
- Linear segment survey practice through Road Alignment Survey
- Practices of horizontal and vertical control survey surrounding the cross-drainage area through the bridge site survey.

1.6 LOCATION MAP

1.7 PROJECT AREA

Tribhuvan University, Kirtipur. Kathmandu.

1.8 LOCATION AND ACCESSIBILITY

Kirtipur is located in the Kathmandu valley 12Km south-west of the city of Kathmandu. Iswari Rajmarg and Viswa Vidhyalayamarg links Kirtipur with Kathmandu. Kirtipur is assumed to be earthquake resistant area. The area under Tribhuvan University located in Kirtipur was surveyed. The journey from Kathmandu to Kirtipur takes about 20 minutes by bus.

- Country: Nepal
- Province: Bagmati
- District: Kathmandu
- Municipality: Kirtipur
- Ward No.: 3
- Location: Tribhuvan University. Kirtipur Campus

1.9 TOPOGRAPHY AND GEOLOGY

Before starting our job, we should study the existing position of the project area related to the natural grid line so that we can relate our result to the natural grid.

The latitude and longitude of Kirtipur are as follows:

Latitude: 27° 38' 30" N and 27° 41' 30" N

Longitude: 85° 13' 00" E and 85° 19' 00" E

Kirtipur is situated in the southern-western part of Kathmandu Valley and just below Chandragiri Mountain. The area of Kirtipur is about 1400 hectares.The average height of Kirtipur is 1414m above the mean sea level.

For conducting any type of work we should know about the geology of that area. Geology plays a vital role in the construction, maintenance, and rehabilitation of any type of structure. Geologically. Nepal is divided into five zones from south to north, which are extending towards the east-west direction and are separated by several geological structures called thrust. For our concern, the job site falls in the "Lesser Himalaya Zone".

Strati graphically, the central region of Nepal is divided into two major complexes, which one is Kathmandu Complex and another one is Nuwakot Complex. The Kathmandu valley and thus, of course, the survey campsite lies in the Kathmandu complex which is separated from the Nuwakot complex by Mahabharat Thrust (M.T.).

1.10 TEMPERATURE, CLIMATE, AND VARIATION

Kirtipur has very pleasant climate. The annual rainfall is about 3000mm. Major Crops grown in Kirtipur are maize, wheat, millet, paddy, etc

The altitude of Kirtipur ranges from 1100-1500m from the sea level. Therefore it has medium rainfall and a temperate climate Kirtipur lies in the mid-hill region of Nepal hence the climate is pleasant. The variation of temperature in summer and winter at kirtipur are as follows:

TEMPERATURE VARIATION TABLE

Season	Max temperature(^oC)	Min temperature(^oC)	Rainfall(mm)
Summer	34	16	90
Winter	17	2	5

The soil of the Kirtipur area seemed to be very vegetative. We saw a number of fertile lands, dense vegetation, and deciduous forest where oak, Sal, bamboo trees are abundantly found.

TOPOGRAPHICAL SURVEY

A topographic survey is a detailed and accurate depiction of the natural and man-made features of a piece of land. It involves the measurement and mapping of the contours, elevations, and features such as hills, valleys, trees, buildings, and roads within a specific area.

The resulting topographic map is essential for architects, engineers, and planners to design and plan projects, ensuring they take into account the land's physical characteristics. The detailed information from a topographic survey helps in making informed decisions about construction, drainage, and environmental management.

2.1 OBJECTIVES

The main objective of the topographic survey is to prepare the topographic map of the given area with horizontal and vertical control at the required accuracy. By topographical survey, we can determine the positions both on plan and elevation, of the natural and artificial features of a locality for the purpose of delineating them by means of conventional signs upon a topographic map.

2.2 BRIEF DESCRIPTION OF THE AREA

The area to be surveyed was a small part of Tribhuvan University, Kirtipur. Since the area over which the campus was situated was very large, the major traverse was run only to cover the large area while the minor traverse covered about one-fifth of area of the Tribhuvan University. Our objective was to prepare a topographic Map of the given small area, which is a part of the University. So, we were asked to prepare a detailed topographical map of the area which includes the following buildings and special ground features:

✓ Central Department of Geology

✓ Central Department of Metrology and Hydrology

✓ Central Department of Microbiology

✓ Central Department of Mathematics and Statistics

✓ Isolation Building

✓ Central Department of Environmental Science

✓ And other nearby small buildings

These buildings and the important ground features are included between two minor traverses provided with two link traverses containing seven link stations and three link stations and seven stations of the major traverses.

2.3 TECHNICAL SPECIFICATIONS (NORMS)

- Conduct a reconnaissance survey of the given area, Form a close traverse (major and minor) around the perimeter of the area by making a traverse station. In the selection of the traverse station maintain the ratio of maximum traverse leg to minimum traverse leg less than 2:1 for major and less than 3:1 for minor.
- Measure the traverse legs in the forward and reverse directions by means of a tape calibrated against the standard length provided in the field, note that the discrepancy between forward and backward measurements should be better than 1:5000 for major and 1:2000 for minor traverse.
- Measure the traverse angle on two sets of readings by Total Station. Note that the difference between the mean angles of two sets of reading should be within 1' and difference between face left and face right readings should be within 180°± 20" for **major traverse** while only one set reading is taken for **minor traverse** with difference between face left and face right readings should be within 180°± 20".
- Balance the traverse. The theoretical sum of interior/exterior angles of a closed traverse should be equal to (2N±4)*90°.The permissible angular error for the sum of interior angles of the traverse should be less than ± 30√n seconds for the Major Traverse and ± 1√n minute for the Minor Traverse (n=no of traverse station). For major and minor traverses, the relative closing error should be less than 1: 5000 and 1: 2000 respectively.
- For Vertical Control, determine the RL of traverse stations by fly leveling from the given P.B.M.
- Perform a two-peg test before the start of fly leveling Note that collimation error should be less than 1:10000. Maintain equal foresight and backsight distances to eliminate collimation error. Take R.L of T.B.M. The Permissible error for fly leveling is (+24√K) mm.
- Plot the traverse stations by the coordinate method in the appropriate scale i.e. 1:1000 for major traverses and 1:500 for minor traverses.
- Carry out the detailed survey of the given area by the Tacheometric method with reference to the major and minor traverse stations, which have been already plotted. Use conventional symbols for plotting including natural details ridge fines, valley lines every change of slopes and planes as well as manmade features such as buildings, roads, transmission lines, fencing, invert of drain, underground structures etc according to station wise.
- All the details are to be plotted with respect to vertical and horizontal control from the respective station. Use conventional symbols for plotting the map.
- Topographic nature of the given minor area should depict through the contour lines at suitable interval (contour interval 1m). Interpolate the Index Contour lines precisely by arithmetic calculation method with the help of guide points and then interpolate remaining contour lines either by graphical method or by estimation method. Do not erase those scatter guide points from the original sheet even after plotting of the contours.

2.4 EQUIPMENT AND ACCESSORIES

The followings are the main equipment required and used during the fieldwork:

- Total station
- Theodolite
- Tripod Stand
- Leveling staff (5m)
- Ranging Rods
- Measuring Tapes (30m & 5m)
- Leveling instrument
- Hammer
- Nails & pegs
- Plumb bob
- Prism
- Prism Pole
- Prism holder

2.5 METHODOLOGY

The methodology of surveying is based on the principle of surveying. They are as follows:

i. Working from whole to a part.
ii. Independent check.
iii. Consistency of work.
iv. Accuracy required

Different methodologies were used in surveying to solve the problems that arise in the field. These methodologies are as follows:

1) TRAVERSING

Traversing is that type of surveying in which a number of connected survey lines form the framework, which is used for housing, factory sides, determination of the perimeter of the lake, setting out and detailing of many engineering works. The main: purpose of traversing is to find control points. When there is a large extend of chaining triangulation, generally traversing is used. It is the method of control survey.

The survey consists of the measurement of

i. The angle between the successive lines or bearing of each line.

ii. The length of each line.

The direction and the length of the survey lines are measured with the help of an angle-measuring instrument, theodolite, and tape. If the coordinate of the first station and the bearing of the first line is known, the coordinates of all successive points can be computed.

It eliminates the accumulation of errors that may happen when the scale and the protractor is used, as we can find out the coordinate of each station.

Traverse is of two types:

- Open traverse
- Close traverse (loop traverse)

a) Open Traverse:

An open traverse originates at a starting station, proceeds to its destination, and ends at a station whose relative position is not previously known. The open traverse is the least desirable type of traverse because it provides no check on fieldwork or starting data. For this reason, the planning of a traverse always provides for the closure of the traverse. Traverses are closed in all cases where time permits.

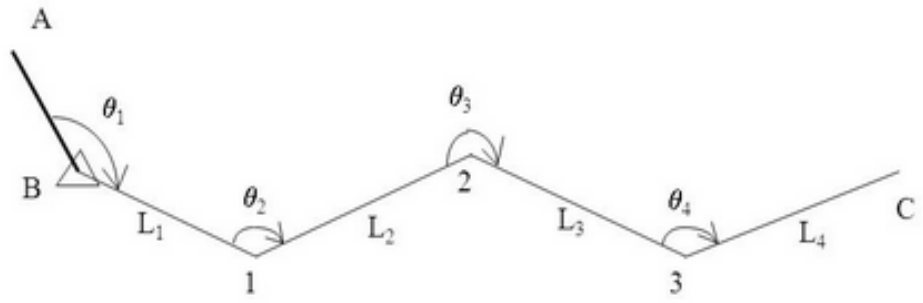


fig: Open Traverse

b) Closed Traverse

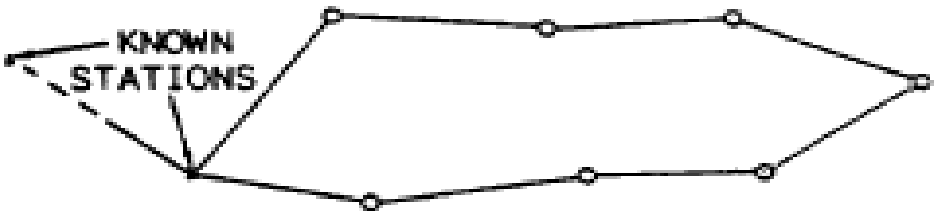
A closed traverse starts at a point and ends at the same point or at a point whose relative position is known. The surveyor adjusts the measurements by computations to minimize the effect of accidental errors made in the measurements. Large errors are corrected. It can be further divided into:

1. Closed-loop traverse

A traverse that starts at a given point proceeds to its destination and returns to the starting point without crossing itself in the process is referred to as a loop traverse. The surveyor uses this type of traverse to provide control of a tract or parcel boundary and data for the area computation within the boundary. This type of traverse is also used if there is little or no existing control in the area and only the relative position of the points is required. A loop traverse starts and ends on a station of assumed coordinates and azimuth without affecting the computations, area, or relative position of the stations. If, however, the coordinates must be tied to an existing grid system, the traverse starts from a known station and azimuth, on that system. While the loop traverse provides some check upon the fieldwork and computations, it does not provide for a check of starting data or ensure the detection of all the systematic errors that may occur in the survey

2. Open-loop traverse

A traverse closed on a second known point begins at a point of known coordinates, moves through the required point(s), and terminates at a second point of known coordinates. The surveyor prefers this type of traverse because it provides a check on the fieldwork, computations, and starting data. It also provides a basis for comparison to determine the overall accuracy of the work. Link traverse is also an open loop traverse.



A. CLOSED LOOP TRAVERSE

2) BALANCING OF TRAVERSE

There are two methods of balancing of traverse: -

a) Bowditch's method

b) Transit method

- **BOWDITCH'S METHOD**

In this method, the total error in the latitude and departure is distributed in proportion to the lengths of the sides. It is mostly used to balance a traverse where linear and angular measurements are of equal precision. This rule says:

Correction to latitude (or departure) of any side)

= (Total error in latitude (or departure) *lengths of that side)/ Perimeter of traverse

- **TRANSIT METHOD**

In this method, the total error in latitude & departure is distributed in proportion to the latitude & departure of its side. This rule is adopted when angular measurements are precise rather than linear measurements. This rule provides correction to the latitude & departure of any side.

Correction in Latitude for Departures of any side = (Total error in latitude or departure *latitude (or departure) of that line)/ (Arithmetic sum of latitude for departure)

3) **TACHEOMETRY**

Tacheometry is the branch of surveying in which both the horizontal and vertical distances between stations are determined by optical means. Tacheometry is used in the preparation of contour maps and they also provide a good check on distances measured with tape or chain.

Principle of Stadia Tacheometry:

The principle of tacheometry is that in isosceles triangles, the ratio of the perpendiculars from the vertex on their bases is constant. The formula for horizontal distance is:

$H = k s \cos^2\theta$

The formula for the vertical distance is :

$V = (k s \sin 2\theta)/2$

Where, s = staff intercept, θ = Vertical Angle, k-Tacheometric constant (100 for analytic lens)

Detailing by tangential method

In this method we have to observe two middle wire staff readings along with the corresponding VCR reading and horizontal angle with any traverse leg. The horizontal and vertical distance can be then calculated as:

$H = S/(\tan\theta_1 - \tan\theta_2)$

$V = H\tan\theta_2$

Where,

S= distance between targets

θ_1=VCR for first target

θ_2=VCR for second target

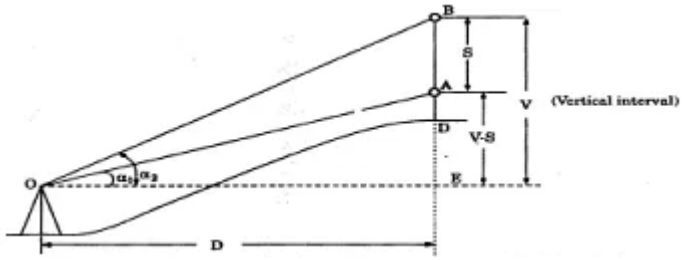


fig: Tangential Method

4) LEVELING

Leveling is a branch of surveying the object of which is

- To find the elevation of given points with respect to a given or assumed datum.
- To establish points at a given elevation or at different elevations with respect to a given or assumed datum.

The first operation is required to enable the works to be designed while the second operation is required in the setting out of all kinds of engineering works. Leveling deals with measurements in a vertical plane.

Different types of leveling are:-

Simple Leveling: The operation of leveling for determining the difference in elevation, if not too great, between two points visible from a single position of the level, is known as simple leveling.

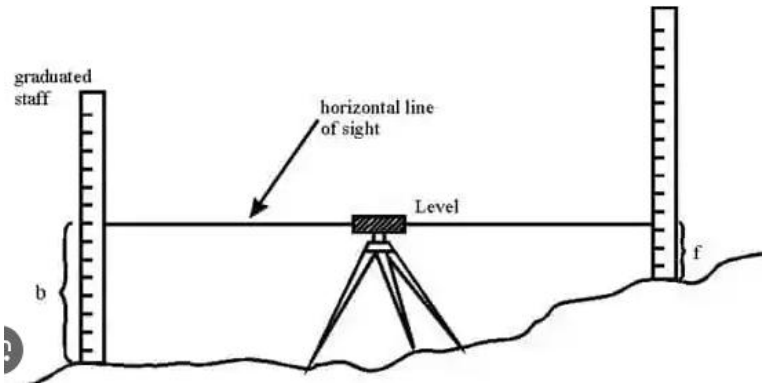


fig: simple leveling

Differential Leveling: The method of leveling for determining the difference in elevation of two points either too far or obstructed by an intervening ground, is known as differential leveling. The level is set up at number of points and the difference in elevation of successive points, is determined in this method.

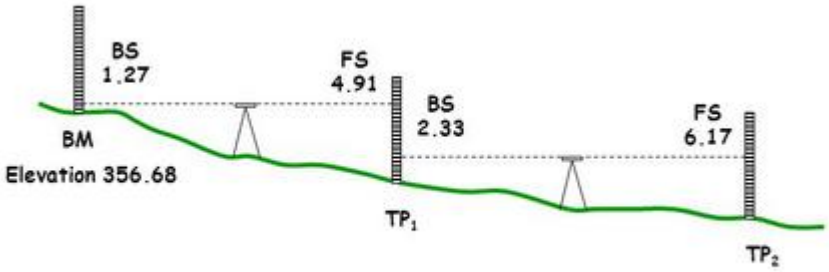
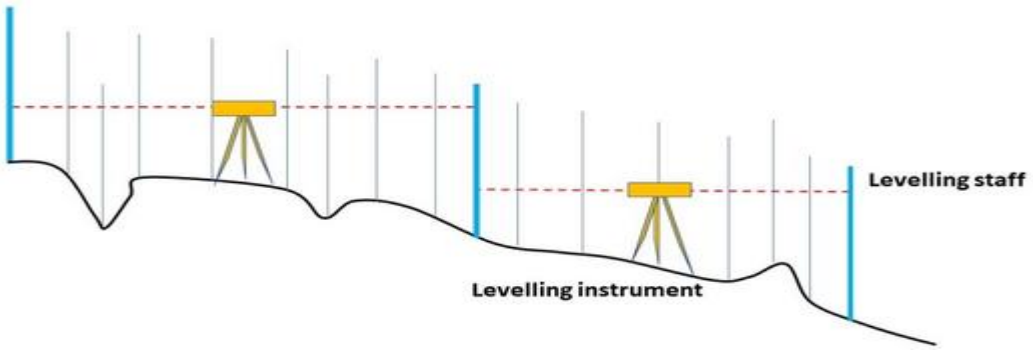


fig: Differential leveling

Check Leveling: After the completion of fly leveling, level lines are run to check the accuracy of the bench marks previously fixed which is called check leveling.

Profile Leveling. The operation of leveling carried out to determine the elevations of the points at known distances apart, and also salient features. along a given straight line is called profile leveling. It is also known as longitudinal leveling.



Cross-section leveling: The operation of leveling which is carried out to provide levels on either side of the main line at right angles, in order to determine the vertical section of the earth surface on the ground is called cross section leveling.

Reciprocal leveling: When the level is not possible to be set up between two points due to an intervening obstruction as large water bodies, reciprocal leveling is carried out. The two sets of reciprocals leveling is done to find out the difference in elevation between two points accurately.

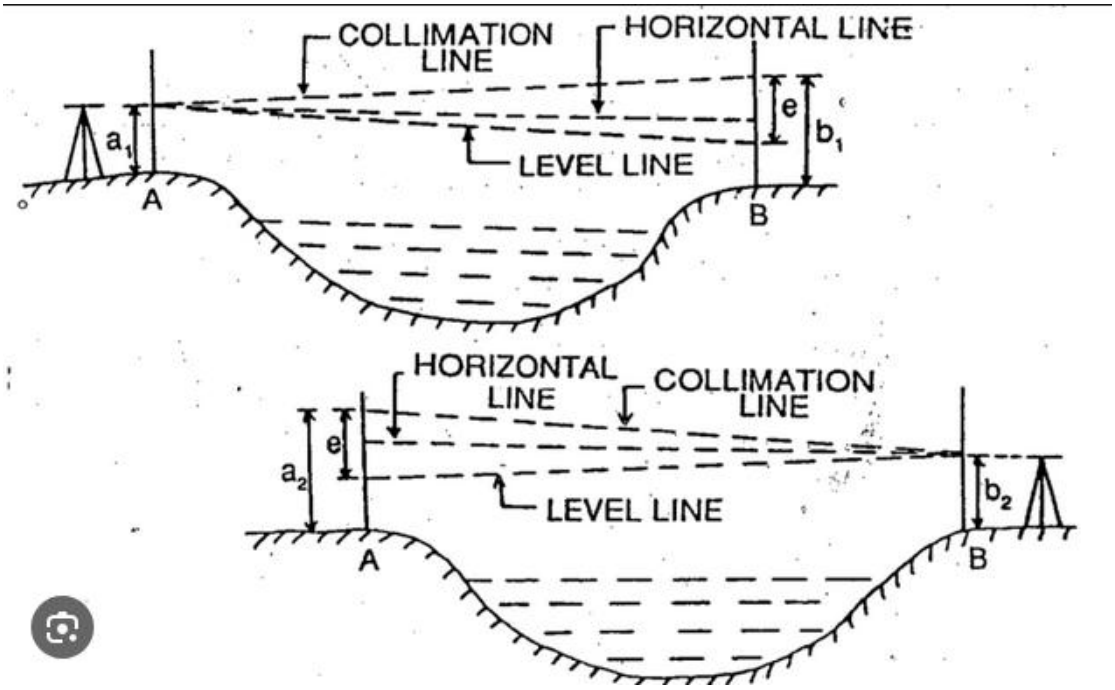


fig: Reciprocal leveling

Temporary adjustments of Level

The temporary adjustments for a level consist of the following:

a) Setting up the level: The operation of setting up includes fixing the instrument on the stand and leveling the instrument approximately.

b) Leveling up Accurate leveling is done with the help of foot screws and with reference to the plate levels. The purpose of leveling is to make the vertical axis truly vertical. It is done by adjusting the screws.
c) Removal of parallax: Parallax is a condition when the image formed by the objective is not in the plane of the cross hairs, Parallax is eliminated by focusing the eye-piece for the distinct vision of the cross hairs and by focusing the objective to bring the image of the object in the plane of crosshairs.

Permanent adjustments of Level

To check for the permanent adjustments of the level two-peg test method should be performed. Two staffs were placed at A and B of known length (about 40 m). First, the instrument was set up on the line near B and both staff readings (Top, Middle, and Bottom) were taken. Then, the instrument was set up at the middle C on the line and again both staff readings on A and B were taken. Then computation was done in order to check whether the adjustment was within the required accuracy or not. No permanent adjustment was required since the error was within the permissible value.

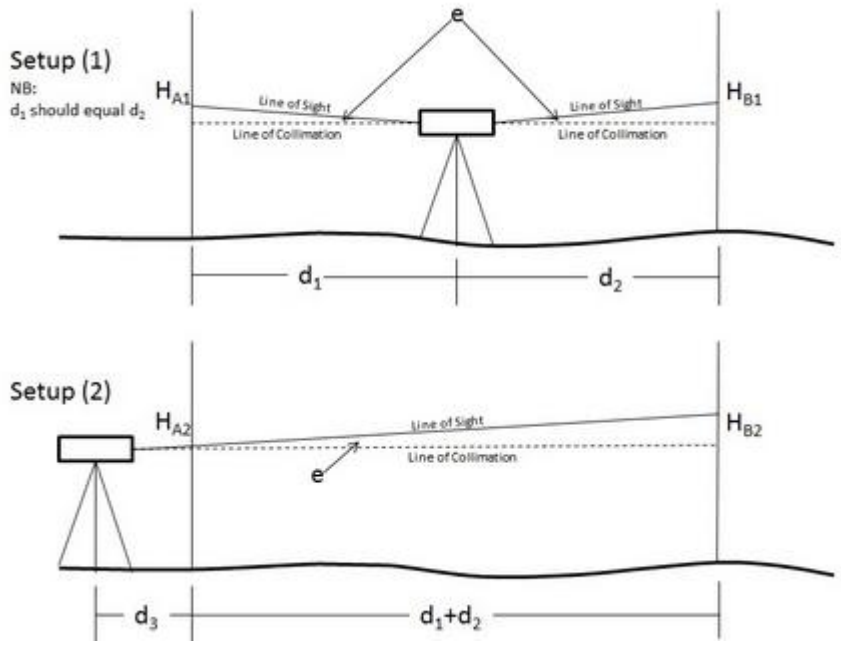


fig: Two peg test

Two staffs were placed at A and B of known length (about 40m). First, the instrument was set up at the middle point C and both staff readings (Top. Middle, and Bottom) were taken. Then, the instrument was set up at D near the A on the line AB and again both staff readings were taken. Then computation was done in order to check whether the adjustment was required or not.

Booking and reducing levels

There are two methods of booking and reducing the elevation of points from the observed staff reading:

1. Height of the Instrument method
   Arithmetic Check:
   ∑BS-∑FS = Last RL - First RL
2. Rise and Fall method
   Arithmetic Check:
   ∑BS-∑FS =Rise-Fall=Last R.L.-First R.L.

Among the two methods, Rise and Fall method was widely used.

Fly Leveling

The RL of the Given TBM3 point was found by transferring the level from known TBM2 by the process of fly leveling. In this method , auto level was used and the level was transferred directly by taking BS and FS at every Turning Point.

Level transfer to the major and minor traverse stations:

The R. L. of the temporary benchmark was then transferred to the control stations of the major and minor traverse. The closing error was found to be within the permissible limits. The misclosure was adjusted in each leg of the leveling path by using the following formula:

Permissible error = $+25\sqrt{k}$ mm.

Where k is perimeter in Km

Actual Error (e) = ∑BS-∑F.S.-=Last R.L. - First R.L

. Correction i^{th} leg =$-(e*(L_1+L_2+...+L_i)/P$

Where L_1. L_2, L_i Length of 1^{st},2^{nd},…i^{th} leg.

P is perimeter

Relative Precision =1/(p/e)

5) CONTOURING

Contour is the imaginary line joining the equal elevation, with reference to given or assumed datum, on the natural ground surface. The branch of surveying that deals with development of contour line is called contouring. Every fifth contour is made darker than other is called index contour. The elevation difference between two consecutive contours is called the contour interval. The contour interval is the important parameter to be considered during the surveying field work. The large contour interval is suitable for the steep hilly areas while small contour interval is suitable for the plain areas. The least horizontal distance between two consecutive contours is called the horizontal equivalent

METHODS OF CONTOURING

There are two ways of contouring. They are namely:

1. The Direct method
2. The Indirect method

1. The direct method:

In this direct method, the contour to be plotted is actually traced on the ground. Only those points are surveyed which happen to be plotted.

2. The indirect method:

In this method, some suitable guide points are selected and surveyed, the guide points need not necessarily be on the contours. These guide points, having been plotted, serve as the basis for the interpolation of contours. There are some of the indirect methods of locating the ground points:

a. By squares

b. By cross-sections

c. By tachometric method

CONTOUR INTERPOLATION

The process of drawing contours proportionately between the plotted ground points or in between the plotted contours is called interpolation of the contours. Interpolation of contours between points is done assuming that the slope of ground between two points is uniform. It may be done by anyone of following methods:

- Estimation
- Arithmetic calculation
- Graphical method

CONTOUR CHARACTERISTICS

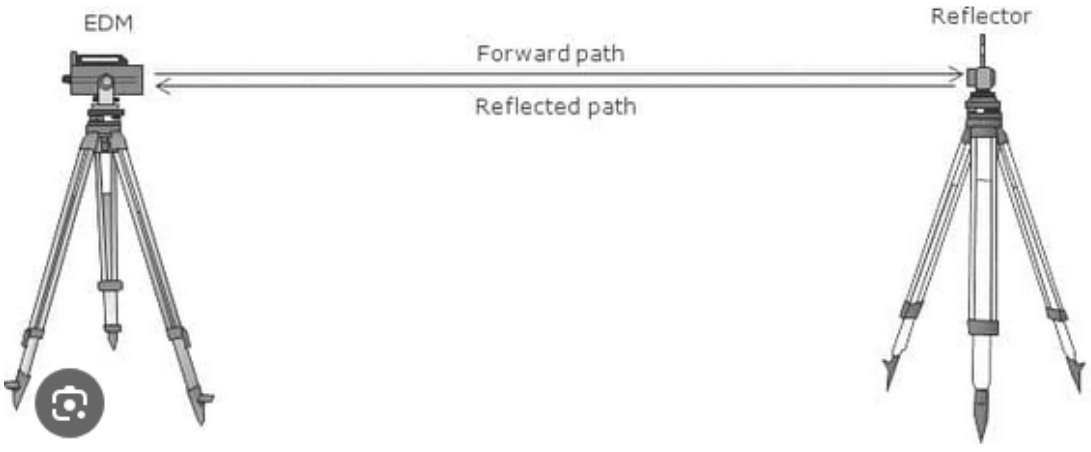
- Two contours of different elevations do not cross each other except in the case of an overhanging cliff.
- Contours of different elevations do not unite to form one contour except in the case of a vertical cliff.
- Contours drawn closer depict a steep slope and if drawn apart, represent a gentle slope.
- Contours equally spaced depict a uniform slope. When contours are parallel. equidistant and straight, these represent an inclined plane surface.
- The contour at any point is perpendicular to the line of the steepest slope at the point.

- A contour line must close itself but need not be necessarily within the limits of the map itself.
- A set of ring contours with higher values inside depict a hill whereas a set of ring contours with lower values inside depict a pond or a depression without an outlet.
- When contours cross a ridge or V-shaped valley, they form sharp V-shapes across them. Contours represent a ridge line, if the concavity of the higher value contour lies towards the next lower value contour, and on the other hand these represent a valley if the concavity of the lower value contour lies toward the higher value contour.
- The same contour must appear on both sides of a ridge or a valley.
- Contours do not have sharp turnings.

6) ELECTRONIC DISTANCE MEASUREMENT (EDM)

These are the instruments used to measure the distance between any two points. This system consists of the emitter and the reflectors. The emitter produces the electronic waves which travel to the reflector and then reflect back. The measured time interval between emission and receiving back the distance can be calculated easily. The emitter instruments emit electromagnetic waves like radio waves. light wave etc.

Distance = (Velocity of EMW time interval)/2



2.5.1. RECONNAISSANCE

Recce means the exploration or scouting of an area. To prepare a good topographic map of any area, it is necessary to know about the area in a proper way so that we can plan our work and complete it in systematic order and in a short span of time with less effort.

For this purpose, the detailed inspection of the given area of Tribhuvan University was carried out by reconnaissance survey.

While doing reconnaissance we find out the major and minor traverse control points to form a closed traverse around the perimeter of the area. While selecting the major and minor control points following points should be taken into account:

- The adjacent stations should be clearly inter-visible and cover the whole area with least number of stations as far as possible. The traverse station should maintain the ratio of maximum traverse leg to minimum traverse leg less than 2:1.
- The steep slopes and badly broken ground should be avoided as for as possible which may cause inaccuracy in taping.
- The stations should provide the minimum level surface required to set up the tripod of the instrument.
- The traverse line of sight should not be near the ground level to avoid refraction.
- If possible well-conditioned triangles should be formed to give good graphical intersection during plotting.

Walking around at least three times inspected the whole area and major ground features were noted. The possible location of major and minor control points was decided by inspecting the intervisibility of the stations. After sketching rough outlines of the area and possible station distances of legs were estimated to make them within a specific range i.e. 1:2 ratios. For minor traverse, all the detail available was noted. After checking the requirements for a good station, the points were fixed for major and minor stations by driving wooden pegs on the ground and it was named by a marker. The measurements of each station from reference points such as permanent objects near it were taken. Hence, the recce survey was completed after fixing all the control points.

2.5.2. MAJOR TRAVERSE

The skeleton of lines joining those control points, which covers the whole entire area, is called Major Traverse. Work on Major Traverse must be precise. So two-set of the reading should be taken for Major Traverse. For convenience , the readings are taken by setting the Total Station at 0°0'0" for one set and 90°00'00" for the second.

In the Kirtipur Survey Camp. two traverses - major and minor had to be established. The major traverse had 24 control stations including two given control points. The control stations were named as 3M1, 3M2… 3M20 and CP1 and CP2 (the two given control points). The leg ratio of maximum traverse leg to minimum traverse leg was maintained within 1:2. The discrepancy in length between the forward measurements and the backward measurements of all the traverse legs was within 1:5000. Two sets of theodolite readings were taken for measuring the horizontal traverse angles. The difference between the mean angles of two sets of readings was within a minute for all the angles.

The distances between the adjacent control points were measured accurately as far as possible for the accuracy of the whole traverse. To attain the accuracy required e 1:5000 ratio, a two-way measurement was done through EDM independently so that the length from each measurement was found within specified range.

COMPUTATION OF CO-ORDINATES

According to the accuracy aimed and the nature of the ground, the lengths of traverse legs are measured directly on the ground either by chaining or taping. The traverse angles are measured with a theodolite by setting up the instrument at each station in turn and the vertical angle at each station measured will help to find the tacheometric distance and reduce level of that point. And the bearing of the any one of the traverse leg measured and the entire traverse angle measured, the bearing of all the legs can be calculated by:

Bearing of a line = (bearing of previous line + included angle)± (180) or (-540)

If θ is the bearing of line (CP-A say), and I be the length of the line and provided that co-ordinate of the control point (CP) is known then the co-ordinate of the point "A" can be calculated as follow-

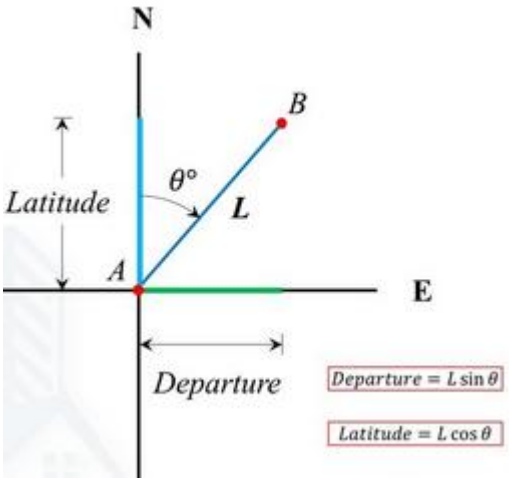
X-coordinate of A=x-coordinate of control point (CP) + Lsinθ

Y-coordinate of A=y-coordinate of control point (CP) + Lcosθ

R.L. or z-coordinate of A=R.L of point (CP) + H.I ±Htanθ-Height of signal.

Where. H.I-Height of instrument

H-horizontal distance



2.5.3 MINOR TRAVERSE

It is not sufficient to detail the area by enclosing with the help of a major traverse Minor traverse is that one runs through the area to make detailing easy. Minor Traverse covers only a small area. Less precise work than that of major traverse is acceptable so that single set reading is sufficient. The minor traverse had 12 control

stations and enclosed the major details as well as the minor details mentioned before. The leg ratio of the maximum traverse leg to minimum traverse leg was maintained within 1:3. The discrepancy in length between the forward measurements and the backward measurements of all the traverse legs was within 1:2000. Measurement of Horizontal and Vertical two sets of horizontal angle was measured at each station and one set of vertical angle. And it was done in the following ways:

i. Temporary adjustment was done.
ii. After setting zero to the first station the second station was sighted by unclamping the upper screw.
iii. For better accuracy and exact bisection horizontal angle was measured at the bottom of the arrow.
iv. And on the same setting or same face vertical angle at both the station was taken.
v. Now again changing the face the horizontal angle was taken and vertical angle too.
vi. Now, setting the reading to ninety at the first station again one set of horizontal angles was taken but the vertical angle is enough. taken earlier.
vii. Before shifting the instrument to the next station the height of the instrument was taken.
viii. Similarly, the instrument was shifted to another station and in each station, one set of vertical angle and two sets of horizontal angle and height of the instrument was measured.

For comparison of the tape distance and the Tachometric distance the stadia reading (top, mid, bottom) was taken at each station and for the calculation of the reduce level of each station we need to read mid reading which can be compared with the level transferred using auto level.

2.5.4 DETAILING

Detailing means locating and plotting relief in a topographic map. Detailing can be done by either plane table surveying or tacheometric surveying or by total station. We use total station while taking details during the camp. This takes less time and computation work.

TOTAL STATION

Introduction

A total station is an optical instrument used a lot in modern surveying and archaeology and, in a minor way, as well as by police, crime scene investigators, private accident reconstructionist, and insurance companies to take measurements of scenes. It is a combination of an electronic theodolite transit, an electronic distance meter (EDM), and software running on an external computer known as a data collector

With a total station, one may determine angles and distances from the instrument to the points to be surveyed. With the aid of trigonometry and triangulation, the angles and distances may be used to calculate the coordinates of actual positions (X. Y. and Z or northing, casting, and elevation) of surveyed points, or the position of the instrument to known points in absolute terms.

Some total stations also have a GPS interface which combines these two technologies to make use of the advantages of both (GPS line of sight not required between measured points: Traditional Total Station - high precision measurement especially in the vertical axis compared with GPS) and reduce the consequences of each technology's disadvantages (GPS- poor accuracy in the vertical axis and lower accuracy without long occupation periods; Total Station - requires line of sight observations and must be set up over a known point or within line of sight of 2 or more known points).

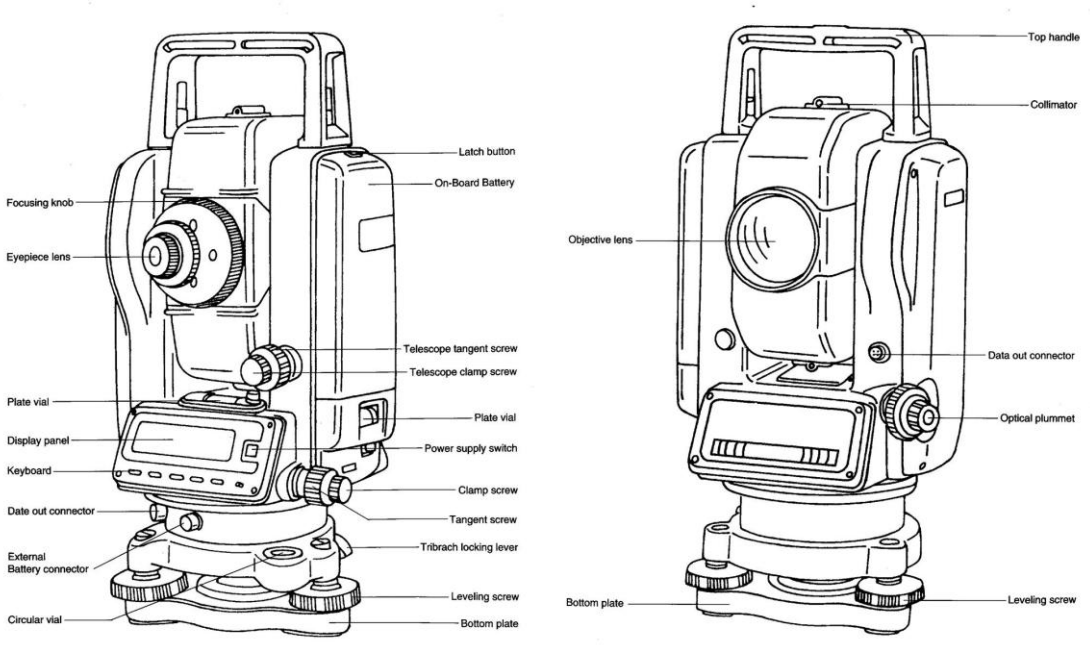


FIG: TOTAL STATION

Most modern total station instruments measure angles by means of electro-optical scanning of extremely precise digital bar-codes etched on rotating glass cylinders or disks within the instrument. The best quality total stations are capable of measuring angles down to 0.5 arc seconds. Inexpensive “construction grade") total stations can generally measure angles to 5 or 10 arc seconds.

Measurement of distance is accomplished with a modulated microwave or infrared carrier signal, generated by a small side emitter within the instrument's gal pack and bounced off of the object med The modulation pattern in the returning is read and imprinted by the board computer in the total station The determined by emitting and revering maple frequencies, and the integer number of wavelengths to the target for each frequency. Most purpose-Buk glass Pompeian as the reflector for the EDM signal. New kilometers, but some instruments are "reflector and le" and core distances to any object that is reasonably light in color, out to a Sew hundred meters. The typical Total Station EDM can measure distances accurate to shout millimeters or 1/100th of a foot.

Some modem total stations are robotic allowing the operator to control the instrument from a distance via remote control This eliminates the need for an assistant staff member to hold the reflector prism over the point to be measured. The operator holds the reflector him herself and controls the total station instrument from the observed point.

The basic principle of Total Station is that the distance between any two points can be known once the time light takes to travel the distance and back and the velocity of light is known. Then the following relation which is already programmed in the memory of the instrument along with other correction factors, calculates the required horizontal distance and is displayed on the LCD screen.

Distance = (velocity of EMW* time taken)/ 2

2.5.5 COMPUTATION AND PLOTTING

For the calculations as well as plotting, we applied the coordinate method (latitude and departure method). In this method, two terms latitude and departure are used for calculation. The latitude of a survey line may be defined as its coordinate lengths measured parallel to an assumed meridian direction. The latitude (L) of a line is positive when measured towards the north, and termed Northing and it is negative when measured towards the south, and termed Southing. The departure (D) of a line is positive when measured towards the east, and termed Easting and it is negative when measured towards the west, and termed Westing. The latitude and departures of each control station can be calculated using the relation:

Latitude = $L\cos\theta$

Departure = $L\sin\theta$

Where, L = distance of the traverse legs

θ=Reduced bearing

If a closed traverse is plotted according to the field measurements, the end of the traverse will not coincide exactly with the starting point. Such an error is known as a closing error

Mathematically,

Closing error (e) $=\sqrt{(\sum L)^2 + (\sum D)^2}$

The relative error of closure = e/p

The error (e) in a closed traverse due to bearing may be determined by comparing the two bearings of the last line as observed at the first and last stations of the traverse.

Plotting of Major and Minor traverse

After computing the coordinate of each of the control points, they were plotted in Al-size grid paper. Both major and minor traverses were plotted to 1:1000 scales. The plotted traverse was made at the center of the sheet with the help of the least co-ordinates and highest coordinates.

2.6 RESECTION

Resection is the determination of the observer's position by means of observations taken to previously fixed points. There are several methods of resection and they include:

- Observing horizontal angles from the unknown point to three known points.
- Observing horizontal angles from two unknown points to two known points.
- Observing horizontal angles from one unknown point to two known points when the Azimuth of one of them is known.

Resection is done by viewing Swyambhunath Temple. Chovar temple and clock tower from point O between the two control points CPI and CP2. The coordinates of these points were used to transfer the coordinates to point O and then to the points CP1 and CP2

2.7 INTERSECTION

A minimum of two control stations is required for this operation, with the unknown point visible from each of them. It is not essential that the control stations are inter-visible, but it makes it easier if they are.

The theodolite is set up at each of the stations (control points) A and B in turn. At station A, the telescope is first sighted on B and then transited around to M, measuring the angle a. Similarly, at B the angle b between line BA and line BM is observed. Since the coordinates of stations A and B are known and the sum of the internal angles in the triangle must equal 180", we can calculate the following:

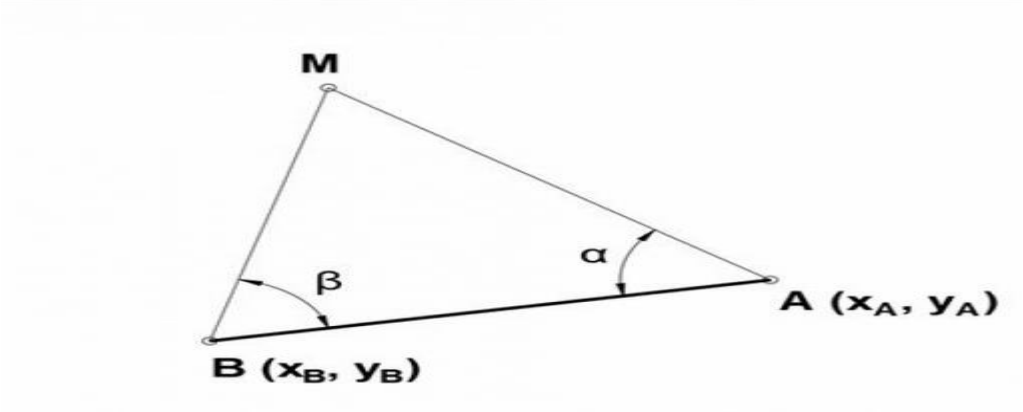
Length of line AB= $\sqrt{(E_A - E_B)^2 + (N_A - N_B)^2}$

The bearing of line AB $=\tan^{-1}(E_B - E_A) / (N_B - N_A)$

Angle m =180^{O}-<α-<β

The further calculation allows us to find the length and bearing of each of the lines AM and BM:

Sine Rule: AB/SinM = AM/Sinβ = BM/Sinα



Bearing of AP=bearing AB+ α

Bearing of BM = bearing BA+ β

Note that angle β is anticlockwise from BA to BM. hence the negative sign in the above equation.

Once we have the bearing and length of lines AM and BM then the coordinates of M can be calculated from each line. These two sets of coordinates should correspond within the expected degree of accuracy.

2.8 COMMENTS AND CONCLUSION

The topographic survey conducted during our survey camp was a remarkable opportunity for practical learning and skill development. Through meticulous data collection and analysis, we gained valuable insights into the terrain and features of the surveyed area. The hands-on experience with modern surveying equipment and techniques has significantly enhanced our understanding of topographic surveys.

In conclusion, the survey camp not only provided us with the technical knowledge required for future projects but also fostered teamwork and problem-solving skills. The comprehensive data obtained will be instrumental for planning and development purposes. We are grateful for the support and guidance from our instructors and peers, which made this an enriching and successful endeavor.

BRIDGE SITE SURVEY

Bridges are the structures that are constructed with the purpose of connecting two places separated by deep valleys or gorges or rivers and streams. Bridges are usually the cross drainage and hence a part of roads making them shorter and hence economical. For places where the ground is uneven and undulated and where the number of rivers is large, bridges are the most economic and efficient way. It is a very convenient way.

3.1 Objectives:

- To select the possible bridge site and axis for the construction of bridge.
- To collect the preliminary data i.e. normal water flow level, high flood level.
- To study about the geological features of the ground.
- To carry out surveying for topographical mapping, longitudinal and cross sections at both the upstream and downstream side of the river.

3.2Brief description of the site:

The bridge site was surrounded by trees and bushes. There were no rocks. The ground was damp and swampy. The soil was soft and clayey. It was brown in color. The hill slopes on both sides were not very steep and are thus geologically stable. There is not much water to be found on the bridge site. The only water is collected from rain and other sources.

3.3 Hydrology, Geology & Soil:

The site is surrounded by a steep hill, which is covered with densely planted shrubs. The width of the stream is not so big but the high flood level covers a large area. Water scoured marks on the sideshow that the highest flood level.

3.4Technical Specifications (Norms):

The following norms were followed while performing the bridge site survey in the field:

- Control point fixing as well as determining the length of the bridge axis had to be done by the method of triangulation. While forming triangles, proper care had to be taken such that the triangles were well conditioned, i.e. none of the angles of the triangle were greater than 120° or less than 30°.
- Maintain free board distance at least 4m in between invert of proposed bridge and high flood level mark.
- In triangulation, distance of the Base Line must be measured in an accuracy of 1:2000. The triangulation angle had to be measured on two sets of readings by Theodolite and the difference between the mean angles of two sets of readings had to be within a minute. Angular misclosure for base triangle should be ±30” √N and other triangle ±1’√N
- Carry out reciprocal levelling to transfer level from one bank to other bank of the river within a precision of ±24√k mm Determine the RL of the other triangulation stations by fly levelling from the end point of bridge axis.

- Plot a topographic map indicating contour lines at suitable interval (contour interval = 1m). Value of index Contour=Multiple of (5*Contour Interval)
- The scale for plotting the topographical map was given to be 1:500
- In order to plot the longitudinal section of the river, data had to be taken along the riverbed 150 m upstream and at least 50 m downstream assuming 0.00m chainage at center of bridge axis. The plot for the longitudinal section along the flow line had to be done in a scale of 1:50 for vertical and 1:500 for horizontal, for cross-section Vertical scale=Horizontal scale=1:200.

3.5 Equipment & Accessories:

The equipment used in the survey during the preparation of topographic map in bridge site are as follows:

1.Theodolite

2.Total Station

3.Ranging Rods

4.Measuring Tapes

5.Leveling Staffs

6.Plumb Bob

7.Pegs & Arrows

8.Marker Pen

9.Compass

10. Prism & Prism Holder

3.6 Methodology:

The various methods performed during the bridge site survey were site selection, triangulation, leveling (fly levelling and reciprocal levelling), detailing by total station, cross section, and L-section. The brief descriptions of these methodologies are given below:

3.6.1 Site Selection:

Site selection is the first and foremost step for the construction of bridge. Several governing factors are there for the site selection of the bridge. Geological condition, socio-economic and ecological aspect etc. guides the way of selection of bridge site. Therefore, the site was chosen such that it is laid on the very stable rocks at the bed of river as far as possible and not affect the ecological balance of the flora and fauna of the site area. The location of the bridge was selected in such a way that the heights of the roads joined by the proposed bridge were almost the same. This prevented a lot of cutting and filling to maintain a gentle gradient. The bridge site was chosen in such a way that the bridge axis was perpendicular to the flow direction and was also shorter in span so as to make the construction economical. The starting point of bridge axis was not laid on the curve of the road.

3.6.2 Topographic Survey:

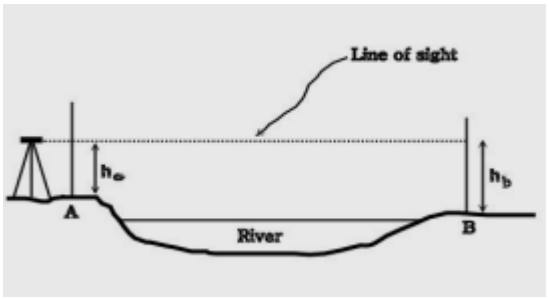
For the topographic survey of bridge site, triangulation was done. Triangulation is the process of measuring the angles of a chain or a network. The main purpose of the triangulation was to determine the length of the bridge axis. The triangulation also serves the control points for detailing. The bridge axis was set and horizontal control stations were fixed on either side. Distances between stations on the same sides of river i.e. base lines were measured with tape precisely. Then the interconnecting triangles were formed and angles were measured with the theodolite with two sets of observations. The bridge axis length or span was calculated by solving the triangles using the sine rule. For vertical control, the level was transferred from the arbitrary benchmark and RL was transferred to the stations on the next bank by reciprocal leveling while direct level transfer method was used or the same bank.

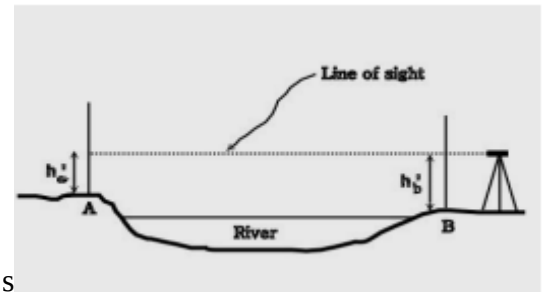
3.6.3 L-Section & Cross Section:

For gaining an idea about bed slope, nature of the riverbed, and the variation in the elevations of the different points along the length of the river, L-section is carried out. Keeping the instrument at the control (traverse) stations on the river banks, the staff readings were taken at different points along the center line of the river up to 150 meters upstream and 50 m downstream. The R. Ls of the traverse stations being known previously, the levels of the different points on the river were calculated. Then the L-Section of the riverbed was plotted on a graph paper on scale for vertical and horizontal. Cross-section of a river at a particular point is the profile of the lateral sides from the centerline of the river cut transverse to the L-Section at that point. The cross section can be used to calculate the volume and discharge of water at the particular section if the velocity at the cross section is known. Cross sections were taken at an interval of about 25 m extending 150 m upstream and 50 m downstream of the river. Staff readings of points along a line perpendicular to the flow of river were taken from the stations points and the elevations of the points were calculated using tachometric methods.

3.6.4 Leveling:

Transferring R.L. from B.M. to control points: The benchmark was on the manhole near the cricket ground. R.L. was transferred to the triangular station from the B.M. by fly leveling by taking the back sight-reading to the bench mark which should be within the given accuracy. The R.L. was transferred to the opposite bank of the river by reciprocal leveling. Reciprocal Leveling: This method is applicable when taping is obstructed but not the vision. For transferring the RL across the bridge reciprocal leveling was performed. This method eliminates the error due to focusing, collimation, earth’s curvature and refraction of atmosphere etc. True difference in elevation between A and B = H = ha- (hb-e) Also the true difference in elevation = H = (ha '- e)-hb' Taking the average of the two differences we get the difference in elevation between A and B





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3.6.5 Detailing:

Total station was used for detailing of the entire bridge site. The reading was taken from the different station set up. The detailing was done with respect to the skeleton formed by triangulation. The vertices of triangles serve as a control point. The details were booked, up to 150m upstream and 50m downstream. The data and the calculations have been tabulated in a systematic way.

3.6.6 Computation & Plotting:

The use of total station makes the detailing process easy and fast. The total station gives the direct vales of the horizontal distances and vertical height difference between the station point and the detailing point. The RLs of the points can be calculated by using following formula. RL of detail = RL of station + HI ± V-Target Height The topographic map, the longitudinal section and the cross section were plotted on the respective scales after the completion of calculations. By taking an A1 grid sheet, control stations were plotted accurately. Then all hard details as well as contours were plotted with reference to the control stations by the method of angle and distances.

3.6.7 Comments and Conclusion:

Economy and durability determine the way how a bridge is designed. The bridge axis should be designed such that the span length should be minimum and the location is safe. The bridge axis should not be below the highest flood level. The bridge span was found out to be 64 meters. The cross-section was taken at the banks of river and at the middle of the river to get the profile of the flowing river. Also, we marked the high flood level and low flood level. Change due to erosion of the bank is not so significant.

In conclusion, this bridge site survey has not only equipped us with critical technical skills but also fostered teamwork, problem-solving abilities, and a deeper understanding of civil engineering principles. The comprehensive insights gained from this survey will be invaluable for planning and designing bridge structures. We extend our gratitude to our instructors and peers for their unwavering support and guidance, making this survey a successful and enriching endeavor.

ROAD ALIGNMENT

A road is an identifiable route, way or path between two or more places. Roads are typically smoothed, paved, or otherwise prepared to allow easy travel; though they need not be, and historically many roads were simply recognizable routes without any formal construction or maintenance. The road needs to pass through positive obligatory points. Positive obligatory points include cities, schools, markets and negative obligatory points include temples, national parks and wild life conservation areas. Road must not pass through such negative obligatory points. Before the construction of the road, preliminary survey is done. Road alignment is the preliminary stage of road construction. Selection of Intersection Points (IP) is the foundation of construction of the road. After that cross section, longitudinal section and formation level are required.

4.1 Brief description of the project area:

Road alignment and bridge site survey goes side by side to run a road between two terminals and to carry a survey for the bridge construction along the route. This specific job is essential for an engineer combating with the mountainous topography of Nepal.

4.2 Geology Hydrology & Soil:

The land was undulated with no large boulders or rocks of any kind along the proposed site. There are several places where culvert or cause way can exist. The soil is uniform throughout the whole length of the road. Although the road alignment has certain up and downs. Finally, the starting and ending point of the road has no significant level differences. Soft clayey soil was found along the road course.

4.3 Technical Specifications (Norms):

Reece alignment selection was carried out of the road corridor considering permissible gradient, obligatory points, bridge site and geometry of tentative horizontal and vertical curves. The road setting horizontal curve, cross sectional detail in 15m interval and longitudinal profile were prepared. The topographic map (scale 1:1000) of road corridor was prepared. Geometric curves, road formation width, right of way, crossings and other details were shown in the map. While performing the road alignment survey, the following norms were strictly followed:

· Carry out reconnaissance survey and alignment selection of a road corridor about 700m or more.

· If the external deflection angle at the I.P. of the road is less than 3°, curves need not be fitted.

· Simple horizontal curves had to be laid out where the road changed its direction, determining and pegging three points on the curve - the beginning of the curve, the middle point of the curve and the end of the curve along the centerline of the road.

· The radius of the curve had to be chosen such that it was convenient and safe. The radius of the curve should not be less than 15m. The radius must be within the multiple of 5 or 10.

· The gradient of the road had to be maintained below 12 %

· Subsequent reverse curves in road alignment should be avoided.

· The deflection angle should not be greater than 90º.

· Two successive curves must not be overlapped.

· Carry out levelling survey for longitudinal section along the center line at 15m interval, at abrupt change point and at all the curve point BC, MC and EC. Close the levelling survey and check the RL at job site immediately. Permissible error of closure for levelling must not be greater than $\pm 25\sqrt{k}$ mm.

· Cross sections had to be taken at 15 m intervals and at the beginning, middle and end of the curve, along the centerline of the road - observations being taken for at least 10 m on either side of the centerline.

· Plan of the road had to be prepared on a scale of 1:500

· L-Section of the road had to be plotted on a scale of 1:1000 horizontally and 1:100 vertically.

· The cross section of the road had to be plotted on a scale of 1:100 (both vertical and horizontal).

· The amount of cutting and filling required for the road construction had to be determined from the L-Section and the cross sections. However, the volume of cutting had to be roughly equal to the volume of filling.

4.4 Equipment & Accessories:

The following are the instruments used during the road alignment survey in the field:

· Theodolite

· Tripod Stand

· Plumb Bob

· Leveling Instrument

· Leveling Staffs

· Ranging Rods

· Measuring Tape

· Pegs and Arrows

· Marker Pen

4.5 Methodology:

The alignment of road includes several ways and procedures that need to be carried out. Following are the listed methodology:

4.5.1 Reconnaissance:

The reconnaissance survey was performed along the given route. Tentative estimations were done for the intersection points, where the direction had to be changed. While returning back the route, the IPs was fixed. For this the inter-visibility of the stations was checked and gradient between the two IPs was adjusted such that it does not exceed 12%, using the Abney level. Meanwhile the pegs with IP no. were driven at these points.

4.5.2 Horizontal Alignment:

Horizontal alignment is done for fixing the road direction in horizontal plane. For this, the bearing of initial line connecting two initial stations was measured using compass. The interior angles were observed using theodolite at each IP and then deflection angles were calculated.

Deflection angle = 180^{0} - observed angle

If the deflection angle is positive the deflection is towards right and if the deflection angle is negative the deflection is towards the left. The radius was assumed according to the deflection angle. Then the tangent length, Beginning of the Curve (BC), End of the Curve (EC), apex distance along with their chainage were found by using the following formulae,

Tangent length (T) = R x Tan ($\Delta/2$)

Length of curve (L.C) = Π x R x $\Delta/180$

Apex distance = R x(1/(Cos ($\Delta/2$)-1)

Chainage of BC = Chainage of IP – T

Chainage of MC = Chainage of BC +LC/2

Chainage of EC = Chainage of MC + LC/2

= Chainage of BC + LC

The BC and EC points were located along the line by measuring the tangent length from the apex and the points were marked distinctly. The radius was chosen such that the tangent does not overlap. The apex was fixed at the length of apex distance from IP along the line bisecting the interior angle.

4.5.3 Alignment:

Vertical profile of the Road alignment is known by the vertical alignment. In the L-section of the Road alignment, vertical alignment was plotted with maximum gradient of 12 %. According to Nepal Road Standard, Gradient of the Road cannot be taken more than 12 %. In the vertical alignment, we set the vertical curve with proper

design. Vertical curve may be either summit curve or valley curve. While setting the vertical alignment, it should keep in mind whether cutting and filling were balanced or not.

4.5.4 Leveling:

The method of fly leveling was applied in transferring the level from the given B.M. to all the I.Ps, beginnings, mid points and ends of the curves as well as to the points along the center line of the road where the cross sections were taken. After completing the work of one way fly leveling on the entire length of the road, check leveling was continued back to the B.M. making a closed loop for check and adjustment. The difference in the R.L. of the B.M. before and after forming the loops should be less than $25\sqrt{k}$ mm, where k is the loop distance in km.

4.5.5 L-section & Cross Section:

Nature of the ground, the variation in the elevations of the different points along the length of road need to be known for the construction of the road. For this L-Section of the road is required. In order to obtain the data for L-Section, staff readings were taken at points at 15m intervals along the centerline of the road with the help of a level by the method of fly leveling. Thus, after performing the necessary calculations, the level was transferred to all those points with respect to the R.L. of the given B.M. Then finally the L-Section of the road was plotted on a graph paper on a vertical scale of 1:100 and a horizontal scale of **1:1000**. The staff readings at BC, EC and apex were also taken. The RL of each points were calculated.

Cross sections at different points are drawn perpendicular to the longitudinal section of the road on either side of its centerline in order to present the lateral outline of the ground. Cross sections are also equally useful in determining the amount of cut and fill required for the road construction. Cross sections were taken at 15m intervals along the centerline of the road and at points where there was a sharp change in the elevation. While doing so, the horizontal distances of the different points from the centerline were measured with the help of a tape and the vertical heights with a measuring staff. The R.L. was transferred to all the points by performing the necessary calculations and finally, the cross sections at different sections were plotted on a graph paper on a scale of **both vertical and 1:100 - horizontal.**

Curve Setting:

A regular curved path followed by highway or railway alignment is curve. It is introduced wherever it is necessary to change the direction of motion due to the nature of terrain. A curve may be circular, parabola or spiral and is always tangential to two straight directions.

There may be different types of curves:

Simple curve, Compound curve, Reverse curve, Transition curve.

Simple Circular Curve:

A simple circular curve is the curve, which consists of a single arc of a circle. It is tangential to both the straight lines.

Setting Out of Simple Circular Curves:

1. **Linear method: -** In this method, only a chain or tape is used. Linear methods are used when a high degree of accuracy is not required and the curve is short.

E.g.: Offsets from Long Chord Offsets from Tangents Successive bisection of Chords Offsets from Chords produced

2. **Angular method: -** In this method, an instrument like theodolite is used with or without chain or tape. E.g. Rankine's Method of Tangential Deflection Angles

   Two Theodolite Method

- **Offset from Long Cord Method:**

Mid-ordinate can be determined by the relation

$Oo = R - \sqrt{[R2 – (L/2)^2]}$

The Ordinate at a distance 'x' is given by,

$Ox = \sqrt{[(R^2 – X^2) – (R - Oo)]}$

Where ,

Oo = mid-ordinate

Ox = ordinate at distance x from the mid-point of the chord

L = length of the long chord

R = Radius of the curve

- **Rankine's Method:**

In Rankine's method, it's assumed that the length of the curve and the chord length are equal (case for larger radius). The deflection angle to any point on the curve is an angle at the point of contact between the back tangent and the chord joining the point of contact and that point.

The angle subtended by first sub-chord is given by,

$\Delta 1 = 1718.9\ C1/R$ minutes

The angle subtended by each normal chord is given by the formula,

$\Delta = 1718.9\ C/R$ minutes

If Δ1, Δ2…, Δn are the tangential angles made by successive chords with their tangents and Δ1, Δ2 Δn are the total deflection angles, then

Δ1 = Δ1

Δ2 = Δ1 + δ1 = δ1+ δ2

…….

……..

Similarly,

Δn = Δ n −1 + δn = δ1+ δ2 + δ3 +……..+ δn = Δ/2

Field Procedure:

- The instrument is set at T1 and zero is set along P.I..
- Then the theodolite is set to read an angle of ™1(=Δ1).
- With T1 as center and C1 as radius, the tape is swung and arrow was marked at intersection of the tape with crosshairs.
- Then angle Δ2 was set on the theodolite and with length of normal chord as radius, the next point on the curve was marked at the point of intersection.

This procedure is continued till the point of tangency is located.

Comments and Conclusion:

Survey of the road alignment is done to make safe, easy, short and economical road. Geological stability and soil stability are also taken into account. Vertical and horizontal curves are set according to Road Design Standards for comfort and other factors.

The road alignment survey conducted during our survey camp was an invaluable practical experience. Through precise measurements and detailed analysis, we were able to determine the optimal alignment for the proposed road, considering factors such as terrain, environmental impact, and connectivity. This hands-on survey allowed us to apply theoretical knowledge to real-world scenarios, significantly enhancing our technical skills.

In conclusion, the road survey provided us with essential insights into the complexities of planning and designing road infrastructure. It fostered teamwork, critical thinking, and problem-solving abilities. The data and findings from this survey will serve as a crucial foundation for future transportation projects. We are grateful for the guidance from our instructors and peers, making this a successful and educational experience.

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Institute of Engineering

Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

3

Observer : Date :

Recorder : Weather:

Instrument : **Distance Measurement Sheet by Total Station** Temperature:

S.No.	Line	Distance (m)		Average	Discrepancy	Precision ≥ 1 : 5,000	Remarks
		Forward (FW)	Backward (BW)				
1	CP1-CP2	96.789	96.791	96.790	0.002	1 : 48395	
2	CP2-3M1	64.150	64.156	64.153	0.006	1 : 10692	
3	3M1-3M2	69.337	69.341	69.339	0.004	1 : 17335	
4	3M2-3M3	82.620	82.616	82.618	0.004	1 : 20654	
5	3M3-3M4	82.346	82.350	82.348	0.004	1 : 20587	
6	3M4-3M5	91.512	91.510	91.511	0.002	1 : 45755	
7	3M5-3M6	110.885	110.895	110.890	0.010	1 : 11089	
8	3M6-3M7	126.390	126.410	126.400	0.020	1 : 6320	
9	3M7-3M8	71.428	71.422	71.425	0.006	1 : 11904	
10	3M8-3M9	107.551	107.541	107.546	0.010	1 : 10755	
11	3M9-3M10	85.168	85.156	85.162	0.012	1 : 7097	
12	3M10-3M11	72.240	72.232	72.236	0.008	1 : 9030	
13	3M11-3M12	109.948	109.942	109.945	0.006	1 : 18324	
14	3M12-3M13	88.496	88.494	88.495	0.002	1 : 44248	
15	3M13-3M14	96.559	96.561	96.560	0.002	1 : 48280	
16	3M14-3M15	77.110	77.104	77.107	0.006	1 : 12851	
17	3M15-3M16	107.269	107.265	107.267	0.004	1 : 26817	
18	3M16-3M17	81.959	81.957	81.958	0.002	1 : 40979	
19	3M17-3M18	86.230	86.234	86.232	0.004	1 : 21558	
20	3M18-3M19	127.040	127.032	127.036	0.008	1 : 15879	
21	3M19-3M20	111.515	111.531	111.523	0.016	1 : 6970	
22	3M20-3M21	96.099	96.095	96.097	0.004	1 : 24024	
23	3M21-3M22	96.670	96.660	96.665	0.010	1 : 9667	
24	3M22-CP1	79.310	79.296	79.303	0.014	1 : 5664	

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3

Group No:3

Observer :

Recorder :

Instrument :

Date :

Weather:

Temperature:

Distance Measurement Sheet by Total Station

S.No.	Leg	Distance (m)		Average	Discrepancy	Precision ≥ 1 : 3,000	Remarks
		Forward (FW)	Backward (BW)				
1	3M19-3m6	68.002	68.004	68.003	0.002	1 : 34001	Internal Minor
2	3m6-3m7	73.503	73.507	73.505	0.004	1 : 18376	
3	3m7-3m8	58.846	54.842	56.844	4.004	1 : 14	
4	3m8-3m9	57.187	57.191	57.189	0.004	1 : 14297	
5	3m9-3m10	46.529	46.527	46.528	0.002	1 : 23264	
6	3m10-3m11	70.5	70.504	70.502	0.004	1 : 17626	
7	3m11-3m12	55.533	55.527	55.53	0.006	1 : 9255	
8	m312-3M17	72.465	72.461	72.463	0.004	1 : 18116	

S.No.	Leg	Distance (m)		Average	Discrepancy	Precision ≥ 1 : 3,000	Remarks
		Forward (FW)	Backward (BW)				
1	3M17-3m5	91.347	91.349	91.348	0.002	45674	External minor
2	3m5-3m4	86.329	86.327	86.328	0.002	43164	
3	3m4-3m3	55.044	55.048	55.046	0.004	13761.5	
4	3m3-3m2	58.337	58.327	58.332	0.01	5833.2	
5	3m2-3m1	71.896	71.886	71.891	0.01	7189.1	
6	3m1-3M19	63.959	63.953	63.956	0.006	10659.3333	

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Group No:3

Observer:
Recorder:
Instrument:

Horizontal Angle And Distance of Major Traverse

Inst. St and Ht. of Inst.	Sighted to	FACE	Set-I						Set-II						Mean Horizontal Angle {(I+II)}/2			Horizontal Distance(m)	Remarks
			HCR Observation			Horizontal Angle			HCR Observation			Horizontal Angle							
			d	m	s	d	m	s	d	m	s	d	m	s	d	m	s		
CP2	CP1	L	0	0	0	271	26	39	90	0	0	271	26	44	271	26	41.5	96.806	
		R	180	0	0				270	0	0								
	M1	L	271	26	37				1	26	47							64.153	
		R	91	26	41				181	26	41								
M1	CP2	L	0	0	0	35	40	12	90	0	0	35	40	7	35	40	9.5	64.153	
		R	180	0	0				270	0	0								
	M2	L	35	40	10				125	40	10							69.339	
		R	215	40	14				305	40	4								
M2	M1	L	0	0	0	214	24	52	90	0	0	214	24	47	214	24	49.5	39.339	
		R	180	0	0				270	0	0								
	M3	L	214	24	50				304	24	50							82.616	
		R	34	24	54				124	24	44								
M3	M2	L	0	0	0	204	33	22	90	0	0	204	33	27	204	33	24.5	82.616	
		R	180	0	0				270	0	0								
	M4	L	204	33	20				294	33	30							82.333	
		R	24	33	24				114	33	24								
M4	M3	L	0	0	0	147	39	2	90	0	0	147	39	8	147	39	5	82.333	
		R	180	0	0				270	0	0								
	M56	L	147	39	0				237	39	8							91.509	
		R	327	39	4				57	39	8								
M5	M4	L	0	0	0	78	25	11	90	0	0	78	25	7	78	25	9	91.509	
		R	180	0	0				270	0	0								
	M6	L	78	25	12				168	25	7							110.886	
		R	258	25	10				348	25	7								

M5	L	0	0	0	218	15	11	90	0	0	218	15	22	218	15	16.5	110.886	
	R	180	0	0				270	0	0								
M7	L	218	15	9				308	15	21							126.384	
	R	38	15	13				128	15	23								
M6	L	0	0	0	236	21	4	90	0	0	236	21	0	236	21	2	126.384	
	R	180	0	0				270	0	0								
M8	L	236	21	2				326	21	0							71.419	
	R	56	21	6				146	21	0								
M7	L	0	0	0	93	22	40	90	0	0	93	22	45	93	22	42.5	71.419	
	R	180	0	0				270	0	0								
M9	L	93	22	41				183	22	44							107.546	
	R	273	22	39				3	22	46								
M8	L	0	0	0	95	6	48	90	0	0	95	6	19	95	6	33.5	107.546	
	R	180	0	0				270	0	0								
M10	L	95	6	46				185	6	19							85.172	
	R	275	6	50				5	6	19								
M9	L	0	0	0	268	1	7	90	0	0	268	1	19	268	1	13	85.172	
	R	180	0	0				270	0	0								
M11	L	268	1	7				358	1	18							72.236	
	R	88	1	7				178	1	20								
M10	L	0	0	0	115	18	16	90	0	0	115	18	14	115	18	15	72.236	
	R	180	0	0				270	0	0								
M12	L	115	18	15				205	18	15							109.955	
	R	295	18	17				25	18	13								
M11	L	0	0	0	253	10	52	90	0	0	253	10	48	253	10	50	109.955	
	R	180	0	0				270	0	0								
M13	L	253	10	50				343	10	49							88.485	
	R	73	10	54				163	10	47								
M12	L	0	0	0	198	13	31	90	0	0	198	13	34	198	13	32.5	88.485	
	R	180	0	0				270	0	0								
M14	L	198	13	30				288	13	35							96.54	
	R	18	13	32				108	13	33								
M13	L	0	0	0	37	36	11	90	0	0	37	36	54	37	36	32.5	96.54	
	R	180	0	0				270	0	0								
M15	L	37	36	10				127	36	55							77.117	
	R	217	36	12				307	36	53								
M114	L	0	0	0	238	59	57	90	0	0	238	59	50	238	59	53.5	77.117	
	R	180	0	0				270	0	0								
M16	L	238	59	58				328	59	50							167.267	
	R	58	59	56				148	59	50								
M15	L	0	0	0	133	49	36	90	0	0	133	49	32	133	49	34	167.267	
	R	180	0	0				270	0	0								
M17	L	133	49	37				223	49	33							81.968	
	R	313	49	35				43	49	31								
M16	L	0	0	0	80	55	35	90	0	0	80	55	36	80	55	35.5	81.968	
	R	180	0	0				270	0	0								
M18	L	80	55	34				170	55	37							86.232	
	R	260	55	36				350	55	35								

M17	L	0	0	0	225	3	58	90	0	0	225	3	56	225	3	57	86.232	
	R	180	0	0				270	0	0								
M19	L	225	3	58				315	3	55							127.036	
	R	45	3	58				135	3	57								
M18	L	0	0	0	211	41	18	90	0	0	211	41	16	211	41	17	127.036	
	R	180	0	0				270	0	0								
M20	L	211	41	18				301	41	17							111.523	
	R	31	41	18				121	41	15								
M19	L	0	0	0	148	8	46	90	0	0	148	8	39	148	8	42.5	111.523	
	R	180	0	0				270	0	0								
M21	L	148	8	45				238	8	40							96.097	
	R	328	8	47				58	8	38								
M20	L	0	0	0	128	27	25	90	0	0	128	27	38	128	27	31.5	96.097	
	R	180	0	0				270	0	0								
M22	L	128	27	26				218	27	36							96.665	
	R	308	27	24				38	27	40								
M21	L	0	0	0	205	8	2	90	0	0	205	8	2	205	8	2	96.665	
	R	180	0	0				270	0	0								
CP1	L	205	8	2				295	8	2							79.303	
	R	25	8	2				115	8	2								
M22	L	0	0	0	120	8	38	90	0	0	120	8	26	120	8	32	79.303	
	R	180	0	0				270	0	0								
CP2	L	120	8	37				210	8	26							96.806	
	R	300	8	39				30	8	26								

SUM=	3959	58	22
ACTUAL=	3960	0	0
ERROR=	0	1	38
PERMISSIBI	0	2	27

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Department of Civil Engineering

Survey Instruction Committee

Horizontal angle and distance of minor traverse

Inst. St and Ht. of Inst.	Sighted to	FACE	HCR Observation			Mean Horizontal Angle			Horizontal Distance(m)	Remarks
			d	m	s	d	m	s		
M17	M16	L	0	0	0	50	23	49		
		R	180	0	12					
	m8	L	50	23	48					
		R	230	23	50					
m8	M17	L	0	0	0	106	29	39		
		R	180	0	5					
	m9	L	106	29	40					
		R	286	29	38					
m9	m8	L	0	0	0	308	50	2.5		
		R	180	0	12					
	m10	L	308	50	4					
		R	128	50	1					
m10	m9	L	0	0	0	122	15	2.5		
		R	180	0	10					
	m11	L	122	15	1					
		R	302	15	4					
m11	m10	L	0	0	0	76	47	0.5		
		R	180	0	12					
	m12	L	76	47	0					
		R	256	47	1					
m12	m11	L	0	0	0	199	37	15		
		R	180	0	5					
	m13	L	199	37	14					
		R	19	37	16					

m13	m12	L	0	0	0	70	37	29		
		R	180	0	0					
	m14	L	70	37	28					
		R	250	37	30					
m14	m13	L	0	0	0	247	34	43		
		R	180	0	0					
	M15	L	247	34	42					
		R	67	34	44					
M15	m14	L	0	0	0	32	19	50		
		R	180	0	0					
	M16	L	32	19	49					
		R	212	19	51					
M16	M15	L	0	0	0	225	3	57		
		R	180	0	0					
	M17	L	225	3	58					
		R	45	3	56					
					SUM=	1439	58	48		

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Department of Civil Engineering
Survey Instruction Committee

Group No:

Observer:

Recorder:

Instrument:

Resection

Inst. St and Ht. of Inst.	Sighted to	FACE	Set-I						Set-II						Mean Horizontal Angle {(I+II)}/2			Remarks
			HCR Observation			Horizontal Angle			HCR Observation			Horizontal Angle						
			d	m	s	d	m	s	d	m	s	d	m	s	d	m	s	
P	Syambhu	L	0	0	0				90	0	0							
		R	180	0	1				270	0	7							
	CH	L	146	18	56	146	18	54	236	18	41	146	18	46	146	18	50	
		R	326	18	53				56	18	59							
	Clock tower	L	279	3	12	132	44	24	9	3	21	132	44	23	132	44	23.5	Major Station
		R	99	3	5				189	3	6							
	CP1	L	348	28	35	69	25	29	78	28	41	69	25	30	69	25	29.5	
		R	168	28	40				258	28	47							
	Syambhu	L	0	0	0	11	31	29	90	0	0	11	31	16	11	31	22.5	
		R	180	0	14				270	0	1							

sum 360 0 5.5

RESECTION CALCULATION

Here we have,

Coordinate of Swoyambhu (A) (Northing, Easting) = (3066928.474, 627464.718)

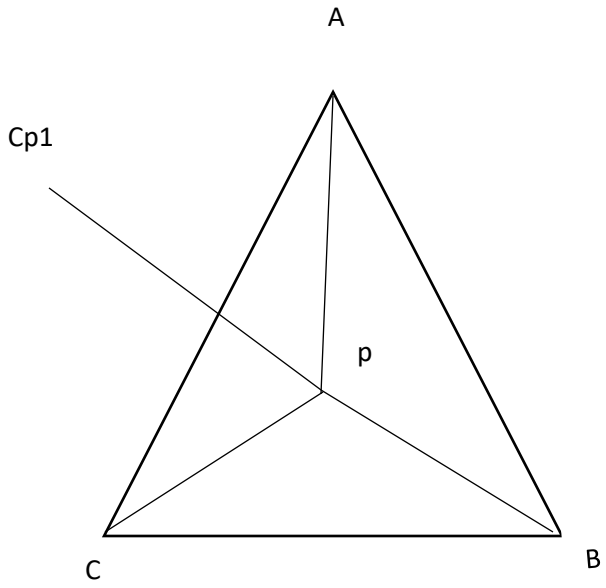
Coordinate of Chovar (B) (Northing, Easting) = (3061479.468, 627611.753)

Coordinate of Clock Tower (C) (Northing, Easting) = (3063142.819, 626832.547)

APB-146° 18' 50"

BPC=132° 44' 24"

CPA=360-APB-BPC =80° 56' 52"



Length calculation

Length of AB = 5450.98 m

Length of BC = 1836.81 m.

Length of CA = 3838.07 m

Bearing calculation

Bearing of AB=23° 33' 19"

Bearing of BC=145° 25' 6"

Bearing of CA = 11° 1' 34"

Total= 179°59'59"

Coordinate calculation

Easting of CP1= 626854.885m

Northing of CP1=3063178.561m

Therefore, the required coordinate of CP1 is (3063178.561m N, 626854.885mE)

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Department of Civil Engineering, Pulchowk Campus

Horizontal control traverse calculation

Roll No.:
078BCE178,078BCE023,
078BCE043,078BCE083,
078BCE122

Group No: 3

Observer:-

Instrument: TS

Date:

Weather:

Temperature:

Reference Co-ordinate:	X	Y	Z
Station No: CP1	626854.885	3063178.561	

Gales Table

Station	Leg	Length (l)	Corrected HCR				WCB (θ)				Consecutive Co-		Correction		Corrected Consecutive Co-		Independent Coordinate		Adjusted length	WCB	WCB DMS	Remarks
			deg	min	sec	DD	DD	deg	min	sec	Lattitude ($l\cos(\theta)$)	Departure ($l\sin(\theta)$)	For lattitude	For departure	Lattitude	Departure	Northing	Easting				
CP1																	3063178.561	626854.885				CP1
CP2	CP1-CP2	96.79	271	26	47	271.446	169.104	169	6	15	-95.045	18.296			-95.045	18.296	3063083.516	626873.181	96.790	169.104	169°06'15"	CP2
3M1	CP2-3M1	64.153	35	40	14	35.671	260.551	260	33	2	-10.532	-63.282	-0.001	0.011	-10.533	-63.271	3063072.983	626809.909	64.142	260.548	260°32'53"	3M1
3M2	3M1-3M2	69.339	214	24	55	214.415	116.221	116	13	16	-30.636	62.204	-0.001	0.012	-30.637	62.216	3063042.345	626872.125	69.350	116.217	116°13'03"	3M2
3M3	3M2-3M3	82.618	204	33	29	204.558	150.636	150	38	11	-72.004	40.512	-0.001	0.014	-72.005	40.526	3062970.340	626912.652	82.626	150.628	150°37'41"	3M3
3M4	3M3-3M4	82.348	147	39	9	147.653	175.194	175	11	40	-82.059	6.899	-0.001	0.014	-82.060	6.913	3062888.281	626919.565	82.350	175.184	175°11'04"	3M4
3M5	3M4-3M5	91.511	78	25	14	78.421	142.847	142	50	49	-72.937	55.268	-0.001	0.016	-72.938	55.284	3062815.343	626974.848	91.522	142.839	142°50'22"	3M5
3M6	3M5-3M6	110.89	218	15	20	218.256	41.268	41	16	3	83.349	73.140	-0.001	0.019	83.348	73.160	3062898.691	627048.008	110.902	41.276	41°16'32"	3M6
3M7	3M6-3M7	126.4	236	21	7	236.352	79.523	79	31	23	22.985	124.293	-0.002	0.022	22.983	124.315	3062921.673	627172.323	126.421	79.526	79°31'32"	3M7
3M8	3M7-3M8	71.425	93	22	44	93.379	135.875	135	52	30	-51.270	49.728	-0.001	0.013	-51.271	49.740	3062870.402	627222.063	71.434	135.868	135°52'06"	3M8
3M9	3M8-3M9	107.546	95	6	50	95.114	49.254	49	15	14	70.196	81.478	-0.001	0.019	70.195	81.497	3062940.597	627303.560	107.559	49.261	49°15'40"	3M9
3M10	3M9-3M10	85.162	268	1	18	268.022	324.368	324	22	4	69.217	-49.614	-0.001	0.015	69.216	-49.599	3063009.813	627253.961	85.152	324.375	324°22'32"	3M10
3M11	3M10-3M11	72.236	115	18	18	115.305	52.389	52	23	22	44.085	57.224	-0.001	0.013	44.084	57.236	3063053.897	627311.198	72.245	52.396	52°23'46"	3M11
3M12	3M11-3M12	109.945	253	10	55	253.182	347.694	347	41	40	107.419	-23.432	-0.001	0.019	107.418	-23.413	3063161.314	627287.785	109.939	347.704	347°42'15"	3M12
3M13	3M12-3M13	88.495	198	13	37	198.227	60.876	60	52	35	43.070	77.307	-0.001	0.016	43.069	77.322	3063204.383	627365.107	88.508	60.882	60°52'55"	3M13
3M14	3M13-3M14	96.56	37	36	7	37.602	79.103	79	6	12	18.254	94.819	-0.001	0.017	18.252	94.836	3063222.636	627459.943	96.576	79.106	79°06'22"	3M14
3M15	3M14-3M15	77.107	238	59	59	239.000	296.705	296	42	19	34.652	-68.882	-0.001	0.014	34.651	-68.868	3063257.287	627391.075	77.094	296.709	296°42'33"	3M15
3M16	3M15-3M16	107.267	133	49	39	133.828	355.705	355	42	18	106.966	-8.033	-0.001	0.019	106.964	-8.015	3063364.251	627383.060	107.264	355.715	355°42'54"	3M16
3M17	3M16-3M17	81.958	80	55	40	80.928	309.533	309	31	57	52.168	-63.211	-0.001	0.014	52.166	-63.197	3063416.417	627319.863	81.946	309.538	309°32'18"	3M17
3M18	3M17-3M18	86.232	225	4	3	225.068	210.460	210	27	37	-74.330	-43.715	-0.001	0.015	-74.331	-43.699	3063342.086	627276.164	86.225	210.451	210°27'04"	3M18
3M19	3M18-3M19	127.036	211	41	22	211.689	255.528	255	31	40	-31.748	-123.005	-0.002	0.022	-31.749	-122.983	3063310.336	627153.181	127.015	255.525	255°31'28"	3M19
3M20	3M19-3M20	111.523	148	8	47	148.146	287.217	287	13	2	33.010	-106.526	-0.002	0.020	33.009	-106.506	3063343.345	627046.675	111.504	287.219	287°13'10"	3M20
3M21	3M20-3M21	96.097	128	27	37	128.460	255.364	255	21	49	-24.282	-92.979	-0.001	0.017	-24.283	-92.962	3063319.062	626953.713	96.081	255.360	255°21'37"	3M21
3M22	3M21-3M22	96.665	205	8	7	205.135	203.824	203	49	26	-88.428	-39.046	-0.001	0.017	-88.430	-39.029	3063230.632	626914.685	96.659	203.814	203°48'52"	3M22
CP1	3M22-CP1	79.303	120	8	36	120.143	228.959	228	57	33	-52.070	-59.814	-0.001	0.014	-52.071	-59.800	3063178.561	626854.885	79.293	228.952	228°57'07"	CP1
		2121.82				3959.998					0.029	-0.372	-0.029	0.372	0	0			2121.811			

Perimeter=2121.811
Closing error= 0.37313

Precision: 1/ 5686.6803
Permissible:1 in 5000

Tribhuwan University

Institute of Engineering

Pulchowk Campus

Department of Civil Engineering, Pulchowk Campus

Horizontal control traverse calculation

Roll No.:
078BCE178,078BCE023,
078BCE043,078BCE083,
078BCE122

Group No:- 3
Observer:- 3-Group Members
Instrument: TS

Gale's Table for Minor Traverse

Date:
Weather:
Temperature:

Station	Line	Length	Angle to the right			Angle	Bearing	Bearing			Correction	Corrected Bearing	Corrected Bearing			Consecutive coordinat		Correction		Corrected consecutive co		Independent coordinate		Adjusted	Adjusted Bearing	Adjusted Be	Remarks
			D	M	S			D	M	S			D	M	S	L=lcosθ	D=lsinθ	L	D	L	D	N	E				
	3M18-3M19						255.52444	255	31	28	0	255.52444	255	31	28												
3M19	3M19-3m6	68.003	50	23	48	50.39666667	125.92111	125	55	16	0.001556	125.92267	125	55	22	-39.8969	55.06948	-0.01015	-0.0100643	-39.90702	55.05942	3063310.336	627153.1810	68.001	125.9345711	125°56'04"	3M19(Known)
3m6	3m6-3m7	73.505	106	29	40	106.4944444	52.415555	52	24	56	0.003113	52.418668	52	25	7	44.82974	58.25186	-0.01098	-0.0108786	44.818767	58.24098	3063270.429	627208.2404	73.490	52.42027719	52°25'13"	3m6
3m7	3m7-3m8	56.844	308	50	4	308.8344444	181.25	181	14	60	0.004669	181.25467	181	15	17	-56.8304	-1.24468	-0.00849	-0.0084128	-56.83886	-1.253089	3063315.248	627266.4814	56.853	181.262958	181°15'47"	3m7
3m8	3m8-3m9	57.189	122	15	1	122.2502778	123.50028	123	30	1	0.006226	123.5065	123	30	23	-31.5701	47.68551	-0.00854	-0.0084638	-31.57868	47.67705	3063258.409	627265.2283	57.187	123.5183188	123°31'06"	3m8
3m9	3m9-3m10	46.528	76	47	0	76.78333333	20.283611	20	17	1	0.007782	20.291393	20	17	29	43.64052	16.13567	-0.00695	-0.006886	43.633573	16.12878	3063226.83	627312.9054	46.519	20.28640579	20°17'11"	3m9
3m10	3m10-3m11	70.502	199	37	14	199.6205556	39.904166	39	54	15	0.009339	39.913505	39	54	49	54.07602	45.23623	-0.01053	-0.0104341	54.065489	45.2258	3063270.464	627329.0341	70.487	39.91249053	39°54'45"	3m10
3m11	3m11-3m12	55.53	70	37	28	70.62444444	290.52861	290	31	43	0.010895	290.53951	290	32	22	19.48287	-52	-0.00829	-0.0082183	19.474583	-52.0082	3063324.529	627374.2599	55.535	290.5285198	290°31'43"	3m11
3m12	3m12-3M17	72.463	247	34	42	247.5783333	358.10694	358	6	25	0.012452	358.1194	358	7	10	72.42397	-2.37801	-0.01082	-0.0107243	72.413149	-2.388731	3063344.004	627322.2517	72.453	358.1106386	358°06'38"	3m12
3M17	3M17-3M18		32	19	49	32.33027778	210.43722	210	26	14	0.014008	210.45123	210	27	4							3063416.417	627319.863				3M17(Known)
		500.564														106.1557	166.7561	-0.07475	-0.0740823	106.081	166.682						

Bearing of M17-M18 (standard)= 210.451
Error= 0.014008222
Permissible Error= 0.022047928

Difference in Latidude of M17 and M19= 106.081
Difference in Departure of B and G= 166.682

Error in Latitude= 0.074748297
Error in Departure= 0.074082262
Closing error= 0.105240151
P/e= 4756
Permissible error= 1 in 3000
(error better than permissible)

Signature of teacher at site…….....

Tribhuwan University

Institute of Engineering

Pulchowk Campus

Department of Civil Engineering, Pulchowk Campus

Horizontal control traverse calculation

Gale's Table for Minor Traverse

Roll No.:
078BCE178,078BCE023,
078BCE043,078BCE083,
078BCE122`

Date:

Weather:

Temperature:

Grp No: 3
Observer:- 3-Group Members
Instrument: TS

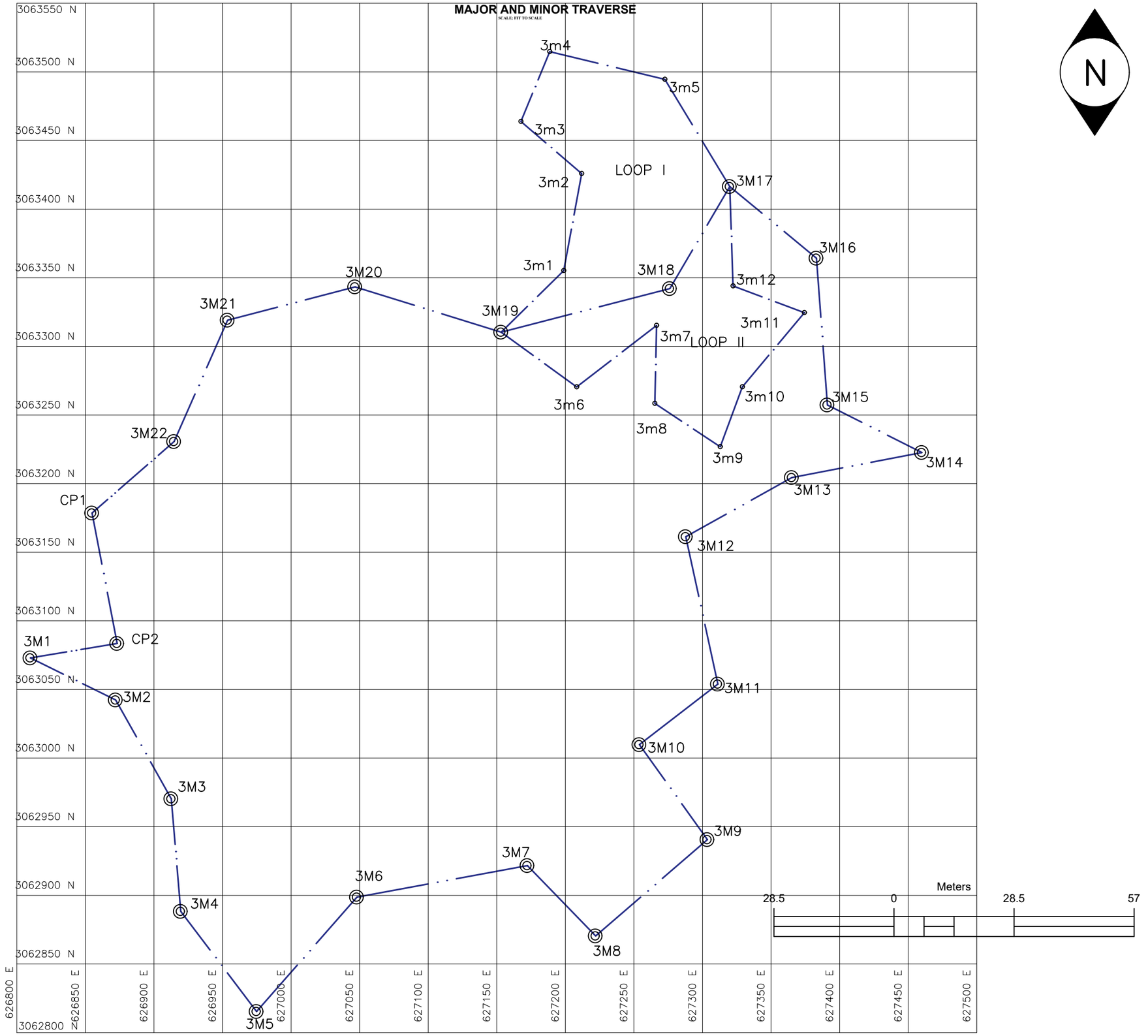
Station	Line	Length	Angle to the right			Angle	Bearing	Bearing			Correction	Corrected Be	Corrected Bearing			Consecutive coordinate		Correction		Corrected consecutive c		Independent coordinate		Adjusted	Adjusted Bearing	Adjusted Be	Remarks
			D	M	S			D	M	S			D	M	S	L=lcosθ	D=lsinθ	L	D	L	D	N	E				
	3M18-3M17						30.45123	30	27	4	0	30.45123	30	27	4												
3M17	3M17-3m5	91.348	118	20	30	118.3416667	328.7929	328	47	34	-0.001455	328.79144	328	47	29	78.1287449	-47.3324	-0.017528	-0.0063189	78.111217	-47.33872	3063416.417	627319.8632	91.336	328.7823536	328°46'56"	3M17
3m5	3m5-3m4	86.328	134	45	30	134.7583333	283.55123	283	33	4	-0.002911	283.54832	283	32	54	20.2236555	-83.92573	-0.016565	-0.0059717	20.20709	-83.9317	3063494.529	627272.5245	86.330	283.5367027	283°32'12"	3m5
3m4	3m4-3m3	55.046	98	53	10	98.88611111	202.43734	202	26	14	-0.004366	202.43297	202	25	59	-50.88048	-21.00569	-0.010562	-0.0038078	-50.89104	-21.00949	3063514.736	627188.5928	55.057	202.432443	202°25'57"	3m4
3m3	3m3-3m2	58.332	108	9	36	108.16	130.59734	130	35	50	-0.005822	130.59152	130	35	29	-37.954406	44.29543	-0.011193	-0.0040351	-37.9656	44.2914	3063463.845	627167.5833	58.336	130.602446	130°36'09"	3m3
3m2	3m2-3m1	71.891	239	52	43	239.8786111	190.47595	190	28	33	-0.007277	190.46868	190	28	7	-70.694331	-13.06245	-0.013795	-0.004973	-70.70813	-13.06742	3063425.879	627211.8747	71.905	190.4705745	190°28'14"	3m2
3m1	3m1-3M19	63.956	215	2	21	215.0391667	225.51512	225	30	54	-0.008733	225.50639	225	30	23	-44.822268	-45.62164	-0.012272	-0.0044241	-44.83454	-45.62607	3063355.171	627198.8073	63.968	225.5013224	225°30'05"	3m1
3M19	3M19-3M18		30	1	21	30.0225	75.537619	75	32	15	-0.010188	75.527431	75	31	39	0	0	0	0	0	0	3063310.336	627153.1812				3M19
		426.901														-105.99908	-166.6525	-0.081916	-0.0295305	-106.081	-166.682						

Bearing of M19-M18 (standard)= 75.525
Error= -0.013098889
Permissible Error= 0.0186339

Difference in Latidude of M17 and M19= -106.081
Difference in Departure of B and G= -166.682

Error in Latitude= 0.081915646
Error in Departure= 0.029530525
Closing error= 0.087075972
P/e= 4903
Permissible error= 1 in 3000

Signature of the teacher at site…….



N

LEGENDS

S.N.	DESCRIPTION	SYMBOL
1.	MAJOR STATION	◎
2.	MAJOR TRAVERSE LEG	——·——·——
3.	MINOR STATION	○
4.	MINOR TRAVERSE LEG	————

HORIZONTAL AND VERTICAL CONTROL POINTS

STATION CO-ORDINATES

Station	Easting(m)	Northing(m)
CP1	626854.885	3063178.561
CP2	626873.181	3063083.516
3M1	626809.909	3063072.983
3M2	626872.125	3063042.345
3M3	626912.652	3062970.340
3M4	626919.565	3062888.281
3M5	626974.848	3062815.343
3M6	627048.008	3062898.691
3M7	627172.323	3062921.673
3M8	627222.063	3062870.402
3M9	627303.560	3062940.597
3M10	627253.961	3063009.813
3M11	627311.198	3063053.897
3M12	627287.785	3063161.314
3M13	627365.107	3063204.383
3M14	627459.943	3063222.636
3M15	627391.075	3063257.287
3M16	627383.060	3063364.251
3M17	627319.863	3063416.417
3M18	627276.164	3063342.086
3M19	627153.181	3063310.336
3M20	627046.675	3063343.345
3M21	626953.713	3063319.062
3M22	626914.685	3063230.632
3m1	627198.807	3063355.171
3m2	627211.875	3063425.879
3m3	627167.583	3063463.845
3m4	627188.593	3063514.736
3m5	627272.525	3063494.529
3m6	627208.240	3063270.429
3m7	627266.481	3063315.248
3m8	627265.228	3063258.409
3m9	627312.905	3063226.830
3m10	627329.034	3063270.464
3m11	627374.260	3063324.529
3m12	627322.252	3063344.004

TITLE: MAJOR AND MINOR TRAVERSE
SCALE: FIT TO SCALE

All dimensions are in meters.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
PULCHOWK CAMPUS
DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMMITTEE

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

Tribhuvan University

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Pulchowk Campus

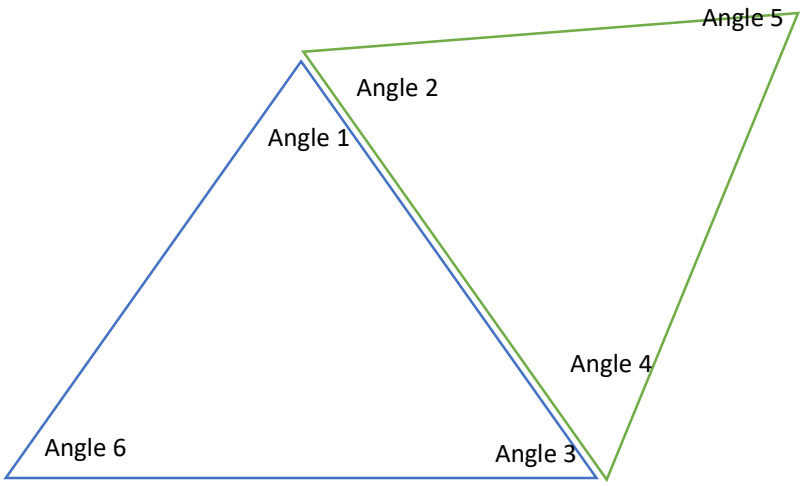
Department of Civil Engineering

Survey Instruction Committee

Observer:
Recorder:
Instrument:

Intersection

Inst. St and Ht. of Inst.	Sighted to	FACE	Set-I						Mean Horizontal Angle {(I+II)}/2			Remarks	Length
			HCR Observation			mean							
			d	m	s	d	m	s	d	m	s		
m12	m11	L	0	0	0	0	0	1					46.528
		R	180	0	2								
	ts	L	73	6	37	73	6	38	73	6	23	angle2	21.634
		R	253	6	39								
	DH	L	207	21	53	207	21	54	134	15	16	angle1	
		R	27	21	55								
TS	DH	L	0	0	0	0	0	1					
		R	180	0	2								
	m12	L	45	27	33	45	27	34	45	27	33	angle 3	21.634
		R	225	27	35								
	m11	L	125	5	12	125	5	13	78	37	39	angle 4	45.182
		R	305	5	14								
m11	ts	L	0	0	0	0	0	1					45.182
		R	180	0	2								
	m12	L	27	15	44	27	15	45	27	15	44	angle 5	46.528
		R	207	15	46								



Angle 6=180°-179°42'49"=0°17'11"
Co-ordinates of m11= (3063226.830 N, 627312.9 E)
Co-ordinates of m12 = (3063270.464 N, 627329.0341 E)
Length of m11-m12= V ((Nm11 - Nm12)2 + (Em11-Em12)2) =46.528m
Bearing of m11-m12= 20.283611
Length of m12.TS =21.634m
Bearing of m12.TS= 20.283611+73.11+180=93.4+180= 273°23'37"
Co-ordinates of TS = (3063270.464+ 21.634 x Cos (273°23'37"), 627329.0341+ 21.634 x Sin (273°23'37") =(3063271.2819 N, 627307.438 E)
Now,
Using sine law,
We get,
m12.DH=3084.91202m
DH.TS=3100.048
Bearing of TS.DH=273°23′37″+180-45°27'33" = 47°56'4"
Bearing of m12.DH = 273°23'37"+ 134°15′16″ = 47°38'53"
Co-ordinates of D using co-ordinates of m12,
Co-ordinates of DH = (3063270.464+ 3084.91202 x Cos (47°38'53"),627329.0341+ 3084.91202 x Sin(47°38'53") =(3065348.716 N, 629608.8477 E)
Co-ordinates of D using co-ordinates of TS,
Co-ordinates of DH = (3063271.281+ 3100.048 x Cos (47°56'4"),627307.481+ 3100.0482 x Sin(47°56'4") =(3065348.253 N, 629608.89 E)

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

11

Observer :
Recorde
Instrument :

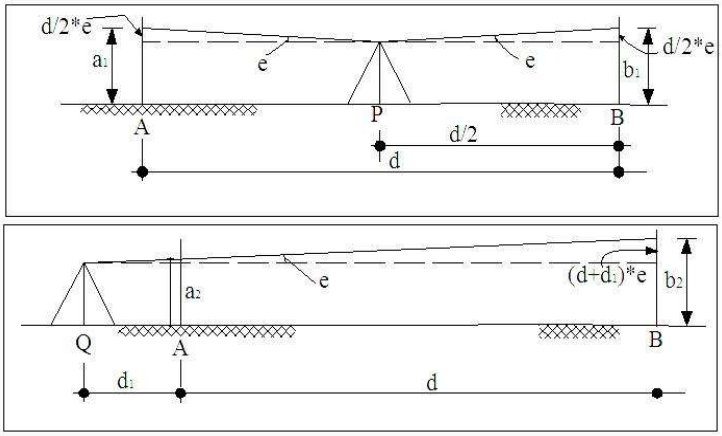
Two Pegtest or Collimation test

When instrument is at midway of two pegs:

Instrument at	Sighted to	Staff Readings (m)			Mean Value = {(T+M+B) ÷ 3}	True Difference; h_1=(MidA-MidB)	Remarks
		Top	Mid	Bottom			
P	A	1.48	1.38	1.28	1.380	0.187	
	B	1.293	1.193	1.093	1.193		

When Instrument is at near one Peg:

Instrument at	Sighted to	Staff Readings (m)			Mean Value = {(T+M+B) ÷ 3}	Apparent Difference; h_2=(MidA-MidB)	Remarks
		Top	Mid	Bottom			
Q	A	1.282	1.262	1.242	1.262	0.189	
	B	1.256	1.073	0.895	1.075		



True difference, $h_1 = (a_1-b_1)$= 0.187
Apparent difference, $h_2 = (a_2-b_2)$= 0.189
Collimation error, $e = |[(h_1-h_2)]|$= 0.002
Precision = 1/d/e ≥ 1 in 10,000
Obtained precision = 1/d/e = 1:16000

Tribhuvan University
Institute of Engineering
Pulchowk Campus

12

Department of Civil Engineering

Survey Instruction Committee

Observer :
Recorder :
Instrument :

Fly Levelling (RL Transfer)

Date :
Weather:
Temperature:

SN	Backsight				D1=(T-B)*100	Foresight				D2=(T-B)*100	D=D1+D2	Rise	Fall	RL	Remarks
	T	M	B	Avg		T	M	B	Avg						
1	1.794	1.716	1.64	1.716	15.4						15.4			1284.726	TBM1
2	1.595	1.545	1.496	1.545	9.9	1.005	0.925	0.844	0.925	16.1	26	0.791	0	1285.517	
3	1.973	1.923	1.874	1.923	9.9	1.014	0.966	0.909	0.966	10.5	20.4	0.579	0	1286.096	
4	1.554	1.521	1.487	1.521	6.7	1.045	0.996	0.947	0.996	9.8	16.5	0.927	0	1287.023	
5	1.815	1.769	1.723	1.769	9.2	0.985	0.95	0.915	0.95	7	16.2	0.571	0	1287.594	
6	1.742	1.686	1.63	1.686	11.2	0.905	0.859	0.814	0.859	9.1	20.3	0.91	0	1288.504	
7	1.706	1.667	1.628	1.667	7.8	0.75	0.695	0.641	0.695	10.9	18.7	0.991	0	1289.495	
8	1.975	1.92	1.861	1.92	11.4	0.691	0.65	0.608	0.65	8.3	19.7	1.017	0	1290.512	
9	1.89	1.842	1.796	1.842	9.4	0.745	0.684	0.623	0.684	12.2	21.6	1.236	0	1291.748	
10	1.854	1.798	1.743	1.798	11.1	0.77	0.72	0.671	0.72	9.9	21	1.122	0	1292.87	
11	1.82	1.76	1.7	1.76	12	0.719	0.665	0.61	0.665	10.9	22.9	1.133	0	1294.003	
12	1.939	1.883	1.832	1.883	10.7	0.732	0.67	0.608	0.67	12.4	23.1	1.09	0	1295.093	
13	1.843	1.792	1.74	1.792	10.3	0.88	0.83	0.78	0.83	10	20.3	1.053	0	1296.146	
14	1.615	1.542	1.466	1.542	14.9	1.115	1.061	1.009	1.061	10.6	25.5	0.731	0	1296.877	
15	1.555	1.486	1.417	1.486	13.8	1.09	1.013	0.935	1.013	15.5	29.3	0.529	0	1297.406	
16	1.618	1.544	1.471	1.544	14.7	1.195	1.124	1.052	1.124	14.3	29	0.362	0	1297.768	
17	1.508	1.437	1.365	1.437	14.3	1.244	1.17	1.098	1.17	14.6	28.9	0.374	0	1298.142	
18	1.55	1.472	1.395	1.472	15.5	1.153	1.078	1.003	1.078	15	30.5	0.359	0	1298.501	
19	1.552	1.503	1.457	1.503	9.5	1.096	1.019	0.943	1.019	15.3	24.8	0.453	0	1298.954	
20	1.617	1.58	1.543	1.58	7.4	1.038	0.986	0.933	0.986	10.5	17.9	0.517	0	1299.471	
21	1.606	1.571	1.536	1.571	7	0.897	0.858	0.819	0.858	7.8	14.8	0.722	0	1300.193	
22	1.763	1.726	1.689	1.726	7.4	0.873	0.836	0.799	0.836	7.4	14.8	0.735	0	1300.928	
23	1.504	1.468	1.432	1.468	7.2	0.654	0.617	0.579	0.617	7.5	14.7	1.109	0	1302.037	
24	1.635	1.602	1.57	1.602	6.5	0.879	0.841	0.804	0.841	7.5	14	0.627	0	1302.664	
25	1.998	1.953	1.908	1.953	9	1.027	0.998	0.968	0.998	5.9	14.9	0.604	0	1303.268	
26	1.936	1.891	1.844	1.891	9.2	0.722	0.676	0.629	0.676	9.3	18.5	1.277	0	1304.545	
27	1.893	1.84	1.786	1.84	10.7	0.874	0.833	0.791	0.833	8.3	19	1.058	0	1305.603	
28	1.615	1.575	1.536	1.575	7.9	0.688	0.636	0.583	0.636	10.5	18.4	1.204	0	1306.807	
29	1.836	1.789	1.75	1.789	8.6	0.694	0.652	0.612	0.652	8.2	16.8	0.923	0	1307.73	
30	1.772	1.733	1.695	1.733	7.7	0.742	0.699	0.655	0.699	8.7	16.4	1.09	0	1308.82	
31	1.779	1.734	1.689	1.734	9	0.736	0.694	0.653	0.694	8.3	17.3	1.039	0	1309.859	
32	1.884	1.849	1.815	1.849	6.9	0.698	0.651	0.606	0.651	9.2	16.1	1.083	0	1310.942	
33				0	0	0.714	0.677	0.642	0.677	7.2	7.2	1.172	0	1312.114	TBM2
SUM											650.9	27.388	0		

Sum.Rise-Sum.Fall =	27.388	K =	1298.7	1.2987	km
Last RL - First RL =	27.388	error=	27.35052	mm	

Tribhuvan University
Institute of Engineering
Pulchowk Campus

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Department of Civil Engineering

Survey Instruction Committee

Observer :
Recorder :
Instrument :

Fly Levelling (RL Transfer)

Date :
Weather:
Temperature:

SN	Backsight				1=(T-B)*10	Foresight				2=(T-B)*10	D=D1+D2	Rise	Fall	RL	Remarks
	T	M	B	Avg		T	M	B	Avg						
1	0.714	0.677	0.642	0.677	7.2						7.2			0	TBM2
2	0.755	0.708	0.662	0.708	9.3	1.894	1.859	1.825	1.859	6.9	16.2	0	1.182	-1.182	
3	0.828	0.79	0.753	0.79	7.5	1.913	1.863	1.813	1.863	10	17.5	0	1.155	-2.337	
4	0.839	0.797	0.756	0.797	8.3	1.815	1.777	1.739	1.777	7.6	15.9	0	0.987	-3.324	
5	0.795	0.755	0.714	0.755	8.1	1.911	1.87	1.83	1.87	8.1	16.2	0	1.073	-4.397	
6	0.844	0.8	0.755	0.8	8.9	1.769	1.729	1.689	1.729	8	16.9	0	0.974	-5.371	
7	0.818	0.776	0.735	0.776	8.3	1.8	1.756	1.715	1.756	8.5	16.8	0	0.956	-6.327	
8	0.84	0.8	0.76	0.8	8	1.841	1.801	1.761	1.801	8	16	0	1.025	-7.352	
9	0.888	0.85	0.813	0.85	7.5	1.996	1.956	1.91	1.956	8.6	16.1	0	1.156	-8.508	
10	0.865	0.825	0.785	0.825	8	1.692	1.652	1.612	1.652	8	16	0	0.802	-9.31	
11	0.681	0.641	0.601	0.641	8	1.493	1.456	1.421	1.456	7.2	15.2	0	0.631	-9.941	
12	0.753	0.706	0.661	0.706	9.2	1.771	1.731	1.691	1.731	8	17.2	0	1.09	-11.031	
13	0.938	0.888	0.838	0.888	10	1.744	1.704	1.664	1.704	8	18	0	0.998	-12.029	
14	1.283	1.205	1.131	1.205	15.2	1.759	1.709	1.661	1.709	9.8	25	0	0.821	-12.85	
15	1.393	1.323	1.252	1.323	14.1	1.88	1.805	1.727	1.805	15.3	29.4	0	0.6	-13.45	
16	1.357	1.277	1.197	1.277	16	1.739	1.664	1.59	1.664	14.9	30.9	0	0.341	-13.791	
17	1.301	1.235	1.169	1.235	13.2	1.695	1.62	1.545	1.62	15	28.2	0	0.343	-14.134	
18	1.255	1.18	1.105	1.18	15	1.668	1.6	1.531	1.6	13.7	28.7	0	0.365	-14.499	
19	1.293	1.246	1.199	1.246	9.4	1.725	1.65	1.575	1.65	15	24.4	0	0.47	-14.969	
20	1.129	1.08	1.031	1.08	9.8	1.655	1.607	1.561	1.607	9.4	19.2	0	0.361	-15.33	
21	1.098	1.057	1.016	1.057	8.2	1.901	1.855	1.809	1.855	9.2	17.4	0	0.775	-16.105	
22	1.016	0.977	0.937	0.977	7.9	2.002	1.956	1.913	1.956	8.9	16.8	0	0.899	-17.004	
23	1.04	1.001	0.962	1.001	7.8	1.72	1.675	1.631	1.675	8.9	16.7	0	0.698	-17.702	
24	1.101	1.069	1.031	1.069	7	1.879	1.84	1.8	1.84	7.9	14.9	0	0.839	-18.541	
25	0.922	0.882	0.843	0.882	7.9	1.805	1.766	1.728	1.766	7.7	15.6	0	0.697	-19.238	
26	0.783	0.733	0.683	0.733	10	1.835	1.796	1.759	1.796	7.6	17.6	0	0.914	-20.152	
27	0.644	0.594	0.544	0.594	10	1.789	1.741	1.696	1.741	9.3	19.3	0	1.008	-21.16	
28	0.759	0.706	0.656	0.706	10.3	1.86	1.813	1.761	1.813	9.9	20.2	0	1.219	-22.379	
29	0.99	0.941	0.891	0.941	9.9	1.81	1.763	1.718	1.763	9.2	19.1	0	1.057	-23.436	
30	0.875	0.825	0.774	0.825	10.1	1.794	1.75	1.707	1.75	8.7	18.8	0	0.809	-24.245	
31	0.912	0.862	0.812	0.862	10	1.737	1.687	1.636	1.687	10.1	20.1	0	0.862	-25.107	
32	0.906	0.825	0.746	0.825	16	1.808	1.76	1.712	1.76	9.6	25.6	0	0.898	-26.005	
33	1.081	1.034	0.986	1.034	9.5	1.746	1.67	1.593	1.67	15.3	24.8	0	0.845	-26.85	
34				0	0	1.595	1.547	1.496	1.547	9.9	9.9	0	0.513	-27.363	TBM1
SUM											647.8	0	27.363		

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Group No:3

Tribhuvan University
Institute of Engineering

Fly Levelling (RL Transfer)

SN	Backsight				D1=(T-B)*100	Foresight				D2=(T-B)*100	D=D1+D2	Rise	Fall	Remarks
	T	M	B	Avg		T	M	B	Avg					
1	0.959	0.906	0.853	0.906	10.6						10.6			TBM4
2	1.208	1.157	1.104	1.156	10.4	1.695	1.644	1.594	1.644	10.1	20.5	0	0.738	
3	1.248	1.195	1.142	1.195	10.6	1.628	1.575	1.521	1.575	10.7	21.3	0	0.419	
4	1.199	1.146	1.097	1.147	10.2	1.598	1.545	1.49	1.545	10.8	21	0	0.350	
5	1.366	1.311	1.26	1.312	10.6	1.571	1.519	1.466	1.519	10.5	21.1	0	0.372	
6					0	1.367	1.317	1.267	1.317	10	10	0	0.005	3M19
SUM											104.5	0	1.883	

Sum.Rise-Sum.Fall = -1.883

SN	Backsight				D1=(T-B)*100	Foresight				D2=(T-B)*100	D=D1+D2	Rise	Fall	Remarks
	T	M	B	Avg		T	M	B	Avg					
1	1.391	1.345	1.299	1.345	9.2						9.2			3M19
2	1.627	1.579	1.532	1.579	9.5	1.359	1.311	1.268	1.311	9.1	18.6	0.034	0	
3	1.622	1.574	1.528	1.574	9.4	1.312	1.263	1.218	1.263	9.4	18.8	0.316	0	
4	1.599	1.552	1.505	1.552	9.4	1.323	1.276	1.229	1.276	9.4	18.8	0.298	0	
5	1.594	1.554	1.515	1.554	7.9	1.243	1.195	1.148	1.195	9.5	17.4	0.357	0	
6	1.728	1.699	1.67	1.699	5.8	1.232	1.189	1.147	1.189	8.5	14.3	0.365	0	
7				0	0	1.217	1.188	1.159	1.188	5.8	5.8	0.511	0	TBM4
SUM											102.9	1.881	0	

Sum.Rise-Sum.Fall = 1.881
Total Distance=0.2074km
Error = 0.000 mm
Permissible Error = 0.010929886 m
Check Error with in range
RL of 3TBM19= 1322.419 m

Tribhuvan University

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Department of Civil Engineering

Survey Instruction Committee

Leveling Field Book by Rise and Fall method

SN	BS	FS	RISE	FALL	RL	Correction	Corrected R	REMARKS
M19	1.035				1322.419	0	1322.419	Known
TP	1.386	1.501	0	0.466	1321.953	-0.00032	1321.953	
TP	1.388	1.595	0	0.209	1321.744	-0.00063	1321.743	
m8	1.54	1.729	0	0.341	1321.403	-0.00095	1321.402	
TP	1.005	1.445	0.095	0	1321.498	-0.00126	1321.497	
TP	1.134	1.852	0	0.847	1320.651	-0.00158	1320.649	
m9	1.966	1.497	0	0.363	1320.288	-0.00189	1320.286	
m10	1.8	2.125	0	0.159	1320.129	-0.00221	1320.127	
TP	0.895	1.845	0	0.045	1320.084	-0.00253	1320.081	
m11	1.482	1.328	0	0.433	1319.651	-0.00284	1319.648	
TP	1.34	1.334	0.148	0	1319.799	-0.00316	1319.796	
m12	1.015	1.101	0.239	0	1320.038	-0.00347	1320.035	
TP	1.38	1.325	0	0.31	1319.728	-0.00379	1319.724	
TP	0.615	2.81	0	1.43	1318.298	-0.00411	1318.294	
TP	0.613	2.908	0	2.293	1316.005	-0.00442	1316.001	
TP	0.847	2.882	0	2.269	1313.736	-0.00474	1313.731	
TP	0.854	2.512	0	1.665	1312.071	-0.00505	1312.066	
m13	2.195	2.586	0	1.732	1310.339	-0.00537	1310.334	
m14	1.87	1.215	0.98	0	1311.319	-0.00568	1311.313	
TP	1.058	0.876	0.994	0	1312.313	-0.006	1312.307	
M17	0.993	1.304	0	0.246	1312.067	-0.00632	1312.061	
TP	0.795	2.826	0	1.833	1310.234	-0.00663	1310.227	
TP	0.615	2.445	0	1.65	1308.584	-0.00695	1308.577	
TP	1.245	2.852	0	2.237	1306.347	-0.00726	1306.34	
m5	2.081	1.331	0	0.086	1306.261	-0.00758	1306.253	
m4	2.93	1.321	0.76	0	1307.021	-0.00789	1307.013	
TP	2.895	0.663	2.267	0	1309.288	-0.00821	1309.28	
TP	2.38	1.161	1.734	0	1311.022	-0.00853	1311.013	
TP	2.316	0.818	1.562	0	1312.584	-0.00884	1312.575	
TP	2.52	1.383	0.933	0	1313.517	-0.00916	1313.508	
m3	2.375	1.079	1.441	0	1314.958	-0.00947	1314.949	
TP	2.811	0.654	1.721	0	1316.679	-0.00979	1316.669	
TP	2.578	0.63	2.181	0	1318.86	-0.01011	1318.85	
m2	1.763	0.902	1.676	0	1320.536	-0.01042	1320.526	
TP	1.329	0.994	0.769	0	1321.305	-0.01074	1321.294	
M18	2.359	2.359	0	1.03	1320.275	-0.01105	1320.264	
m1	1.73	1.287	1.072	0	1321.347	-0.01137	1321.336	
M19		0.646	1.084	0	1322.431	-0.01168	1322.419	
SUM	59.133	59.121	19.656	19.644				

SUM ∑BS-∑FS= 0.012 ∑Rise-∑Fall 0.012 error=calculated-known Difference

∑BS-∑FS=∑Rise-∑Fall error= 0.012m

Permissible=5√Nmm where, N=Number of Setups(Number of Change points +1)=5√38=31mm

Tribhuvan University
Institute of Engineering
Pulchowk Campus
Department of Civil Engineering
Survey Instruction Committee

Group no: 3

Observer: Group 3
Recorder: Group 3
Instrument: Total Station

Weather:
Temperature:
Date:

DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
3M19	3M20	1.35	0	0	0	111.516	0.031	0.000	75.524	3063338.211	627261.157	1321.810	
(HI)=1.051	1	1.35	96	24	24	3.186	0.035	96.407	171.931	3063307.182	627153.628	1321.834	
	2	1.35	200	0	19	63.801	0.169	200.005	275.530	3063316.484	627089.677	1321.753	
	3	1.35	70	45	2	27.714	-0.027	70.751	146.275	3063287.286	627168.568	1321.665	
	4	1.35	63	5	38	37.805	-1.287	63.094	138.618	3063281.970	627178.173	1321.571	
	5	1.35	52	12	19	94.039	-1.272	52.205	127.730	3063252.790	627227.557	1321.466	
	6	1.35	246	36	38	8.013	-0.393	246.611	322.135	3063316.662	627148.263	1321.520	
	7	1.35	358	38	29	13.814	-0.639	358.641	109.170	3063305.800	627166.229	1321.300	
	8	1.35	242	45	2	17.733	-0.454	242.751	318.275	3063323.571	627141.379	1321.524	
	9	1.35	351	41	50	22.788	-0.766	351.697	102.226	3063305.510	627175.452	1321.671	
	10	1.35	5	3	42	42.122	-0.850	5.062	80.586	3063317.226	627194.736	1321.589	
	11	1.35	5	33	28	52.374	-1.034	5.558	81.082	3063318.455	627204.922	1321.720	
	12	1.35	1	33	54	58.573	-1.148	1.565	77.089	3063323.423	627210.273	1321.769	
	13	1.35	14	34	59	35.154	-0.803	14.583	90.107	3063310.270	627188.335	1321.785	
	14	1.35	20	52	47	44.078	-0.796	20.880	96.404	3063305.419	627196.984	1322.006	
	15	1.35	25	35	0	47.264	-0.816	25.583	101.108	3063301.230	627199.560	1322.060	EC
	16	1.35	1	16	39	59.067	-1.160	1.278	76.802	3063323.822	627210.688	1322.278	EC
	17	1.35	358	1	17	61.516	-1.274	358.021	108.550	3063290.766	627211.501	1321.768	
	18	1.35	347	19	41	71.484	-1.379	347.328	97.857	3063300.565	627223.994	1321.801	
	19	1.35	344	30	33	76.684	-1.402	344.509	95.038	3063303.602	627229.569	1321.907	
	20	1.35	347	25	33	82.442	-1.394	347.426	97.954	3063298.927	627234.830	1322.154	
	21	1.35	349	8	47	80.010	-1.396	349.146	99.675	3063296.890	627232.053	1322.173	
	22	1.35	348	27	37	77.368	-1.361	348.460	98.989	3063298.248	627229.599	1322.311	
	23	1.35	349	47	48	74.146	-1.409	349.797	100.325	3063297.046	627226.126	1322.351	
	24	1.35	357	30	37	66.710	-1.306	357.510	108.039	3063289.679	627216.612	1322.368	
	25	1.35	4	55	59	54.404	-1.181	4.933	80.457	3063319.355	627206.832	1322.365	
	26	1.35	7	43	32	69.153	-1.230	7.726	83.250	3063318.464	627221.855	1322.370	
	27	1.35	10	46	11	78.313	-1.392	10.770	86.294	3063315.398	627231.330	1322.292	
	28	1.35	14	43	30	79.807	-1.326	14.725	90.249	3063309.989	627232.987	1322.440	
	29	1.35	19	20	27	80.093	-1.330	19.341	94.865	3063303.543	627232.985	1322.416	
	30	1.35	22	32	34	78.489	-1.262	22.543	98.067	3063299.321	627230.893	1322.434	

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Group no: 3

Observer: Group 3

Recorder: Group 3

Instrument: Total Station

Weather:

Temperature:

Date:

DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	31	1.35	25	41	7	75.333	-1.460	25.685	101.210	3063295.691	627227.077	1322.782	
	32	1.35	16	53	54	62.154	-0.160	16.898	92.423	3063307.709	627215.279	1322.724	CENTER
	33	1.51	317	15	32	46.796	-0.673	317.259	67.787	3063328.027	627196.504	1322.798	RIGHT SMALL
	34	1.51	309	4	39	55.535	-1.130	309.078	59.606	3063338.434	627201.084	1322.702	
3m6	3M19	1.35	0	0	0	67.496	1.086	0.000	305.935	3063310.040	627153.590	1321.476	
HI=1.255	35	1.35	45	51	10	20.003	0.611	45.853	351.787	3063290.227	627205.383	1321.583	GATE
	36	1.35	53	29	46	18.332	0.619	53.496	359.431	3063288.760	627208.058	1321.679	GATE
	37	1.35	29	11	18	16.307	0.190	29.188	335.123	3063285.223	627201.381	1321.558	TRAIL
	38	1.35	21	1	48	15.424	0.093	21.030	326.965	3063283.359	627199.832	1321.407	TRAIL
	39	1.45	22	31	13	35.078	0.608	22.520	328.455	3063300.323	627189.889	1321.903	POST
	40	1.45	24	29	47	35.865	0.668	24.496	330.431	3063301.623	627190.542	1322.025	POST
	41	1.45	350	10	7	37.182	0.313	350.169	296.103	3063286.789	627174.851	1322.021	PARKING
	42	1.45	8	41	1	38.895	0.284	8.684	314.618	3063297.748	627180.555	1322.144	PARKING
	43	1.45	7	12	45	43.588	0.004	7.213	313.147	3063300.238	627176.439	1322.178	GP
	44	1.45	7	7	38	19.443	0.195	7.127	313.062	3063283.704	627194.035	1322.862	GP
	45	1.45	357	31	54	17.704	0.101	357.532	303.466	3063280.192	627193.472	1322.866	GP
	46	1.45	29	0	4	16.803	0.057	29.001	334.936	3063285.650	627201.122	1322.829	GP
	47	1.45	40	16	28	10.903	0.146	40.274	346.209	3063281.018	627205.641	1322.883	GP
	48	1.45	65	8	36	8.929	0.128	65.143	11.078	3063279.192	627209.956	1323.139	GP
	49	1.45	74	58	23	11.247	0.044	74.973	20.908	3063280.935	627212.254	1323.203	GP
	50	1.45	77	49	0	13.385	0.530	77.817	23.751	3063282.680	627213.631	1323.183	GP
	51	1.45	93	11	56	12.489	0.123	93.199	39.133	3063280.116	627216.123	1323.578	GP
	52	1.35	19	37	32	5.489	-0.018	19.626	325.560	3063274.956	627205.136	1323.869	GP
	53	1.35	12	10	55	6.670	-0.009	12.182	318.117	3063275.395	627203.787	1324.353	GP
	54	1.35	320	32	27	6.173	-0.054	320.541	266.475	3063270.049	627202.079	1324.395	GP
	55	1.35	327	39	58	4.578	-0.014	327.666	273.601	3063270.716	627203.671	1325.064	GP
	56	1.35	182	5	21	27.666	-0.114	182.089	128.024	3063253.387	627230.034	1325.164	GP
	57	1.35	179	4	39	27.645	-0.115	179.078	125.012	3063254.568	627230.883	1325.902	GP

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
3m7	3m6	1.35	0	0	0	73.609	1.024	0.000	232.420	3063270.356	627208.146	1324.000	MINOR STATION
(HI=1.475)	58	1.35	77	36	31	55.595	0.770	77.609	310.029	3063351.005	627223.911	1323.949	MATH CORNER
	59	1.35	82	1	7	46.687	0.776	82.019	314.439	3063347.936	627233.147	1323.888	MATH CORNER
	60	1.35	78	30	42	47.331	0.761	78.512	310.932	3063346.257	627230.723	1323.115	ROAD CORNER
	61	1.35	75	18	55	45.932	0.800	75.315	307.736	3063343.359	627230.156	1323.283	ROAD CORNER
	62	1.35	74	26	4	44.428	0.602	74.434	306.855	3063341.895	627230.932	1322.668	MATH CORNER
	63	1.35	79	39	39	35.185	0.590	79.661	312.081	3063338.828	627240.367	1322.685	MATH CORNER
	64	1.35	88	35	49	32.285	0.724	88.597	321.017	3063340.344	627246.171	1322.414	MATH CORNER
	65	1.35	98	10	27	30.740	0.694	98.174	330.594	3063342.027	627251.388	1322.443	MATH CORNER
	66	1.35	106	3	40	35.357	0.588	106.061	338.481	3063348.140	627253.512	1322.251	MATH CORNER
	67	1.35	112	27	23	31.075	0.551	112.456	344.877	3063345.247	627258.374	1321.501	MATH CORNER
	68	1.35	118	7	48	35.824	0.588	118.130	350.550	3063350.586	627260.600	1321.470	STAIR CASE
	69	1.35	120	22	38	38.836	0.591	120.377	352.797	3063353.777	627261.612	1320.851	STAIR CASE
	70	1.35	122	55	6	38.040	0.600	122.918	355.339	3063353.162	627263.390	1320.825	STAIR CASE
	71	1.35	120	54	57	35.000	0.603	120.916	353.336	3063350.011	627262.420	1321.287	STAIR CASE
	72	1.35	120	27	54	35.148	0.884	120.465	352.885	3063350.125	627262.128	1321.251	STAIR CASE
	73	1.35	122	32	33	38.111	0.880	122.543	354.963	3063353.212	627263.135	1321.253	STAIR CASE
	74	1.3	119	46	23	14.402	-0.707	119.773	352.193	3063329.516	627264.525	1321.231	DRAIN CORNER
	75	1.3	120	37	51	14.547	-0.712	120.631	353.051	3063329.688	627264.721	1321.310	MET.. CORNER
	76	1.3	157	5	13	13.299	-0.783	157.087	29.507	3063326.822	627273.032	1320.758	DRAIN CORNER
	77	1.3	157	12	54	13.436	-0.792	157.215	29.635	3063326.926	627273.125	1320.791	MET.. CORNER
	78	1.3	224	55	19	11.728	-0.636	224.922	97.342	3063313.749	627278.113	1320.094	STAIR CASE
	79	1.89	237	16	44	16.063	-0.242	237.279	109.699	3063309.833	627281.604	1320.098	HYDRO CORNER
	80	1.91	236	41	30	16.182	-0.228	236.692	109.112	3063309.950	627281.771	1320.006	GP
	81	1.35	264	59	42	18.595	-0.757	264.995	137.415	3063301.557	627279.064	1319.926	GP
	82	1.35	265	55	28	18.520	-0.775	265.924	138.345	3063301.410	627278.791	1319.749	GP
	83	1.35	270	49	21	19.270	-0.248	270.823	143.243	3063299.809	627278.013	1320.060	GP
	84	1.35	272	45	36	18.428	-0.056	272.760	145.180	3063300.119	627277.004	1320.177	GP
	85	1.35	233	21	43	11.874	-0.053	233.362	105.782	3063312.018	627277.908	1320.117	GP
	86	1.35	240	39	56	10.062	-0.029	240.666	113.086	3063311.302	627275.738	1320.101	GP

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	87	1.71	241	45	20	11.981	0.188	241.756	114.176	3063310.341	627277.412	1320.042	GP
	88	1.35	245	54	39	8.094	-0.046	245.911	118.331	3063311.407	627273.606	1320.022	GP
	89	1.35	243	39	21	5.087	-0.052	243.656	116.076	3063313.012	627271.051	1320.239	GP
	90	1.71	240	40	3	4.944	-0.726	240.668	113.088	3063313.309	627271.029	1320.503	GP
	91	1.35	242	13	15	9.147	-0.776	242.221	114.641	3063311.434	627274.795	1320.832	GP
	92	1.35	208	5	14	3.167	-0.742	208.087	80.507	3063315.770	627269.605	1320.779	GP
	93	1.35	171	53	0	4.236	-0.762	171.883	44.304	3063318.279	627269.440	1320.209	GP
	94	1.35	166	24	39	9.639	-0.840	166.411	38.831	3063322.757	627272.525	1320.777	GP
	95	1.6	160	47	46	10.092	-0.219	160.796	33.216	3063323.691	627272.010	1320.758	GP
	96	1.6	159	20	19	9.991	0.326	159.339	31.759	3063323.743	627271.740	1321.623	GP
	97	1.35	164	33	51	9.539	-0.070	164.564	36.984	3063322.867	627272.220	1322.056	GP
	98	1.35	155	34	34	8.951	-0.023	155.576	27.996	3063323.151	627270.683	1322.358	GP
	99	1.82	206	40	14	2.728	0.347	206.671	79.091	3063315.764	627269.160	1322.453	GP
	100	1.82	350	3	30	11.396	0.001	350.058	222.479	3063306.843	627258.786	1321.761	STAIRCASE
	101	1.82	348	10	47	11.400	-0.105	348.180	220.600	3063306.592	627259.063	1319.649	STAIRCASE
	102	1.82	334	32	14	12.158	-0.092	334.537	206.957	3063304.411	627260.970	1319.265	STAIRCASE
	103	1.82	333	20	44	12.288	-0.030	333.346	205.766	3063304.181	627261.140	1318.484	STAIRCASE
	104	1.82	334	41	9	13.198	0.349	334.686	207.106	3063303.499	627260.468	1313.412	STAIRCASE
	105	1.82	350	6	33	12.804	0.342	350.109	222.529	3063305.812	627257.826	1319.371	STAIRCASE
	106	1.82	350	2	56	16.884	0.417	350.049	222.469	3063302.793	627255.081	1319.793	ROAD
	107	1.82	347	1	11	25.283	0.396	347.020	219.440	3063295.722	627250.420	1320.340	ROAD
	108	1.82	344	15	47	30.629	0.377	344.263	216.683	3063290.685	627248.184	1319.560	ROAD
	109	1.82	343	17	28	33.271	0.386	343.291	215.711	3063288.233	627247.061	1319.348	ROAD
	110	1.82	344	56	50	34.506	0.479	344.947	217.367	3063287.824	627245.539	1319.482	ROAD
	111	1.82	347	4	41	33.315	0.719	347.078	219.498	3063289.540	627245.291	1319.483	POLE
	112	1.82	359	31	4	37.753	0.446	359.518	231.938	3063291.973	627236.757	1319.285	STAIRCASE
	113	1.82	2	23	11	38.518	0.789	2.386	234.807	3063293.048	627235.004	1319.380	STAIRCASE
	114	2.3	4	53	18	39.513	1.917	4.888	237.309	3063293.906	627233.228	1319.325	STAIRCASE
	115	2.3	7	37	59	40.518	1.974	7.633	240.053	3063295.021	627231.373	1319.514	STAIRCASE
	116	2.3	9	39	35	41.704	2.017	9.660	242.080	3063295.720	627229.632	1319.323	STAIRCASE
	117	2.3	9	45	43	45.898	2.044	9.762	242.182	3063293.829	627225.888	1319.300	ROAD

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	118	2.3	7	5	9	44.182	2.054	7.086	239.506	3063292.828	627228.411	1319.260	STAIRCASE
	119	2.3	4	9	32	43.062	1.849	4.159	236.579	3063291.530	627230.540	1319.246	
	120	1.35	2	41	25	42.356	0.775	2.690	235.111	3063291.020	627231.739	1319.417	
	121	1.35	0	19	33	41.349	0.615	0.326	232.746	3063290.217	627233.569	1319.421	
	122	1.35	357	44	2	40.357	0.392	357.734	230.154	3063289.390	627235.496	1319.387	
	123	1.35	342	28	13	37.772	0.424	342.470	214.891	3063284.265	627244.875	1319.876	
	124	1.35	338	51	46	41.880	0.433	338.863	211.283	3063279.457	627244.735	1319.706	
	125	1.35	334	22	7	43.771	0.417	334.369	206.789	3063276.175	627246.754	1320.011	
	126	1.35	334	59	36	41.781	0.426	334.993	207.414	3063278.158	627247.245	1320.089	
	127	1.35	335	23	34	37.529	0.414	335.393	207.813	3063282.054	627248.971	1320.458	
	128	1.35	337	39	50	32.210	0.416	337.664	210.084	3063287.377	627250.335	1321.023	
	129	1.35	338	57	39	29.332	0.335	338.961	211.381	3063290.206	627251.207	1321.312	
	130	1.35	340	44	31	23.074	0.391	340.742	213.162	3063295.932	627253.860	1320.907	
	131	1.35	335	10	14	12.962	0.346	335.171	207.591	3063303.760	627260.478	1320.524	
	132	1.35	269	1	18	20.278	-0.355	269.022	141.442	3063299.391	627279.121	1320.714	
	133	1.35	269	47	21	20.183	-0.314	269.789	142.209	3063299.298	627278.849	1321.389	
	134	1.35	276	10	57	21.960	-0.204	276.183	148.603	3063296.503	627277.922	1321.313	
	135	2	294	25	14	28.360	0.658	294.421	166.841	3063287.632	627272.938	1321.778	
	136	1.6	294	37	58	27.973	0.630	294.633	167.053	3063287.986	627272.749	1321.034	
	137	1.35	299	9	29	26.754	0.393	299.158	171.578	3063288.782	627270.400	5263.461	
	138	1.35	303	6	51	28.240	0.383	303.114	175.534	3063287.093	627268.680	1321.703	
	139	1.35	301	39	2	29.334	0.299	301.651	174.071	3063286.071	627269.512	1321.401	
	140	1.35	309	11	9	28.923	0.305	309.186	181.606	3063286.336	627265.671	1321.734	
	141	1.35	317	39	54	33.013	0.295	317.665	190.085	3063282.745	627260.700	1321.570	
	142	1.35	318	23	55	33.308	0.239	318.399	190.819	3063282.532	627260.229	1321.644	
	143	1.35	318	11	48	33.314	0.314	318.197	190.617	3063282.504	627260.344	1321.867	
	144	2	319	32	54	36.077	1.021	319.548	191.969	3063279.955	627259.000	1322.112	
	145	1.35	318	30	22	36.512	0.444	318.506	190.926	3063279.398	627259.561	1321.987	
	146	1.35	315	37	38	40.963	0.313	315.627	188.047	3063274.688	627260.747	1322.156	
	147	1.35	309	56	54	43.522	0.283	309.948	182.369	3063271.763	627264.683	1322.082	
	148	1.35	311	21	18	43.889	0.306	311.355	183.775	3063271.454	627263.592	1321.973	

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			degrees(d)	minutes(m)	seconds(s)								
	149	1.35	310	51	4	46.306	0.359	310.851	183.271	3063269.017	627263.839	1321.997	
	150	1.35	310	33	57	46.217	0.402	310.566	182.986	3063269.093	627264.074	1322.572	
	151	1.35	307	34	36	46.980	0.404	307.577	179.997	3063268.268	627266.484	1322.600	
	152	1.35	310	19	25	56.351	-0.160	310.324	182.744	3063258.961	627263.784	1323.115	
	153	1.35	308	34	59	56.682	-0.230	308.583	181.003	3063258.574	627265.489	1322.600	
	154	1.35	182	47	30	12.056	-0.299	182.792	55.212	3063322.126	627276.383	1322.500	
	155	1.35	193	7	9	9.770	-0.127	193.119	65.539	3063319.293	627275.375	1321.921	
	156	1.35	227	7	4	14.725	-0.754	227.118	99.538	3063312.808	627281.003	1321.964	
	157	1.35	44	14	43	20.265	1.550	44.245	276.666	3063317.600	627246.353	1321.639	
	158	1.35	24	3	25	16.676	0.541	24.057	256.477	3063311.348	627250.268	1321.560	
	159	1.35	59	41	29	11.914	0.549	59.691	292.112	3063319.732	627255.444	1322.107	
	160	1.35	61	19	51	9.413	0.538	61.331	293.751	3063319.039	627257.866	1322.938	
	161	1.35	60	43	14	6.416	0.218	60.721	293.141	3063317.769	627260.582	1322.950	
	162	1.35	60	14	31	4.235	-0.118	60.242	292.662	3063316.879	627262.573	1323.338	
	163	1.35	101	3	49	3.968	-0.143	101.064	333.484	3063318.798	627264.710	1323.729	
	164	1.35	99	19	22	7.781	-0.007	99.323	331.743	3063322.102	627262.798	1323.776	
	165	1.35	95	29	38	11.469	0.497	95.494	327.914	3063324.965	627260.389	1323.847	
	166	1.35	89	52	1	15.549	0.654	89.867	322.287	3063327.548	627256.970	1324.460	
	167	1.35	23	27	22	13.070	0.466	23.456	255.876	3063312.058	627253.806	1323.831	
	168	1.35	23	14	57	9.359	0.430	23.249	255.669	3063312.931	627257.414	1323.654	
	169	1.35	23	16	40	5.487	-0.131	23.278	255.698	3063313.892	627261.164	1323.949	
	170	1.35	314	58	57	7.311	-0.202	314.983	187.403	3063307.998	627265.539	1323.383	
	171	1.35	317	27	10	11.488	-0.060	317.453	189.873	3063303.930	627264.512	1323.412	
	172	1.35	314	0	9	15.057	0.317	314.003	186.423	3063300.285	627264.797	1322.808	
	173	1.35	314	27	3	19.678	0.319	314.451	186.871	3063295.711	627264.127	1322.865	
	174	1.35	288	44	32	19.771	0.320	288.742	161.162	3063296.536	627272.865	1322.876	
	175	1.35	287	15	13	15.246	0.009	287.254	159.674	3063300.951	627271.777	1322.709	
	176	1.35	286	3	59	12.048	-0.208	286.066	158.487	3063304.039	627270.900	1322.657	
	177	1.35	287	3	28	7.528	-0.199	287.058	159.478	3063308.197	627269.120	1322.060	
	178	1.35	358	1	12	4.920	-0.119	358.020	230.440	3063312.114	627262.688	1321.928	
	179	1.35	354	44	35	9.777	-0.116	354.743	227.163	3063308.600	627259.312	1321.918	

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Group no: 3

Observer: Group 3
Recorder: Group 3
Instrument: Total Station

DETAILING

Weather:
Temperature:
Date:

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	180	1.35	353	53	33	14.684	0.375	353.893	226.313	3063305.105	627255.863	1322.073	
	181	1.35	353	7	18	17.565	0.401	353.122	225.542	3063302.945	627253.944	1321.862	
3m8													
(HI=1.476)	3m9	1.35	122	15	0	57.157	-0.025	122.250	123.513	3063226.851	627312.884	1321.612	
	182	1.35	195	29	10	5.476	-0.112	195.486	196.749	3063253.165	627263.650	1321.106	
	183	1.35	197	25	42	13.669	-0.081	197.428	198.691	3063245.461	627260.848	1321.109	
	184	1.83	209	2	56	18.456	0.379	209.049	210.312	3063242.476	627255.913	1320.784	
	185							0.000	1.263	3063258.409	627265.228	1320.101	
	186	1.35	223	44	40	25.049	-0.139	223.744	225.007	3063240.699	627247.514	1320.273	
	187	1.35	223	54	57	30.546	-0.132	223.916	225.179	3063236.877	627243.562	1319.648	
	188	1.35	230	9	50	33.140	-0.115	230.164	231.427	3063237.746	627239.319	1319.611	
	189	1.35	220	47	30	27.220	-0.258	220.792	222.055	3063238.198	627246.995	1319.643	
	190	1.35	226	24	27	26.851	-0.216	226.408	227.670	3063240.328	627245.378	1319.664	
	191	1.35	226	10	58	25.930	-0.207	226.183	227.446	3063240.873	627246.127	1319.239	
	192	1.35	232	9	11	24.681	-0.172	232.153	233.416	3063243.699	627245.410	1319.156	
	193	1.35	238	10	59	20.541	-0.131	238.183	239.446	3063247.967	627247.539	1318.321	
	194	1.35	247	53	10	20.259	0.449	247.886	249.149	3063251.198	627246.296	1318.756	
	195	1.35	257	44	42	20.074	0.417	257.745	259.008	3063254.581	627245.523	1318.655	
	196	1.35	257	54	34	16.995	0.449	257.909	259.172	3063255.216	627248.536	1321.603	
	197	1.35	250	39	31	17.185	0.444	250.659	251.922	3063253.076	627248.892	1319.490	
	198	1.35	237	56	12	17.807	-0.123	237.937	239.200	3063249.291	627249.933	1319.515	
	199	1.35	229	35	29	14.930	-0.168	229.591	230.854	3063248.984	627253.649	1320.203	
	200	1.35	214	44	25	15.210	-0.207	214.740	216.003	3063246.104	627256.287	1320.426	
	201	1.35	214	36	6	15.207	-0.207	214.602	215.865	3063246.085	627256.319	1320.900	
	202	1.82	212	40	18	14.226	1.012	212.672	213.935	3063246.606	627257.287	1320.966	
	203	1.82	209	15	49	14.871	0.390	209.264	210.527	3063245.599	627257.675	1321.351	
	204	2.3	216	6	52	13.547	1.403	216.114	217.377	3063247.644	627257.004	1321.532	
	205	1.35	229	24	3	16.570	0.572	229.401	230.664	3063247.906	627252.412	1321.908	
	206	2.18	133	30	18	11.945	0.690	133.505	134.768	3063249.997	627273.709	1322.018	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
3m9	3m8	1.35	0	0	0	57.148	0.717	0.000	303.518	3063258.388	627265.261	1321.253	
(HI	208	1.35	356	55	54	45.362	0.514	356.932	300.450	3063249.819	627273.800	1322.181	
=1.483)	209	1.35	0	7	44	30.739	0.502	0.129	303.647	3063243.862	627287.316	1322.851	
	210	1.35	357	32	20	32.570	0.598	357.539	301.057	3063243.633	627285.004	1322.955	
	211	1.35	354	59	33	31.217	0.493	354.993	298.511	3063241.731	627285.474	1322.939	
	212	1.35	358	19	22	29.696	0.428	358.323	301.841	3063242.497	627287.678	1323.403	
	213	1.35	1	51	33	26.717	0.234	1.859	305.377	3063242.298	627291.122	1323.423	
	214	1.35	5	13	40	24.161	0.124	5.228	308.746	3063241.952	627294.062	1323.732	
	215	1.35	2	26	53	22.673	0.047	2.448	305.966	3063240.146	627294.555	1324.099	
	216	1.35	9	56	50	17.735	-0.027	9.947	313.466	3063239.030	627300.034	1324.793	
	217	1.35	5	53	21	15.741	-0.003	5.889	309.407	3063236.823	627300.743	1324.861	
	218	1.35	7	51	27	9.799	-0.087	7.858	311.376	3063233.307	627305.552	1324.821	
	219	1.35	9	59	15	9.306	-0.183	9.988	313.506	3063233.237	627306.156	1324.844	
	220	1.35	352	48	52	7.827	-0.089	352.814	296.333	3063230.302	627305.891	1325.388	
	221	1.35	343	53	58	6.748	-0.023	343.899	287.418	3063228.850	627306.467	1325.456	
	222	1.35	336	42	19	5.970	-0.006	336.705	280.224	3063227.890	627307.030	1325.935	
	223	1.35	327	20	41	4.732	-0.056	327.345	270.863	3063226.901	627308.174	1325.994	
	224	1.35	321	0	4	3.902	-0.101	321.001	264.519	3063226.458	627309.021	1325.957	
	225	1.35	309	41	26	2.829	-0.135	309.691	253.209	3063226.013	627310.197	1325.962	
	226	1.35	287	17	6	1.439	-0.168	287.285	230.803	3063225.921	627311.790	1325.960	
	227	1.35	171	6	30	0.833	-0.123	171.108	114.627	3063226.483	627313.663	1325.624	
	228	1.35	189	23	14	1.933	-0.124	189.387	132.906	3063225.514	627314.321	1325.509	
	229	1.35	185	26	28	3.792	-0.180	185.441	128.959	3063224.446	627315.854	1325.267	
	230	1.35	152	42	0	8.140	-0.206	152.700	96.218	3063225.949	627320.997	1324.628	
	231	1.35	109	34	37	8.873	-0.214	109.577	53.095	3063232.158	627320.001	1324.625	
	232	1.35	72	31	20	8.737	-0.233	72.522	16.041	3063235.227	627315.320	1322.268	
	233	1.35	38	32	20	10.363	-0.147	38.539	342.057	3063236.689	627309.713	1321.655	
	234	1.35	32	43	21	8.766	-0.134	32.723	336.241	3063234.853	627309.374	1321.653	
	235	1.35	21	26	57	8.342	-0.112	21.449	324.967	3063233.661	627308.117	1320.859	
	236	1.35	9	39	47	7.500	-0.105	9.663	313.181	3063231.963	627307.436	1320.932	
	237	1.35	356	56	25	6.047	-0.123	356.940	300.459	3063229.896	627307.693	1320.524	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	238	1.35	344	15	41	3.457	-0.156	344.261	287.780	3063227.886	627309.613	1320.429	
	239	1.35	349	45	25	1.704	-0.167	349.757	293.275	3063227.504	627311.340	1319.861	
	240	1.35	65	3	34	1.217	-0.224	65.059	8.578	3063228.034	627313.087	1318.378	
	241	1.35	89	11	58	2.926	-0.054	89.199	32.718	3063229.292	627314.487	1318.357	
	242	1.35	96	33	53	2.977	-0.055	96.565	40.083	3063229.108	627314.822	1317.366	
	243	1.35	135	7	40	2.357	-0.220	135.128	78.646	3063227.294	627315.216	1317.413	
	244	1.35	156	7	43	5.386	-0.213	156.129	99.647	3063225.928	627318.215	1317.306	
	245	1.35	124	51	25	7.760	-0.212	124.857	68.375	3063229.690	627320.119	1316.528	
	246	1.35	104	49	5	6.838	-0.277	104.818	48.336	3063231.376	627318.014	1316.063	
	247	1.35	103	56	25	5.888	-0.059	103.940	47.459	3063230.811	627317.244	1315.487	
	248	1.35	97	58	0	4.787	-0.075	97.967	41.485	3063230.416	627316.076	1314.944	
	249	1.35	85	56	56	4.454	-0.001	85.949	29.467	3063230.708	627315.096	1315.466	
	250	1.35	70	23	21	6.883	-0.058	70.389	13.907	3063233.511	627314.560	1315.892	
	251	1.35	43	2	40	8.664	-0.045	43.044	346.563	3063235.257	627310.892	1317.264	
	252	1.35	311	40	3	4.466	-0.058	311.668	255.186	3063225.688	627308.588	1318.127	
	253	1.35	302	8	33	6.679	-0.189	302.143	245.661	3063224.078	627306.820	1319.171	
	254	1.35	290	19	48	5.653	-0.399	290.330	233.848	3063223.495	627308.341	1319.770	
	255	1.35	348	40	25	5.516	-0.099	348.674	292.192	3063228.914	627307.798	1320.150	
3m1													
(HI =	3m2	2.01	0	0	0	71.891	-0.087	0.000	10.471	3063425.865	627211.872	1322.368	
1.307)	M17	1.3	215	2	21	63.956	1.065	215.039	225.510	3063310.351	627153.183	1322.493	
	256	1.35	241	56	55	19.775	0.101	241.949	252.419	3063349.198	627179.956	1322.836	
	257	1.35	246	45	27	17.809	0.038	246.758	257.228	3063351.234	627181.439	1322.488	
	258	1.35	241	54	37	19.080	0.096	241.910	252.381	3063349.396	627180.622	1323.212	
	259	1.35	242	36	12	19.447	0.169	242.603	253.074	3063349.509	627180.203	1322.496	
	260	1.35	271	22	35	16.369	0.583	271.376	281.847	3063358.531	627182.787	1322.492	
	261	1.35	277	55	21	16.307	0.602	277.923	288.393	3063360.316	627183.333	1322.875	
	262	1.35	278	15	33	15.646	0.088	278.259	288.730	3063360.195	627183.990	1323.003	
	263	1.35	270	55	35	15.745	0.099	270.926	281.397	3063358.282	627183.373	1322.967	
	264	1.35	303	26	16	17.088	0.063	303.438	313.908	3063367.022	627186.496	1322.966	

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	265	1.35	302	26	26	17.945	0.655	302.441	312.911	3063367.389	627185.664	1323.639	
	266	1.35	307	12	59	18.843	0.655	307.216	317.687	3063369.105	627186.123	1323.693	
	267	1.35	319	3	26	21.916	0.845	319.057	329.528	3063374.060	627187.693	1323.795	
	268	1.35	326	34	20	19.559	0.646	326.572	337.043	3063373.181	627191.178	1324.257	
	269	1.35	332	12	58	17.941	0.632	332.216	342.687	3063372.299	627193.468	1324.634	
	270	1.35	330	44	25	17.092	-0.061	330.740	341.211	3063371.352	627193.302	1324.624	
	271	1.35	339	54	42	16.621	0.646	339.912	350.382	3063371.558	627196.030	1324.601	
	272	1.35	341	55	48	17.784	0.643	341.930	352.401	3063372.799	627196.455	1324.253	
	273	1.35	341	45	35	16.395	0.405	341.760	352.230	3063371.415	627196.591	1325.454	
	274	1.7	343	45	41	17.519	0.765	343.761	354.232	3063372.601	627197.047	1324.531	
	275	1.7	5	20	49	14.554	0.314	5.347	15.818	3063369.174	627202.774	1324.563	
	276	1.7	12	8	8	14.114	0.330	12.136	22.606	3063368.200	627204.233	1324.548	
	277	1.35	15	17	49	11.585	-0.109	15.297	25.768	3063365.604	627203.844	1324.417	
	278	1.35	20	45	24	7.902	-0.035	20.757	31.227	3063361.928	627202.904	1324.805	
	279	1.35	52	52	36	5.309	-0.062	52.877	63.347	3063357.552	627203.552	1324.755	
	280	1.35	89	4	10	7.404	-0.066	89.069	99.540	3063353.944	627206.109	1324.779	
	281	1.35	98	27	14	16.860	-0.100	98.454	108.924	3063349.703	627214.756	1323.940	
	282	1.35	84	47	49	17.705	-0.063	84.797	95.268	3063353.545	627216.438	1323.968	
	283	1.35	79	30	59	12.762	-0.060	79.516	89.987	3063355.174	627211.569	1323.650	
	284	1.35	58	16	18	9.025	-0.038	58.272	68.742	3063358.443	627207.218	1322.896	
	285	1.35	35	31	25	11.152	-0.035	35.524	45.994	3063362.919	627206.829	1322.337	
	286	1.35	24	56	50	17.167	-0.055	24.947	35.418	3063369.161	627208.756	1322.260	
	287	1.9	2	30	27	16.238	0.504	2.508	12.978	3063370.994	627202.454	1322.341	
	288	1.35	11	49	45	16.765	-0.027	11.829	22.300	3063370.682	627205.169	1322.308	
	289	1.35	11	59	6	21.218	-0.058	11.985	22.456	3063374.780	627206.912	1322.090	
	295	1.6	12	39	35	47.567	0.202	12.660	23.130	3063398.914	627217.493	1320.499	
	296	1.6	15	25	34	45.286	0.239	15.426	25.897	3063395.909	627218.586	1321.038	
	297	1.6	18	2	0	31.178	0.309	18.033	28.504	3063382.570	627213.686	1321.223	
	298	1.6	32	8	55	33.561	0.143	32.149	42.619	3063379.867	627221.532	1320.656	
	299	1.6	47	29	40	29.820	-0.016	47.494	57.965	3063370.988	627224.086	1321.517	
	300	1.6	77	57	41	21.213	-0.187	77.961	88.432	3063355.751	627220.012	1320.761	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	301	1.6	76	58	46	25.843	-0.228	76.979	87.450	3063356.321	627224.625	1321.148	
	302	1.6	88	9	57	24.538	-0.141	88.166	98.636	3063351.486	627223.067	1322.819	
	303	1.8	37	19	20	35.852	0.544	37.322	47.793	3063379.257	627225.364	1312.785	
	304	2.15	20	22	22	49.565	0.811	20.373	30.843	3063397.726	627224.219	1321.286	
	305	2.15	15	15	6	52.991	0.638	15.252	25.722	3063402.911	627221.806	1321.295	
	306	2.15	21	52	30	48.578	0.787	21.875	32.346	3063396.211	627224.798	1321.282	
	308	2.15	14	40	56	52.811	0.792	14.682	25.153	3063402.974	627221.254	1321.312	
	309	2.15	14	19	10	55.847	0.747	14.319	24.790	3063405.872	627222.224	1321.154	
	310	2.15	11	24	58	60.549	1.924	11.416	21.887	3063411.356	627221.378	1320.907	
	313	2.15	22	8	51	50.208	0.307	22.148	32.618	3063397.460	627225.871	1321.167	
	314	3.88	25	27	48	51.298	1.325	25.463	35.934	3063396.707	627228.912	1320.507	
	315	3.88	28	33	12	49.750	1.901	28.553	39.024	3063393.821	627230.132	1320.586	
	316	2.15	32	40	33	41.966	0.157	32.676	43.146	3063385.790	627227.506	1320.599	
	317	1.9	33	18	28	40.612	0.586	33.308	43.778	3063384.494	627226.906	1320.638	
	318	1.35	30	23	35	28.039	-0.033	30.393	40.864	3063376.376	627217.152	1320.531	
	319	1.35	29	52	29	22.998	-0.010	29.875	40.345	3063372.699	627213.696	1320.188	
	320	1.35	30	20	15	16.855	-0.085	30.338	40.808	3063367.928	627209.823	1320.515	
	321	1.35	28	47	4	5.937	-0.092	28.784	39.255	3063359.768	627202.564	1320.641	
	322	1.35	321	18	30	4.079	-0.213	321.308	331.779	3063358.765	627196.878	1320.637	
	323	1.35	323	4	21	7.403	-0.194	323.073	333.543	3063361.799	627195.509	1320.536	
	324	1.35	324	44	8	11.302	-0.103	324.736	335.206	3063365.431	627194.068	1320.596	
	325	1.35	326	5	16	15.681	-0.120	326.088	336.558	3063369.558	627192.569	1320.642	
	326	1.35	299	31	35	15.443	-0.055	299.526	309.997	3063365.097	627186.977	1319.698	
	327	1.35	298	1	50	12.211	-0.154	298.031	308.501	3063362.773	627189.251	1318.882	
	328	1.35	295	22	36	8.553	-0.280	295.377	305.847	3063360.180	627191.874	1319.172	
	329	1.35	291	46	0	4.253	-0.165	291.767	302.237	3063357.440	627195.210	1319.087	
	330	1.35	226	38	28	3.846	-0.258	226.641	237.112	3063353.082	627195.578	1318.263	
	331	1.35	226	33	4	8.243	-0.264	226.551	237.022	3063350.684	627191.892	1318.079	
	332	1.35	225	10	36	13.747	-0.150	225.177	235.647	3063347.414	627187.458	1317.710	
	333	1.35	192	8	25	19.698	-0.159	192.140	202.611	3063336.987	627191.234	1317.730	
	334	1.35	191	39	40	14.373	-0.183	191.661	202.132	3063341.857	627193.392	1322.819	

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Group no: 3

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Recorder: Group 3
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Weather:
Temperature:
Date:

DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	335	1.35	189	39	42	9.852	-0.206	189.662	200.132	3063345.921	627195.416	1322.106	
	336	1.35	186	54	29	4.831	-0.233	186.908	197.379	3063350.560	627197.364	1321.462	
	337	1.35	131	50	19	4.770	-0.230	131.839	142.309	3063351.396	627201.724	1321.393	
	338	1.35	132	32	18	8.491	-0.184	132.538	143.009	3063348.389	627203.916	1321.339	
	339	1.35	132	13	56	13.194	-0.177	132.232	142.703	3063344.675	627206.802	1321.476	
	340	1.35	130	7	46	19.609	-0.114	130.129	140.600	3063340.018	627211.254	1321.397	
	341	1.35	135	40	0	24.678	0.059	135.667	146.137	3063334.679	627212.558	1321.541	
	342	1.35	143	40	56	28.589	0.186	143.682	154.153	3063329.442	627211.271	1321.354	
	343	1.35	151	15	38	32.526	0.406	151.261	161.731	3063324.284	627209.003	1321.388	
	344	1.35	171	33	0	37.077	0.371	171.550	182.021	3063318.117	627197.500	1321.408	
	345	1.35	183	57	45	38.098	0.447	183.963	194.433	3063318.275	627189.311	1321.457	
	346	1.35	194	15	33	39.861	0.448	194.259	204.730	3063318.965	627182.132	1321.534	
	347	1.35	207	20	9	43.753	0.562	207.336	217.806	3063320.602	627171.987	1321.448	
	348	1.35	290	50	52	10.008	-0.045	290.848	301.318	3063360.373	627190.258	1321.568	
	349	1.35	293	50	29	14.592	-0.033	293.841	304.312	3063363.396	627186.755	1321.398	
	350	1.35	250	50	1	15.751	-0.137	250.834	261.304	3063352.789	627183.237	1320.990	
	351	1.35	238	38	50	21.942	0.312	238.647	249.118	3063347.350	627178.307	1320.869	
	352	1.35	229	13	48	27.220	0.071	229.230	239.701	3063341.438	627175.306	1320.881	
	353	1.35	218	53	44	30.260	0.130	218.896	229.366	3063335.465	627175.843	1320.848	
	354	1.35	131	28	22	61.019	0.033	131.473	141.943	3063307.124	627236.422	1320.879	
	355	1.35	132	20	30	42.378	0.006	132.342	142.812	3063321.410	627224.422	1320.944	
	356	1.35	156	39	20	34.946	0.301	156.656	167.126	3063321.103	627206.593	1320.956	
	357	1.35	162	33	3	35.125	0.257	162.551	173.021	3063320.306	627203.075	1321.042	
	358	1.35	218	27	46	47.596	0.397	218.463	228.933	3063323.903	627162.923	1321.038	
3m10 (HI = 1.358)	3m9	1.3	0	0	0	46.439	-0.245	0.000	200.286	3063226.905	627312.933	1319.848	
	359	1.35	48	51	32	49.256	0.501	48.859	249.145	3063252.929	627283.005	1320.544	
	360	1.35	43	52	54	43.216	0.449	43.882	244.168	3063251.633	627290.136	1320.492	
	361	1.35	43	51	24	41.904	0.435	43.857	244.143	3063252.188	627291.325	1320.478	
	362	1.35	32	38	38	37.210	-0.235	32.644	232.930	3063248.034	627299.344	1319.808	
	363	1.35	29	14	57	40.557	-0.229	29.249	229.536	3063244.143	627298.178	1319.814	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	364	1.35	67	19	26	32.946	0.403	67.324	267.610	3063269.090	627296.117	1320.446	
	365	1.35	71	24	23	40.269	0.840	71.406	271.693	3063271.653	627288.783	1320.883	
	366	1.35	85	5	59	38.200	0.399	85.100	285.386	3063280.599	627292.203	1320.442	
	367	1.35	84	59	27	30.991	0.369	84.991	285.277	3063278.630	627299.138	1320.412	
	368	1.35	70	43	19	32.346	0.759	70.722	271.008	3063271.033	627296.693	1320.802	
	369	1.35	105	35	28	32.583	0.363	105.591	305.878	3063289.559	627302.633	1320.406	
	370	1.35	101	0	58	39.324	0.416	101.016	301.303	3063290.895	627295.434	1320.459	
	371	1.35	22	52	25	35.687	-0.127	22.874	223.160	3063244.432	627304.623	1319.916	
	372	1.35	66	9	29	31.002	0.815	66.158	266.444	3063268.541	627298.092	1320.858	
	373	1.35	69	35	31	30.390	0.787	69.592	269.878	3063270.399	627298.644	1320.830	
	374	1.35	64	19	28	28.480	0.270	64.324	264.611	3063267.789	627300.680	1320.313	
	375	1.35	67	57	21	27.788	0.280	67.956	268.242	3063269.611	627301.259	1320.323	
	376	1.35	37	32	1	14.523	-0.309	37.534	237.820	3063262.729	627316.742	1319.734	
	377	1.35	43	27	29	13.163	-0.328	43.458	243.744	3063264.641	627317.229	1319.715	
	378	1.35	353	10	44	11.268	-0.630	353.179	193.465	3063259.506	627326.410	1319.413	
	379	1.35	352	32	57	9.235	-0.194	352.549	192.836	3063261.460	627326.983	1319.849	
	380	1.35	320	55	24	13.825	-0.755	320.923	161.210	3063257.376	627333.487	1319.288	
	381	1.35	315	38	48	12.344	-0.768	315.647	155.933	3063259.193	627334.068	1319.275	
	382	1.35	307	1	23	17.354	-1.425	307.023	147.309	3063255.859	627338.407	1318.618	
	383	1.35	301	40	36	15.976	-1.457	301.677	141.963	3063257.881	627338.878	1318.586	
	384	1.35	299	51	43	15.631	-1.274	299.862	140.148	3063258.464	627339.051	1318.769	
	385	1.35	307	54	5	17.822	-1.299	307.901	148.188	3063255.319	627338.429	1318.744	
	386	1.35	296	26	52	17.192	-1.288	296.448	136.734	3063257.945	627340.817	1318.755	
	387	1.35	304	48	59	19.673	-1.263	304.816	145.103	3063254.328	627340.289	1318.780	
	388	1.35	319	43	34	25.176	-1.494	319.726	160.013	3063246.804	627337.640	1318.549	
	389	1.35	336	20	13	30.584	-1.575	336.337	176.623	3063239.933	627330.836	1318.468	
	390	1.35	283	5	35	15.472	-1.625	283.093	123.379	3063261.951	627341.954	1318.418	
	391	1.35	245	5	5	10.724	-1.793	245.085	85.371	3063271.329	627339.723	1318.250	
	392	1.35	240	38	43	18.023	-2.406	240.645	80.932	3063273.304	627346.832	1317.637	
	393	1.35	238	45	36	26.126	-3.043	238.760	79.046	3063275.428	627354.684	1317.000	
	394	1.35	238	6	12	17.399	-2.631	238.103	78.390	3063273.965	627346.077	1317.412	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	395	1.35	238	46	45	14.925	-2.350	238.779	79.066	3063273.295	627343.688	1317.693	
	396	1.35	240	40	62	12.314	-1.877	240.684	80.970	3063272.396	627341.196	1318.166	
	397	1.35	245	31	55	7.747	-1.988	245.532	85.818	3063271.029	627336.761	1318.055	
	398	1.35	254	43	37	6.111	-1.973	254.727	95.013	3063269.930	627335.122	1318.070	
	399	1.35	216	9	52	7.343	-2.017	216.164	56.451	3063274.522	627335.154	1318.026	
	400	1.35	198	16	37	5.340	-1.229	198.277	38.563	3063274.639	627332.363	1318.814	
	401	1.35	141	25	2	9.575	-0.530	141.417	341.704	3063279.555	627326.028	1319.513	
	402	1.35	149	36	10	10.112	-0.786	149.603	349.889	3063280.419	627327.259	1319.257	
	403	1.35	158	8	40	9.631	-1.027	158.144	358.431	3063280.091	627328.770	1319.016	
	404	1.35	166	20	25	8.859	-1.019	166.340	6.627	3063279.264	627330.056	1319.024	
	405	1.35	186	20	25	8.397	-1.589	186.340	26.627	3063277.970	627332.797	1318.454	
	406	1.35	190	13	52	9.181	-1.937	190.231	30.518	3063278.373	627333.696	1318.106	
	407	1.35	79	59	43	4.851	-0.306	79.995	280.282	3063271.330	627324.261	1319.737	
	408	1.35	83	58	37	9.358	-0.439	83.977	284.263	3063272.769	627319.965	1319.604	
	409	1.35	86	4	46	17.191	-0.388	86.079	286.366	3063275.308	627312.540	1319.655	
	410	1.35	73	35	11	25.516	-0.448	73.586	273.873	3063272.187	627303.576	1319.595	
	411	1.35	72	16	35	18.444	-0.445	72.276	272.563	3063271.288	627310.609	1319.598	
	412	1.35	62	26	13	10.130	-0.471	62.437	262.723	3063269.181	627318.986	1319.572	
	413	1.35	17	33	54	8.870	-0.325	17.565	217.851	3063263.460	627323.591	1319.718	
	414	1.35	22	15	12	16.999	-0.386	22.253	222.540	3063257.939	627317.541	1319.657	
	415	1.35	35	6	57	22.177	-0.410	35.116	235.402	3063257.871	627310.779	1319.633	
	416	1.35	42	41	58	26.473	-0.341	42.699	242.986	3063258.439	627305.449	1319.702	
	417	1.35	7	50	6	26.778	-0.296	7.835	208.121	3063246.847	627316.413	1319.747	
	418	1.35	353	4	12	28.787	-0.633	353.070	193.356	3063242.455	627322.384	1319.410	
	419	1.35	346	56	40	25.696	-0.736	346.944	187.231	3063244.972	627325.800	1319.307	
	420	1.35	344	8	47	23.208	-1.047	344.146	184.433	3063247.325	627327.240	1318.996	
	421	1.35	346	34	57	19.377	-1.512	346.583	186.869	3063251.226	627326.717	1318.531	
	422	1.35	331	25	21	21.497	-1.567	331.423	171.709	3063249.191	627332.134	1318.476	
	423	1.35	335	48	22	28.995	-1.588	335.806	176.093	3063241.536	627331.010	1318.455	
	424	1.35	334	46	20	12.154	-1.024	334.772	175.059	3063258.355	627330.081	1319.019	
	425	1.35	331	16	42	8.416	-0.709	331.278	171.565	3063262.139	627330.269	1319.334	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	426	1.35	325	38	8	4.327	-0.521	325.636	165.922	3063266.267	627330.087	1319.522	
3m11	3m10	1.3	0	0	0	70.416	9.665	0.000	219.912	3063270.518	627329.080	1310.975	
(HI=1.38	427	1.3	61	26	54	8.370	-0.115	61.448	281.361	3063326.178	627366.054	1311.035	
6)	428	1.3	87	14	28	10.893	-0.314	87.241	307.154	3063331.108	627365.578	1311.153	
	429	1.3	80	37	3	12.472	-0.019	80.618	300.530	3063330.865	627363.517	1311.787	
	430	1.35	58	38	19	10.207	0.034	58.639	278.551	3063326.047	627364.166	1311.438	
	431	1.35	107	27	34	12.867	-0.198	107.459	327.372	3063335.366	627367.322	1311.310	
	432	1.35	86	26	24	16.938	0.848	86.440	306.352	3063334.569	627360.618	1311.399	
	433	1.35	78	6	13	20.301	0.843	78.104	298.016	3063334.065	627356.338	1311.346	
	434	1.35	72	34	54	30.174	0.884	72.582	292.494	3063336.074	627346.382	1311.795	
	435	1.35	27	29	24	34.566	1.901	27.490	247.402	3063311.247	627342.348	1311.822	
	436	1.75	20	56	53	32.970	2.304	20.948	240.861	3063308.475	627345.463	1310.904	
	437	1.75	19	24	11	36.077	2.921	19.403	239.316	3063306.119	627343.234	1310.889	
	438	1.35	323	5	32	3.293	0.127	323.092	183.005	3063321.241	627374.087	1311.863	
	439	1.35	316	19	56	10.962	0.155	316.332	176.245	3063313.591	627374.978	1311.740	
	440	1.35	315	45	19	16.297	0.024	315.755	175.668	3063308.279	627375.491	1311.404	
	441	1.35	318	14	41	19.180	1.312	318.245	178.157	3063305.359	627374.877	1311.720	
	442	1.35	318	44	27	23.917	1.437	318.741	178.653	3063300.619	627374.822	1304.765	
	443	1.35	319	41	53	28.694	1.583	319.698	179.611	3063295.836	627374.455	1300.878	
	444	1.35	319	15	36	31.716	2.535	319.260	179.172	3063292.817	627374.718	1300.705	
	445	1.35	311	3	52	35.831	2.445	311.064	170.977	3063289.142	627379.879	1300.290	
	446	1.35	302	13	1	35.495	1.561	302.217	162.129	3063290.747	627385.152	1300.319	
	447	1.35	296	21	42	31.147	1.497	296.362	156.274	3063296.015	627386.792	1300.252	
	448	1.35	297	49	36	26.800	1.036	297.827	157.739	3063299.727	627384.412	1300.413	
	449	1.35	294	6	48	23.784	-0.092	294.113	154.026	3063303.148	627384.677	1300.852	
	450	1.35	282	57	12	19.154	-0.188	282.953	142.866	3063309.259	627385.823	1300.893	
	451	1.35	261	1	19	22.452	0.027	261.022	120.934	3063312.988	627393.518	1300.959	
	452	1.35	258	27	29	20.260	-0.593	258.458	118.371	3063314.902	627392.087	1301.098	
	453	1.35	250	18	19	14.791	0.007	250.305	110.218	3063319.418	627388.140	1301.102	
	454	1.35	233	51	51	10.870	-0.516	233.864	93.777	3063323.813	627385.106	1301.323	

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	455	1.35	173	17	23	8.866	-0.626	173.290	33.202	3063331.948	627379.115	1301.073	
	456	1.35	177	3	51	11.691	-0.580	177.064	36.977	3063333.869	627381.292	1300.876	
	457	1.35	160	13	24	14.254	-0.933	160.223	20.136	3063337.912	627379.167	1300.736	
	458	1.35	139	35	58	18.254	-0.806	139.599	359.512	3063342.783	627374.104	1300.116	
	459	1.35	147	10	53	20.577	-1.084	147.181	7.094	3063344.949	627376.801	1300.315	
	460	1.35	149	23	56	20.790	-1.251	149.399	9.311	3063345.045	627377.624	1301.704	
	461	1.35	156	21	44	21.233	-1.601	156.362	16.275	3063344.911	627380.210	1302.165	
	462	1.35	148	10	16	25.100	-1.644	148.171	8.084	3063349.380	627377.789	1301.989	
	463	1.35	152	31	18	23.519	-1.866	152.522	12.434	3063347.497	627379.324	1302.314	
	464	1.35	158	27	41	23.478	-1.863	158.461	18.374	3063346.810	627381.661	1301.947	
	465	1.35	150	15	14	27.883	-1.808	150.254	10.166	3063351.974	627379.181	1302.475	
	466	1.35	151	41	28	28.301	-2.166	151.691	11.604	3063352.252	627379.952	1301.950	
	467	1.35	146	58	35	30.480	-1.899	146.976	6.889	3063354.789	627377.916	1302.858	
	468	1.35	138	3	15	29.077	-0.980	138.054	357.967	3063353.588	627373.228	1302.264	
	469	1.35	139	8	30	33.930	-0.932	139.142	359.054	3063358.455	627373.700	1302.847	
	470	1.35	141	7	17	36.357	-1.131	141.121	1.034	3063360.880	627374.916	1302.294	
	471	1.35	144	56	15	35.607	-1.729	144.938	4.850	3063360.009	627377.270	1302.903	
	472	1.35	148	29	38	33.725	-2.100	148.494	8.406	3063357.892	627379.190	1302.357	
	473	1.35	151	36	35	33.231	-2.181	151.610	11.522	3063357.091	627380.898	1302.859	
	474	1.35	152	57	40	33.939	-2.127	152.961	12.874	3063357.615	627381.822	1302.646	
	475	1.35	155	29	53	33.230	-2.378	155.498	15.411	3063356.565	627383.090	1302.747	
	476	1.35	160	31	45	30.043	-2.431	160.529	20.442	3063352.680	627384.753	1303.297	
	477	1.35	164	52	55	27.264	-2.481	164.882	24.794	3063349.280	627385.693	1302.589	
	478	1.35	168	26	40	26.386	-2.781	168.444	28.357	3063347.749	627386.792	1303.181	
	479	1.35	173	56	32	26.536	-2.792	173.942	33.855	3063346.566	627389.043	1302.587	
	480	1.35	182	17	0	23.703	-2.498	182.283	42.196	3063342.090	627390.180	1303.398	
	481	1.35	192	52	22	24.237	-3.201	192.873	52.785	3063339.188	627393.562	1304.151	
	482	1.35	206	31	40	23.311	-3.031	206.528	66.440	3063333.847	627395.628	1303.397	
	483	1.35	216	53	29	22.450	-2.533	216.891	76.804	3063329.654	627396.117	1304.081	
	484	1.35	222	15	44	23.996	-2.324	222.262	82.175	3063327.796	627398.032	1303.323	
	485	1.35	224	45	57	26.884	-3.040	224.766	84.678	3063327.023	627401.028	1304.082	

Tribhuvan University
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Survey Instruction Committee

Group no: 3

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Recorder: Group 3
Instrument: Total Station

Weather:
Temperature:
Date:

DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	486	1.35	227	33	53	25.712	-2.234	227.565	87.477	3063325.661	627399.947	1303.802	
	487	1.35	224	14	17	15.859	-1.426	224.238	84.151	3063326.146	627390.036	1304.119	
	488	1.3	243	21	11	30.957	-1.906	243.353	103.266	3063317.426	627404.391	1303.707	
	489	1.35	109	8	45	10.305	-0.349	109.146	329.058	3063333.368	627368.961	1304.146	
	490	1.35	118	22	34	15.564	-0.614	118.376	338.289	3063338.989	627368.502	1303.627	
	491	1.35	126	9	16	20.924	-0.826	126.154	346.067	3063344.838	627369.222	1304.133	
	492	1.35	127	9	45	25.501	-0.904	127.163	347.075	3063349.384	627368.556	1303.631	
	493	1.35	130	15	15	30.829	-0.881	130.254	350.167	3063354.905	627368.995	1305.358	
	494	1.35	139	43	36	33.397	-0.955	139.727	359.639	3063357.926	627374.050	1304.865	
	495	1.35	144	30	41	35.255	-1.634	144.511	4.424	3063359.679	627376.979	1305.591	
	496	1.35	148	20	36	35.526	-2.029	148.343	8.256	3063359.687	627379.361	1304.814	
	497	1.35	151	1	14	35.687	-2.237	151.021	10.933	3063359.569	627381.028	1305.458	
	498	1.35	156	16	15	36.020	-2.534	156.271	16.183	3063359.122	627384.299	1304.833	
	499	1.35	155	1	11	39.062	-2.577	155.020	14.932	3063362.272	627384.325	1305.353	
	500	1.35	153	24	37	41.682	-2.319	153.410	13.323	3063365.089	627383.865	1306.032	
	501	1.35	149	16	34	46.133	-2.458	149.276	9.189	3063370.070	627381.627	1306.938	
	502	1.35	144	39	47	45.968	-1.963	144.663	4.576	3063370.351	627377.927	1306.304	
	503	1.35	142	31	2	49.037	-1.930	142.517	2.430	3063373.522	627376.339	1307.003	
	504	1.35	138	3	51	51.202	-1.357	138.064	357.977	3063375.699	627372.452	1306.312	
	505	1.35	138	9	8	51.998	-1.357	138.152	358.065	3063376.498	627372.504	1307.043	
	506	1.35	133	15	28	52.103	-0.974	133.258	353.170	3063376.263	627368.064	1307.948	
	507	1.35	131	40	54	47.863	-0.894	131.682	351.594	3063371.878	627367.263	1308.566	
	508	1.35	137	9	23	41.963	-1.456	137.156	357.069	3063366.437	627372.114	1308.209	
	509	1.35	132	9	56	32.398	-0.968	132.166	352.078	3063356.618	627369.795	1308.432	
3m12	3m11	1.35	0	0	0	55.356	-1.045		110.529	3063324.592	627374.093	1310.338	
(HI=1.420)	510	1.35	256	25	21	30.207	-0.031	256.423	6.951	3063373.989	627325.907	1311.352	
	511	1.35	355	51	10	25.312	-0.123	355.853	106.381	3063336.865	627346.536	1311.260	
	512	1.35	128	21	58	3.724	0.405	128.366	238.895	3063342.080	627319.063	1311.788	
	513	1.35	157	25	41	4.146	0.382	157.428	267.957	3063343.856	627318.108	1311.765	
	514	1.35	165	4	5	3.211	0.412	165.068	275.597	3063344.317	627319.056	1311.795	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	515	1.35	203	47	25	8.140	0.328	203.790	314.319	3063349.691	627316.428	1311.711	
	516	1.35	216	52	19	8.130	0.147	216.872	327.400	3063350.853	627317.872	1311.530	
	517	1.35	356	2	11	4.413	-0.310	356.036	106.565	3063342.746	627326.482	1311.073	
	518	1.35	358	26	51	8.624	-0.286	358.448	108.976	3063341.200	627330.407	1311.097	
	519	1.35	358	36	43	13.685	-0.367	358.612	109.140	3063339.517	627335.180	1311.016	
	520	1.35	0	37	47	19.128	-0.455	0.630	111.158	3063337.100	627340.090	1310.928	
	521	1.35	0	49	24	25.687	-0.549	0.823	111.352	3063334.651	627346.176	1310.834	
	522	1.35	0	30	18	33.761	-0.654	0.505	111.034	3063331.887	627353.763	1310.729	
	523	1.35	0	40	7	39.514	-0.600	0.669	111.197	3063329.716	627359.092	1310.783	
	524	1.35	1	1	7	42.683	-0.820	1.019	111.547	3063328.328	627361.952	1310.563	
	525	1.35	5	9	29	43.748	-0.596	5.158	115.687	3063325.041	627361.676	1310.787	
	526	1.35	6	37	10	40.156	-0.449	6.619	117.148	3063325.681	627357.984	1310.934	
	527	1.35	6	59	15	36.671	-0.531	6.988	117.516	3063327.062	627354.775	1310.852	
	528	1.35	7	38	57	32.276	-0.400	7.649	118.178	3063328.763	627350.703	1310.983	
	529	1.35	8	39	10	28.376	-0.351	8.653	119.181	3063330.168	627347.026	1311.032	
	530	1.35	9	34	58	25.150	-0.335	9.583	120.111	3063331.387	627344.008	1311.048	
	531	1.35	9	59	41	20.820	-0.114	9.995	120.523	3063333.430	627340.187	1311.269	
	532	1.35	9	53	58	16.968	-0.060	9.899	120.428	3063335.410	627336.883	1311.323	
	533	1.35	12	49	41	13.135	0.158	12.828	123.357	3063336.782	627333.223	1311.541	
	534	1.35	12	28	47	9.048	-0.352	12.480	123.008	3063339.075	627329.839	1311.031	
	535	1.35	8	53	54	5.220	-0.319	8.898	119.427	3063341.439	627326.798	1311.064	
	536	1.35	5	17	41	3.216	-0.213	5.295	110.529	3063342.876	627325.264	1311.170	
	537	1.35	33	13	43	3.194	0.034	33.229	110.529	3063342.884	627325.243	1311.417	
	538	1.35	29	25	40	6.848	0.053	29.428	110.529	3063341.602	627328.665	1311.436	
	539	1.35	30	25	4	11.175	0.191	30.418	110.529	3063340.085	627332.717	1311.574	
	540	1.35	30	54	57	15.905	0.231	30.916	110.529	3063338.426	627337.147	1311.614	
	541	1.35	29	51	58	21.467	0.248	29.866	110.529	3063336.476	627342.356	1311.631	
	542	1.35	24	5	38	25.524	0.245	24.094	110.529	3063335.053	627346.155	1311.628	
	543	1.35	22	18	21	31.023	0.250	22.306	110.529	3063333.125	627351.305	1311.633	
	544	1.35	20	38	55	38.647	0.172	20.649	110.529	3063330.451	627358.445	1311.555	
	545	1.35	21	12	5	44.326	0.320	21.201	110.529	3063328.460	627363.763	1311.703	

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DETAILING

Weather:

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	546	1.35	21	8	25	49.058	0.296	21.140	131.669	3063311.389	627358.898	1311.679	
	547	1.35	21	4	23	49.077	0.314	21.073	131.602	3063311.419	627358.951	1311.697	
	548	1.35	26	32	48	48.988	0.662	26.547	137.075	3063308.132	627355.614	1312.045	
	549	1.35	27	38	29	45.615	0.604	27.641	138.170	3063310.015	627352.673	1311.987	
	550	1.35	27	49	10	40.955	0.678	27.819	138.348	3063313.402	627349.471	1312.061	
	551	1.35	28	23	10	35.579	0.582	28.386	138.915	3063317.187	627345.634	1311.965	
	552	1.35	28	43	59	32.589	0.460	28.733	139.262	3063319.311	627343.520	1311.843	
	553	1.35	27	56	19	29.896	0.260	27.939	138.467	3063321.624	627342.074	1311.643	
	554	1.35	31	30	22	23.432	0.169	31.506	142.035	3063325.530	627336.667	1311.552	
	555	1.35	33	52	14	19.528	0.276	33.871	144.399	3063328.126	627333.620	1311.659	
	556	1.35	34	34	32	17.170	0.372	34.576	145.104	3063329.921	627332.074	1311.755	
	557	1.35	35	6	45	12.441	0.251	35.113	145.641	3063333.734	627329.273	1311.634	
	558	1.35	34	58	57	7.816	0.100	34.983	145.511	3063337.562	627326.678	1311.483	
	559	1.35	49	34	24	4.940	0.596	49.573	160.102	3063339.359	627323.933	1311.979	
	560	1.35	46	45	9	27.422	0.718	46.753	157.281	3063318.710	627332.842	1312.101	
	561	1.35	54	8	34	25.707	0.714	54.143	164.671	3063319.211	627329.048	1312.097	
	562	1.35	52	48	46	19.882	0.837	52.813	163.341	3063324.956	627327.951	1312.220	
	563	1.35	62	55	52	22.502	0.871	62.931	173.460	3063321.648	627324.815	1312.254	
	564	1.35	59	37	47	28.986	1.555	59.630	170.158	3063315.444	627327.206	1312.938	
	565	1.35	67	14	8	27.307	1.559	67.236	177.764	3063316.718	627323.317	1312.942	
	566	1.35	75	24	19	25.055	1.522	75.405	185.934	3063319.083	627319.662	1312.905	
	567	1.35	85	38	55	21.764	1.576	85.649	196.177	3063323.102	627316.188	1312.959	
	568	1.35	94	2	55	20.981	1.832	94.049	204.577	3063324.924	627313.525	1313.215	
	569	1.35	122	56	0	19.613	1.896	122.933	233.462	3063332.327	627306.493	1313.279	
	570	1.35	124	57	48	18.774	1.876	124.963	235.492	3063333.368	627306.781	1313.259	
	571	1.35	119	45	7	23.016	2.271	119.752	230.280	3063329.296	627304.548	1313.654	
	572	1.35	117	22	22	23.031	2.562	117.373	227.901	3063328.564	627305.163	1313.945	
	573	1.35	112	12	16	23.929	3.046	112.204	222.733	3063326.427	627306.014	1314.429	
	574	1.35	106	25	21	24.843	3.088	106.423	216.951	3063324.151	627307.318	1314.471	
	575	1.35	99	45	54	25.589	3.757	99.765	210.294	3063321.909	627309.344	1315.140	
	576	1.35	99	30	8	26.939	3.857	99.502	210.031	3063320.681	627308.770	1315.240	

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	577	1.35	96	10	38	27.902	4.595	96.177	206.706	3063319.078	627309.712	1315.978	
	578	1.35	96	17	56	28.844	4.733	96.299	206.827	3063318.264	627309.234	1316.116	
	579	1.35	95	41	45	29.482	4.644	95.696	206.224	3063317.556	627309.224	1316.027	
	580	1.35	90	47	18	27.363	3.589	90.788	201.317	3063318.513	627312.305	1314.972	
	581	1.35	92	57	16	26.033	3.538	92.954	203.483	3063320.127	627311.878	1314.921	
	582	1.35	95	4	51	25.500	3.477	95.081	205.609	3063321.009	627311.230	1314.860	
	583	1.35	99	19	18	24.726	2.704	99.322	209.850	3063322.558	627309.945	1314.087	
	584	1.35	89	34	47	24.048	2.872	89.580	200.108	3063321.422	627313.984	1314.255	
	585	1.35	95	44	4	29.045	2.257	95.734	206.263	3063317.957	627309.400	1313.640	
	586	1.35	74	15	18	27.241	2.274	74.255	184.784	3063316.858	627319.980	1313.657	
	587	1.35	83	20	48	24.379	2.003	83.347	193.875	3063320.336	627316.405	1313.386	
	588	1.35	88	34	24	22.710	2.032	88.573	199.102	3063322.544	627314.820	1313.415	
	589	1.35	95	26	43	21.332	1.840	95.445	205.974	3063324.827	627312.909	1313.223	
	590	1.35	97	57	13	15.894	1.090	97.954	208.482	3063330.034	627314.672	1312.473	
	591	1.35	95	48	41	12.392	1.059	95.811	206.340	3063332.898	627316.753	1312.442	
	592	1.35	95	41	52	9.460	0.440	95.698	206.226	3063335.518	627318.071	1311.823	
	593	1.35	83	18	54	9.312	0.414	83.315	193.844	3063334.962	627320.024	1311.797	
	594	1.35	79	53	52	11.429	0.876	79.898	190.426	3063332.764	627320.183	1312.259	
	595	1.35	76	57	34	16.898	0.840	76.959	187.488	3063327.250	627320.050	1312.223	
	596	1.35	74	47	26	20.950	0.842	74.791	185.319	3063323.144	627320.310	1312.225	
	597	1.35	59	15	33	16.916	0.820	59.259	169.788	3063327.356	627325.251	1312.203	
	598	1.35	59	36	33	13.835	0.899	59.609	170.138	3063330.373	627324.621	1312.282	
	599	1.35	59	43	27	9.669	0.347	59.724	170.253	3063334.474	627323.889	1311.730	
	600	1.35	62	2	22	4.087	0.380	62.039	172.568	3063339.951	627322.780	1311.763	
	601	1.35	304	23	34	7.132	-0.317	304.393	54.921	3063348.103	627328.088	1311.066	
	602	1.35	299	39	47	12.931	-0.313	299.663	50.192	3063352.283	627332.185	1311.070	
	603	1.35	295	11	54	17.179	-0.405	295.198	45.727	3063355.996	627334.552	1310.978	
	604	1.35	274	24	38	19.328	-0.485	274.411	24.939	3063361.530	627330.401	1310.898	
	605	1.35	273	26	58	15.599	-0.662	273.449	23.978	3063358.257	627328.591	1310.721	
	606	1.35	272	39	46	12.323	-0.351	272.663	23.191	3063355.331	627327.105	1311.032	
	607	1.35	271	40	58	7.891	-0.234	271.683	22.211	3063351.309	627325.235	1311.149	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	608	1.35	243	1	46	7.371	-0.294	243.029	353.558	3063351.328	627321.425	1311.089	
	609	1.35	247	46	14	14.747	-0.310	247.771	358.299	3063358.744	627321.814	1311.073	
	610	1.35	251	1	1	21.437	-0.369	251.017	1.545	3063365.433	627322.830	1311.014	
	611	1.35	248	44	9	28.683	-0.389	248.736	359.264	3063372.684	627321.883	1310.994	
	612	1.35	248	9	26	34.754	-0.172	248.157	358.686	3063378.749	627321.455	1311.211	
	613	1.35	248	22	29	42.692	0.092	248.375	358.903	3063386.688	627321.435	1311.475	
	614	1.35	241	48	31	41.944	0.421	241.809	352.337	3063385.573	627316.659	1311.804	
	615	1.35	238	58	54	36.795	0.368	238.982	349.510	3063380.184	627315.553	1311.751	
	616	1.35	238	1	17	29.384	-0.202	238.021	348.550	3063372.803	627316.419	1311.181	
	617	1.35	224	46	36	18.702	0.366	224.777	335.305	3063360.995	627314.438	1311.749	
	618	1.35	221	18	19	25.857	0.347	221.305	331.834	3063366.799	627310.046	1311.730	
	619	1.35	220	54	35	31.248	1.212	220.910	331.438	3063371.449	627307.312	1312.595	
	620	1.35	221	35	37	34.334	1.645	221.594	332.122	3063374.353	627306.198	1313.028	
	621	1.35	221	46	19	37.047	1.947	221.772	332.300	3063376.805	627305.031	1313.330	
	622	1.35	221	4	51	38.127	2.042	221.081	331.609	3063377.545	627304.123	1313.425	
3M17	3m12	1.35	0	0	0	72.443	-0.762	0.000	178.111	3063344.014	627322.252	1311.309	
(HI=1.360)	623	1.35	329	36	45	29.437	-1.146	329.613	147.723	3063391.529	627335.583	1310.925	
	624	1.35	321	8	11	48.864	-1.927	321.136	139.247	3063379.401	627351.762	1310.144	
	625	1.35	345	37	10	34.559	-6.999	345.619	163.730	3063383.242	627329.545	1305.072	
	626	1.35	359	53	4	42.389	-1.040	359.884	177.995	3063374.054	627321.346	1311.031	
	627	1.35	305	57	47	10.281	-0.618	305.963	124.074	3063410.657	627328.379	1311.453	
	628	1.35	309	8	56	9.557	-0.071	309.149	127.260	3063410.631	627327.470	1312.000	
	629	1.35	239	46	44	4.425	-0.851	239.779	57.890	3063418.769	627323.611	1311.220	
	630	1.35	158	28	34	4.114	-1.063	158.476	336.587	3063420.193	627318.229	1311.008	
	631	1.35	146	7	38	8.213	-0.929	146.127	324.238	3063423.082	627315.063	1311.142	
	632	1.35	146	7	39	8.223	-0.928	146.128	324.238	3063423.090	627315.058	1311.143	
	633	1.35	166	26	43	10.527	-1.126	166.445	344.556	3063426.564	627317.060	1310.945	
	634	1.35	166	30	21	13.362	-1.031	166.506	344.616	3063429.301	627316.319	1311.040	
	635	1.35	169	32	43	15.954	-1.086	169.545	347.656	3063432.002	627316.453	1310.985	
	636	1.35	172	35	43	19.057	-0.897	172.595	350.706	3063435.224	627316.786	1311.174	

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Group no: 3

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Instrument: Total Station

DETAILING

Weather:
Temperature:
Date:

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	637	1.35	164	0	46	18.497	-1.088	164.013	342.123	3063434.021	627314.185	1310.983	
	638	1.35	154	23	53	18.779	-1.111	154.398	332.509	3063433.076	627311.195	1310.960	
	639	1.35	154	24	54	20.671	-1.151	154.415	332.526	3063434.757	627310.327	1310.920	
	640	1.35	155	35	57	22.922	-1.165	155.599	333.710	3063436.968	627309.711	1310.906	
	641	1.35	148	0	12	23.519	-0.994	148.003	326.114	3063435.942	627306.750	1311.077	
	642	1.35	138	41	6	25.259	-0.990	138.685	316.796	3063434.829	627302.571	1311.081	
	643	1.35	135	23	1	24.622	-1.024	135.384	313.494	3063433.364	627302.001	1311.047	
	644	1.35	132	49	28	24.927	-0.535	132.824	310.935	3063432.750	627301.032	1311.536	
	645	1.35	132	19	25	22.449	-0.705	132.324	310.434	3063430.977	627302.776	1311.366	
	646	1.35	132	55	6	20.326	-0.400	132.918	311.029	3063429.760	627304.530	1311.671	
	647	1.35	133	8	28	17.710	-0.322	133.141	311.252	3063428.095	627306.549	1311.749	
	648	1.3	130	31	38	14.721	-0.003	130.527	308.638	3063425.609	627308.365	1312.118	
	649	1.3	124	41	4	15.887	0.562	124.684	302.795	3063425.022	627306.508	1312.683	
	650	1.3	122	0	26	16.577	0.851	122.007	300.118	3063424.735	627305.524	1312.972	
	651	1.3	126	54	18	21.400	0.446	126.905	305.016	3063428.697	627302.337	1312.567	
	652	1.3	130	50	1	23.826	0.063	130.834	308.944	3063431.393	627301.332	1312.184	
	653	1.3	130	17	20	26.747	0.253	130.289	308.400	3063433.031	627298.902	1312.374	
	654	1.3	128	10	17	30.247	0.928	128.171	306.282	3063434.316	627295.481	1313.049	
	655	1.3	123	17	25	28.739	0.852	123.290	301.401	3063431.391	627295.333	1312.973	
	656	1.3	119	47	28	27.039	1.317	119.791	297.902	3063429.070	627295.967	1313.438	
	657	1.3	113	27	40	9.905	0.573	113.461	291.572	3063420.059	627310.652	1312.694	
	658	1.3	94	50	45	9.978	3943.000	94.846	272.956	3063416.932	627309.899	5255.121	
	659	1.3	78	29	51	8.677	1.242	78.498	256.608	3063414.408	627311.422	1313.363	
	660	1.3	58	42	12	7.997	0.940	58.703	236.814	3063412.040	627313.171	1313.061	
	661	1.3	69	54	47	9.451	1.273	69.913	248.024	3063412.881	627311.099	1313.394	
	662	1.3	87	47	6	10.614	1.109	87.785	265.896	3063415.658	627309.276	1313.230	
	663	1.3	100	16	3	11.876	1.183	100.268	278.378	3063418.148	627308.114	1313.304	
	664	1.3	100	48	46	12.973	1.406	100.813	278.923	3063418.430	627307.047	1313.527	
	665	1.3	99	17	8	15.202	1.651	99.286	277.396	3063418.374	627304.788	1313.772	
	666	1.3	104	52	51	14.359	1.526	104.881	282.991	3063419.645	627305.872	1313.647	
	667	1.3	109	16	1	16.801	1.695	109.267	287.378	3063421.435	627303.829	1313.816	

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DETAILING

Weather:
Temperature:
Date:

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	668	1.3	111	26	36	18.873	1.621	111.443	289.554	3063422.734	627302.079	1313.742	
	669	1.3	115	36	23	23.618	1.512	115.606	293.717	3063425.917	627298.240	1313.633	
	670	1.3	117	0	45	26.572	1.536	117.013	295.123	3063427.699	627295.805	1313.657	
	671	1.3	115	1	58	27.255	2.111	115.033	293.143	3063427.129	627294.802	1314.232	
	672	1.3	109	38	39	26.476	2.139	109.644	287.755	3063424.491	627294.648	1314.260	
	673	1.3	107	20	24	26.655	2.654	107.340	285.451	3063423.518	627294.172	1314.775	
	674	1.3	112	52	56	27.168	2.139	112.882	290.993	3063426.150	627294.499	1314.260	
	675	1.3	116	6	0	30.789	2.039	116.100	294.211	3063429.044	627291.782	1314.160	
	676	1.3	121	16	5	29.582	1.460	121.268	299.379	3063430.930	627294.086	1313.581	
	677	1.3	122	4	28	32.185	1.503	122.074	300.185	3063432.600	627292.042	1313.624	
	678	1.3	127	16	17	33.059	1.178	127.271	305.382	3063435.559	627292.910	1313.299	
	679	1.3	127	46	50	35.908	1.099	127.781	305.891	3063437.468	627290.773	1313.220	
	680	1.3	122	19	33	36.501	1.646	122.326	300.436	3063434.908	627288.392	1313.767	
	681	1.3	112	34	44	33.581	2.477	112.579	290.690	3063428.282	627288.448	1314.598	
	682	1.3	111	11	38	32.251	2.489	111.194	289.305	3063427.079	627289.426	1314.610	
	683	1.3	106	50	45	34.320	2.877	106.846	284.956	3063425.275	627286.706	1314.998	
	684	1.3	101	53	9	33.737	3.268	101.886	279.996	3063422.274	627286.638	1315.389	
	685	1.3	99	19	33	33.035	3.315	99.326	277.436	3063420.693	627287.106	1315.436	
	686	1.3	95	37	35	33.115	3.386	95.626	273.737	3063418.576	627286.819	1315.507	
	687	1.3	83	43	30	35.274	3.999	83.725	261.836	3063411.408	627284.947	1316.120	
	688	1.3	73	32	27	30.669	3.370	73.541	251.651	3063406.763	627290.753	1315.491	
	689	1.3	67	18	59	29.053	3.193	67.316	245.427	3063404.336	627293.442	1315.314	
	690	1.3	66	6	17	28.718	3.488	66.105	244.215	3063403.925	627294.005	1315.609	
	691	1.3	58	1	57	27.324	2.922	58.033	236.143	3063401.195	627297.173	1315.043	
	692	1.3	51	14	24	31.921	2.951	51.240	229.351	3063395.623	627295.644	1315.072	
	693	1.3	43	46	14	31.734	2.347	43.771	221.881	3063392.790	627298.678	1314.468	
	694	1.3	44	39	18	33.548	2.404	44.655	222.766	3063391.788	627297.084	1314.525	
	695	1.3	39	8	28	43.713	2.415	39.141	217.252	3063381.623	627293.403	1314.536	
	696	1.3	34	54	36	34.131	2.248	34.910	213.021	3063387.799	627301.264	1314.369	
	697	1.3	34	52	51	36.255	2.196	34.881	212.991	3063386.008	627300.122	1314.317	
	698	1.3	34	45	8	32.886	1.599	34.752	212.863	3063388.794	627302.018	1313.720	

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DETAILING

Weather:
Temperature:
Date:

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	699	1.3	34	22	54	29.446	1.467	34.382	212.492	3063391.581	627304.045	1313.588	
	700	1.3	34	50	52	24.530	1.457	34.848	212.958	3063395.835	627306.518	1313.578	
	701	1.3	33	11	14	19.095	1.612	33.187	211.298	3063400.101	627309.944	1313.733	
	702	1.3	33	19	47	18.264	1.401	33.330	211.440	3063400.835	627310.337	1313.522	
	703	1.3	31	55	27	18.675	1.348	31.924	210.035	3063400.250	627310.516	1313.469	
	704	1.3	34	54	51	16.986	1.435	34.914	213.025	3063402.176	627310.606	1313.556	
	705	1.3	47	44	45	15.627	1.309	47.746	225.856	3063405.534	627308.649	1313.430	
	706	1.3	45	6	58	14.394	0.803	45.116	223.227	3063405.929	627310.005	1312.924	
	707	1.3	21	33	40	11.698	0.806	21.561	199.672	3063405.402	627315.925	1312.927	
	708	1.3	1	40	47	9.344	0.481	1.680	179.790	3063407.073	627319.897	1312.602	
	709	1.3	332	57	41	5.677	-0.202	332.961	151.072	3063411.449	627322.609	1311.919	
	710	1.3	297	50	19	4.155	-0.030	297.839	115.949	3063414.599	627323.599	1312.091	
	711	1.3	299	14	45	7.537	-0.655	299.246	117.356	3063412.954	627326.557	1311.466	
	712	1.3	308	0	37	11.075	-0.692	308.010	126.121	3063409.889	627328.809	1311.429	
	713	1.3	308	41	59	12.979	-0.660	308.700	126.810	3063408.641	627330.255	1311.461	
	714	1.3	298	10	7	13.399	-0.639	298.169	116.279	3063410.485	627331.877	1311.482	
	715	1.3	294	31	7	13.518	-1.064	294.519	112.629	3063411.216	627332.341	1311.057	
	716	1.3	303	44	41	9.178	-1.147	303.745	121.855	3063411.573	627327.659	1310.974	
	717	1.3	311	14	44	24.243	-1.982	311.246	129.356	3063401.044	627338.608	1310.139	
	718	1.3	316	42	37	25.762	-1.547	316.710	134.821	3063398.258	627338.137	1310.574	
	719	1.3	317	58	55	28.370	-1.648	317.982	136.093	3063395.978	627339.538	1310.473	
3m4	3m5	1.3	0	0	0	86.308	-0.813	0.000	103.537	3063494.534	627272.503	1306.260	
(HI=1.36	720	1.3	12	13	52	42.040	-0.788	12.231	115.768	3063496.460	627226.453	1306.285	
)	721	1.3	14	39	0	42.643	-0.100	14.650	118.187	3063494.593	627226.179	1306.973	
	722	1.3	14	24	37	45.046	0.123	14.410	117.947	3063493.625	627228.386	1307.196	
	723	1.3	14	34	23	48.687	0.597	14.573	118.110	3063491.796	627231.537	1307.670	
	724	1.3	16	4	45	50.318	0.663	16.079	119.616	3063489.869	627232.337	1307.736	
	725	1.3	16	48	50	50.414	1.048	16.814	120.351	3063489.262	627232.098	1308.121	
	726	1.3	17	30	29	50.048	1.229	17.508	121.045	3063488.926	627231.472	1308.302	
	727	1.3	17	46	25	49.963	1.605	17.774	121.310	3063488.771	627231.279	1308.678	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	728	1.3	19	6	2	50.092	1.715	19.101	122.637	3063487.720	627230.775	1308.788	
	729	1.3	18	12	25	49.081	1.560	18.207	121.744	3063488.913	627230.332	1308.633	
	730	1.3	18	19	30	44.391	1.422	18.325	121.862	3063491.303	627226.295	1308.495	
	731	1.3	23	25	15	43.563	2.350	23.421	126.958	3063488.545	627223.403	1309.423	
	732	1.3	24	31	38	44.730	3.020	24.527	128.064	3063487.158	627223.810	1310.093	
	733	1.3	24	5	45	46.271	3.124	24.096	127.633	3063486.483	627225.237	1310.197	
	734	1.3	24	28	50	49.801	3.108	24.481	128.017	3063484.063	627227.827	1310.181	
	735	1.3	26	26	7	49.650	3.572	26.435	129.972	3063482.840	627226.643	1310.645	
	736	1.3	32	17	36	44.342	3.592	32.293	135.830	3063482.930	627219.490	1310.665	
	737	1.3	33	35	20	44.989	3.901	33.589	137.126	3063481.766	627219.203	1310.974	
	738	1.3	29	59	36	48.951	4.268	29.993	133.530	3063481.021	627224.083	1311.341	
	739	1.3	39	9	33	43.008	4.962	39.159	142.696	3063480.526	627214.658	1312.035	
	740	1.3	35	34	30	50.207	5.030	35.575	139.112	3063476.780	627221.458	1312.103	
	741	1.3	37	10	52	50.860	4.990	37.181	140.718	3063475.368	627220.794	1312.063	
	742	1.3	41	41	1	43.955	5.013	41.684	145.220	3063478.633	627213.666	1312.086	
	743	1.3	42	15	50	44.250	5.557	42.264	145.801	3063478.137	627213.465	1312.630	
	744	1.3	40	59	56	47.417	5.625	40.999	144.536	3063476.116	627216.104	1312.698	
	745	1.3	43	50	51	47.318	6.104	43.848	147.384	3063474.880	627214.097	1313.177	
	746	1.3	46	39	39	43.825	6.163	46.661	150.198	3063476.707	627210.374	1313.236	
	747	1.3	48	47	39	41.969	6.126	48.794	152.331	3063477.566	627208.082	1313.199	
	748	1.3	51	24	34	40.175	6.131	51.409	154.946	3063478.341	627205.606	1313.204	
	749	1.3	52	13	54	38.678	6.129	52.232	155.768	3063479.465	627204.467	1313.202	
	750	1.3	54	18	33	36.121	5.793	54.309	157.846	3063481.281	627202.214	1312.866	
	751	1.3	54	5	23	34.521	5.678	54.090	157.626	3063482.813	627201.733	1312.751	
	752	1.3	51	10	52	34.486	5.436	51.181	154.718	3063483.553	627203.321	1312.509	
	753	1.3	50	12	30	32.375	4.797	50.208	153.745	3063485.701	627202.914	1311.870	
	754	1.3	47	35	32	32.427	4.794	47.592	151.129	3063486.339	627204.250	1311.867	
	755	1.3	40	8	28	29.858	2.437	40.141	143.678	3063490.679	627206.278	1309.510	
	756	1.3	37	52	32	28.697	1.824	37.876	141.412	3063492.305	627206.492	1308.897	
	757	1.3	33	51	26	30.599	1.822	33.857	137.394	3063492.214	627209.307	1308.895	
	758	1.3	30	56	7	32.352	1.028	30.935	134.472	3063492.071	627211.679	1308.101	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	759	1.3	32	24	17	35.313	1.101	32.405	135.941	3063489.359	627213.149	1308.174	
	760	1.3	28	42	55	35.440	0.693	28.715	132.252	3063490.906	627214.825	1307.766	
	761	1.3	25	52	39	37.038	0.598	25.878	129.414	3063491.219	627217.208	1307.671	
	762	1.3	22	28	38	39.911	0.030	22.477	126.014	3063491.269	627220.876	1307.103	
	763	1.3	13	40	52	38.732	-1.453	13.681	117.218	3063497.021	627223.036	1305.620	
	764	1.3	11	31	9	41.154	-1.474	11.519	115.056	3063497.307	627225.874	1305.599	
	765	1.3	9	18	57	37.371	-2.465	9.316	112.853	3063500.222	627223.030	1304.608	
	766	1.3	8	12	34	39.577	-2.418	8.209	111.746	3063500.073	627225.353	1304.655	
	767	1.3	4	53	27	41.154	-2.525	4.891	108.428	3063501.727	627227.637	1304.548	
	768	1.3	2	39	13	42.708	-3.303	2.654	106.190	3063502.827	627229.607	1303.770	
	769	1.3	357	55	44	44.314	-3.768	357.929	101.466	3063505.927	627232.023	1303.305	
	770	1.85	359	22	38	40.799	-3.794	359.377	102.914	3063505.618	627228.360	1302.729	
	771	2.15	358	50	16	37.670	-4.037	358.838	102.374	3063506.663	627225.388	1302.186	
	772	2.15	359	39	7	35.894	-3.515	359.652	103.189	3063506.546	627223.540	1302.708	
	773	2.15	359	32	38	33.294	-3.089	359.544	103.081	3063507.200	627221.023	1303.134	
	774	1.3	358	16	49	27.649	-2.567	358.280	101.817	3063509.074	627215.656	1304.506	
	775	1.3	359	26	25	25.444	-1.704	359.440	102.977	3063509.022	627213.387	1305.369	
	776	1.3	10	4	9	23.812	-0.660	10.069	113.606	3063505.200	627210.412	1306.413	
	777	1.3	13	12	46	23.719	-0.061	13.213	116.749	3063504.060	627209.773	1307.012	
	778	1.3	17	10	56	23.091	0.319	17.182	120.719	3063502.940	627208.444	1307.392	
	779	1.3	23	17	34	21.759	0.300	23.293	126.829	3063501.693	627206.009	1307.373	
	780	1.3	31	9	13	21.754	0.321	31.154	134.690	3063499.437	627204.058	1307.394	
	781	1.3	32	57	36	22.178	1.044	32.960	136.497	3063498.649	627203.860	1308.117	
	782	1.3	32	58	59	24.331	0.849	32.983	136.520	3063497.081	627205.335	1307.922	
	783	1.3	36	43	4	21.639	0.974	36.718	140.254	3063498.098	627202.428	1308.047	
	784	1.3	38	15	37	22.414	1.317	38.260	141.797	3063497.122	627202.455	1308.390	
	785	1.3	38	50	12	20.136	0.969	38.837	142.373	3063498.788	627200.886	1308.042	
	786	1.3	40	3	21	20.344	1.693	40.056	143.593	3063498.362	627200.667	1308.766	
	787	1.3	37	17	40	17.114	0.977	37.294	140.831	3063501.467	627199.402	1308.050	
	788	1.3	38	48	53	13.204	0.973	38.815	142.351	3063504.281	627196.658	1308.046	
	789	1.3	55	7	44	12.644	1.356	55.129	158.666	3063502.958	627193.193	1308.429	

Tribhuvan University
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Survey Instruction Committee

Group no: 3

Observer: Group 3

Recorder: Group 3

Instrument: Total Station

Weather:

Temperature:

Date:

DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	790	1.3	70	39	53	10.368	1.484	70.665	174.201	3063504.421	627189.640	1308.557	
	791	1.3	94	15	43	10.390	1.448	94.262	197.799	3063504.843	627185.417	1308.521	
	792	1.3	93	42	13	13.611	1.447	93.704	197.240	3063501.736	627184.559	1308.520	
	793	1.3	94	23	49	20.617	2.120	94.397	197.934	3063495.120	627182.245	1309.193	
	794	1.3	93	22	21	22.317	2.174	93.373	196.909	3063493.383	627182.102	1309.247	
	795	1.3	91	13	18	22.409	2.276	91.222	194.758	3063493.066	627182.884	1309.349	
	796	1.3	85	2	8	22.227	2.738	85.036	188.572	3063492.757	627185.280	1309.811	
	797	1.3	86	46	6	22.456	3.115	86.768	190.305	3063492.642	627184.576	1310.188	
	798	1.3	86	59	23	22.977	3.105	86.990	190.526	3063492.145	627184.395	1310.178	
	799	1.3	87	13	3	22.982	3.082	87.218	190.754	3063492.157	627184.304	1310.155	
	800	1.3	93	46	35	24.220	2.734	93.776	197.313	3063491.613	627181.385	1309.807	
	801	1.3	93	43	15	24.633	3.935	93.721	197.258	3063491.212	627181.285	1311.008	
	802	1.3	101	12	18	24.495	3.012	101.205	204.742	3063492.489	627178.341	1310.085	
	803	1.3	104	43	58	26.515	3.044	104.733	208.269	3063491.383	627176.035	1310.117	
	804	1.3	109	45	30	28.541	3.029	109.758	213.295	3063490.879	627172.925	1310.102	
	805	1.3	113	30	34	30.425	2.898	113.509	217.046	3063490.452	627170.263	1309.971	
	806	1.3	111	8	11	30.962	3.286	111.136	214.673	3063489.272	627170.979	1310.359	
	807	1.3	113	39	45	32.816	3.236	113.663	217.199	3063488.596	627168.753	1310.309	
	808	1.3	118	53	15	34.355	3.260	118.888	222.424	3063489.376	627165.416	1310.333	
	809	1.3	122	20	6	34.172	2.421	122.335	225.872	3063490.943	627164.065	1309.494	
	810	1.3	122	22	50	34.157	2.449	122.381	225.917	3063490.973	627164.057	1309.522	
	811	1.3	122	18	46	31.881	2.131	122.313	225.849	3063492.529	627165.718	1309.204	
	812	1.3	126	19	37	30.469	1.377	126.327	229.864	3063495.095	627165.299	1308.450	
	813	1.3	131	52	5	29.507	0.818	131.868	235.405	3063497.982	627164.303	1307.891	
	814	1.3	135	24	32	26.726	0.741	135.409	238.946	3063500.949	627165.697	1307.814	
	815	1.3	135	34	52	26.716	0.822	135.581	239.118	3063501.023	627165.665	1307.895	
	816	1.3	146	27	3	21.048	0.789	146.451	249.988	3063507.532	627168.816	1307.862	
	817	1.3	147	7	53	18.560	0.571	147.131	250.668	3063508.592	627171.079	1307.644	
	818	1.3	140	52	24	14.951	0.667	140.873	244.410	3063508.278	627175.108	1307.740	
	819	1.3	151	23	38	12.234	0.017	151.394	254.931	3063511.555	627176.780	1307.090	
	820	1.3	151	35	37	15.037	-0.321	151.594	255.130	3063510.877	627174.059	1306.752	

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DETAILING

Weather:
Temperature:
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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	821	1.3	154	15	35	19.488	-0.335	154.260	257.796	3063510.616	627169.545	1306.738	
	822	1.3	166	35	1	19.393	-1.037	166.584	270.120	3063514.776	627169.200	1306.036	
	823	1.3	166	38	51	14.765	-1.020	166.648	270.184	3063514.783	627173.828	1306.053	
	824	1.3	165	4	27	10.246	-0.481	165.074	268.611	3063514.487	627178.350	1306.592	
	825	1.3	162	24	53	6.313	-0.296	162.415	265.951	3063514.290	627182.296	1306.777	
	826	1.3	184	6	51	4.616	-0.863	184.114	287.651	3063516.135	627184.194	1306.210	
	827	1.3	229	19	51	2.244	-0.002	229.331	332.868	3063516.733	627187.569	1307.071	
	828	1.3	320	20	31	3.641	-0.758	320.342	63.879	3063516.339	627191.862	1306.315	
	829	1.3	351	15	37	5.039	-0.371	351.260	94.797	3063514.314	627193.614	1306.702	
3M18 (HI=1.510)	3M17	1.3	0	0	0	86.240	-8.734	0.000	30.451	3063416.430	627319.871	1311.810	
	830	1.3	141	11	33	2.082	-0.233	141.193	171.644	3063340.026	627276.466	1320.311	
	831	1.3	148	9	35	1.798	-0.224	148.160	178.611	3063340.288	627276.207	1320.320	
	832	1.3	175	26	12	1.735	-0.237	175.437	205.888	3063340.525	627275.406	1320.307	
	833	1.3	219	26	52	3.056	-0.225	219.448	249.899	3063341.036	627273.294	1320.319	
	834	1.3	273	37	50	2.406	-0.207	273.631	304.082	3063343.434	627274.171	1320.337	
	835	1.3	289	39	59	3.288	-0.365	289.666	320.118	3063344.609	627274.056	1320.179	
	836	1.3	339	43	45	1.827	-0.612	339.729	10.180	3063343.884	627276.487	1319.932	
	837	1.3	347	19	46	4.369	-0.703	347.329	17.781	3063346.246	627277.498	1319.841	
	838	1.3	241	18	31	6.830	-0.101	241.309	271.760	3063342.296	627269.337	1320.443	
	839	2.15	318	40	34	13.544	0.498	318.676	349.127	3063355.387	627273.609	1320.192	
	840	1.3	228	29	4	8.166	-1.012	228.484	258.936	3063340.519	627268.150	1319.532	
	841	2.15	110	54	2	7.646	-0.083	110.901	141.352	3063336.114	627280.939	1319.611	
	842	1.3	90	25	10	4.350	-0.920	90.419	120.871	3063339.854	627279.898	1319.624	
	843	1.3	58	12	29	4.435	-0.881	58.208	88.659	3063342.190	627280.598	1319.663	
	844	1.3	53	13	31	6.619	-0.988	53.225	83.677	3063342.815	627282.743	1319.556	
	845	1.3	49	40	38	8.317	-1.331	49.677	80.128	3063343.512	627284.358	1319.213	
	846	1.3	35	47	58	6.964	-1.004	35.799	66.251	3063344.890	627282.538	1319.540	
	847	1.3	23	25	46	6.451	-0.878	23.429	53.881	3063345.888	627281.375	1319.666	
	848	1.3	2	10	19	5.790	-0.882	2.172	32.623	3063346.962	627279.285	1319.662	
	849	1.3	0	7	38	7.454	-0.983	0.127	30.578	3063348.503	627279.956	1319.561	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	850	1.3	350	10	41	7.445	-0.923	350.178	20.629	3063349.053	627278.787	1319.621	
	851	1.3	349	59	14	8.790	-0.877	349.987	20.438	3063350.322	627279.233	1319.667	
	852	1.3	351	11	45	12.235	-1.821	351.196	21.647	3063353.458	627280.677	1318.723	
	853	1.3	7	14	8	13.034	-2.637	7.236	37.687	3063352.400	627284.132	1317.907	
	854	1.3	14	31	19	11.666	-2.347	14.522	44.973	3063350.339	627284.409	1318.197	
	855	1.3	10	7	43	16.808	-2.432	10.129	40.580	3063354.852	627287.098	1318.112	
	856	1.3	4	7	29	18.313	-3.256	4.125	34.576	3063357.164	627286.556	1317.288	
	857	1.3	12	31	15	17.576	-3.440	12.521	42.972	3063354.946	627288.144	1317.104	
	858	1.3	13	36	43	20.058	-3.809	13.612	44.063	3063356.499	627290.113	1316.735	
	859	1.3	4	49	42	22.306	-3.789	4.828	35.280	3063360.295	627289.047	1316.755	
3m2	3m1	2.15	0	0	0	71.916	1.437	0.000	190.471	3063355.161	627198.805	1321.343	
(HI=1.530)	863	1.3	342	21	33	12.036	-0.057	342.359	190.471	3063414.043	627209.687	1320.699	micro
	864	1.3	282	55	45	5.262	-0.126	282.929	190.471	3063420.705	627210.918	1320.630	micro
	865	1.3	279	4	52	18.075	-0.180	279.081	190.471	3063408.105	627208.590	1320.576	micro
	866	1.3	7	58	48	46.517	-0.043	7.980	190.471	3063380.137	627203.421	1320.713	zoology corner
	867	2.15	5	21	17	31.526	0.728	5.355	190.471	3063394.878	627206.145	1320.634	road
	868	2.15	359	58	58	31.916	0.872	359.983	190.471	3063394.494	627206.075	1320.778	road
	869	1.3	341	16	31	3.318	-0.165	341.275	190.471	3063422.616	627211.272	1320.591	gp
	870	1.3	334	41	27	5.644	-0.131	334.691	190.471	3063420.329	627210.849	1320.625	gp
	871	1.3	347	54	37	6.092	-0.111	347.910	190.471	3063419.888	627210.768	1320.645	gp
	872	1.3	354	1	4	8.244	-0.062	354.018	190.471	3063417.772	627210.377	1320.694	gp
	873	2.15	358	58	52	28.205	0.865	358.981	190.471	3063398.144	627206.749	1320.771	road
	874	2.15	5	18	5	27.798	0.779	5.301	190.471	3063398.544	627206.823	1320.685	road
	875	1.3	354	49	2	13.353	0.049	354.817	190.471	3063412.748	627209.448	1320.805	
	876	1.3	96	24	40	18.434	-0.121	96.411	190.471	3063407.752	627208.525	1320.635	corner
	877	1.3	102	45	27	17.378	-0.529	102.758	190.471	3063408.790	627208.717	1320.227	
	878	1.3	109	48	19	16.559	-0.650	109.805	190.471	3063409.596	627208.865	1320.106	
	879	1.3	114	29	46	15.282	-0.638	114.496	190.471	3063410.851	627209.098	1320.118	
	880	1.3	123	5	14	15.186	-0.671	123.087	190.471	3063410.946	627209.115	1320.085	
	881	1.3	127	26	38	14.452	-0.640	127.444	190.471	3063411.668	627209.248	1320.116	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	882	1.3	123	34	36	13.053	-0.575	123.577	190.471	3063413.043	627209.503	1320.181	
	883	1.3	123	11	55	11.111	-0.563	123.199	190.471	3063414.953	627209.856	1320.193	
	884	1.3	136	8	32	9.590	-0.477	136.142	190.471	3063416.449	627210.132	1320.279	
	885	1.3	133	54	49	8.466	-0.481	133.914	190.471	3063417.554	627210.336	1320.275	
	886	1.3	134	12	11	5.892	-0.421	134.203	190.471	3063420.085	627210.804	1320.335	
	887	1.3	123	32	15	17.828	-1.167	123.538	190.471	3063408.348	627208.635	1319.589	
	888	1.3	124	31	20	18.558	-1.381	124.522	190.471	3063407.630	627208.502	1319.375	
	889	1.3	124	33	56	20.229	-2.033	124.566	190.471	3063405.987	627208.199	1318.723	
	890	1.3	126	23	7	23.004	-1.634	126.385	190.471	3063403.258	627207.694	1319.122	
	891	2.15	128	57	2	25.950	-2.031	128.951	190.471	3063400.361	627207.159	1317.875	
	892	2.15	126	2	47	26.104	-2.499	126.046	190.471	3063400.210	627207.131	1317.407	
	893	2.15	134	52	52	20.228	-1.755	134.881	190.471	3063405.988	627208.199	1318.151	
	894	2.15	139	10	53	18.014	-1.853	139.181	190.471	3063408.165	627208.601	1318.053	
	895	2.15	147	35	40	15.275	-1.858	147.594	190.471	3063410.858	627209.099	1318.048	
	896	2.15	158	35	34	13.935	-1.930	158.593	190.471	3063412.176	627209.342	1317.976	
	897	2.15	179	54	53	13.286	-2.375	179.915	190.471	3063412.814	627209.460	1317.531	
	898	2.15	189	56	43	12.762	-2.550	189.945	190.471	3063413.330	627209.555	1317.356	
	899	2.15	184	41	11	11.480	-2.120	184.686	190.471	3063414.590	627209.788	1317.786	
3m3	3m4	1.3	0	0	0	55.061	-8.269	0.000	22.432	3063514.739	627188.594	1306.820	
(HI=1.440)	900	1.3	347	30	31	27.489	-5.089	347.509	9.941	3063490.921	627172.329	1310.000	
	901	1.3	358	44	2	30.316	-5.101	358.734	21.166	3063492.115	627178.530	1309.988	
	902	1.3	6	36	24	31.657	-4.979	6.607	29.039	3063491.522	627182.950	1310.110	
	903	1.3	341	54	50	26.673	-5.219	341.914	4.346	3063490.441	627169.605	1309.870	
	904	1.3	334	2	24	25.710	-4.879	334.040	356.472	3063489.506	627166.001	1310.210	
	905	1.3	328	51	7	23.018	-4.391	328.852	351.284	3063486.597	627164.095	1310.698	
	906	1.3	342	25	20	24.154	-4.322	342.422	4.855	3063487.912	627169.627	1310.767	
	907	1.3	352	49	5	25.953	-4.334	352.818	15.250	3063488.884	627174.410	1310.755	
	908	1.3	359	37	41	27.962	-4.483	359.628	22.060	3063489.759	627178.085	1310.606	
	909	1.3	5	46	37	28.303	-4.250	5.777	28.209	3063488.786	627180.962	1310.839	
	910	1.3	9	28	56	30.553	-4.216	9.482	31.915	3063489.779	627183.735	1310.873	

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	911	1.3	15	43	51	32.277	-3.635	15.731	38.163	3063489.222	627187.527	1311.454	
	912	1.3	21	19	24	33.917	-3.646	21.323	43.756	3063488.343	627191.040	1311.443	
	913	1.3	24	35	26	36.643	-3.695	24.591	47.023	3063488.824	627194.392	1311.394	
	914	1.3	27	23	46	36.537	-3.292	27.396	49.829	3063487.414	627195.502	1311.797	
	915	1.3	31	9	19	38.220	-3.413	31.155	53.588	3063486.532	627198.342	1311.676	
	916	1.3	33	45	26	37.009	-2.522	33.757	56.190	3063484.438	627198.334	1312.567	
	917	1.3	38	1	41	38.088	-2.582	38.028	60.460	3063482.623	627200.721	1312.507	
	918	1.3	34	32	39	34.831	-2.871	34.544	56.977	3063482.827	627196.787	1312.218	
	919	1.3	35	0	51	33.783	-2.395	35.014	57.447	3063482.023	627196.059	1312.694	
	920	1.3	36	13	11	34.572	-2.664	36.220	58.652	3063481.830	627197.109	1312.425	
	921	1.3	28	30	9	32.399	-2.635	28.503	50.935	3063484.263	627192.739	1312.454	
	922	1.3	25	24	41	29.412	-2.599	25.411	47.844	3063483.585	627189.387	1312.490	
	923	1.3	18	55	23	25.533	-2.471	18.923	41.355	3063483.010	627184.454	1312.618	
	924	1.3	14	2	39	25.055	-2.890	14.044	36.477	3063483.991	627182.478	1312.199	
	925	1.3	9	38	23	22.425	-2.612	9.640	32.072	3063482.847	627179.491	1312.477	
	926	1.3	5	38	10	20.029	-2.571	5.636	28.069	3063481.518	627177.008	1312.518	
	927	1.3	1	15	14	17.079	-2.384	1.254	23.686	3063479.485	627174.444	1312.705	
	928	1.3	344	45	33	13.250	-2.366	344.759	7.192	3063476.990	627169.242	1312.723	
	929	1.3	328	13	7	12.847	-2.314	328.219	350.651	3063476.521	627165.496	1312.775	
	930	1.3	310	22	46	12.773	-2.175	310.379	332.812	3063475.206	627161.747	1312.914	
	931	1.3	310	19	49	10.941	-1.771	310.330	332.763	3063473.572	627162.576	1313.318	
	932	1.3	346	27	13	10.283	-1.813	346.454	8.886	3063474.004	627169.172	1313.276	
	933	1.3	7	45	53	16.110	-1.798	7.765	30.197	3063477.768	627175.686	1313.291	
	934	1.3	26	36	49	22.239	-1.826	26.614	49.046	3063478.421	627184.379	1313.263	
	935	1.3	33	57	23	22.829	-1.431	33.956	56.389	3063476.482	627186.596	1313.658	
	936	1.3	31	7	54	18.916	-1.172	31.132	53.564	3063475.079	627182.802	1313.917	
	937	1.3	16	49	29	14.685	-1.127	16.825	39.257	3063475.215	627176.876	1313.962	
	938	1.3	23	4	3	14.644	-0.874	23.068	45.500	3063474.109	627178.028	1314.215	
	939	1.3	17	46	48	9.305	-1.137	17.780	40.212	3063470.950	627173.591	1313.952	
	940	1.3	16	38	54	4.875	-0.799	16.648	39.081	3063467.629	627170.657	1314.290	
	941	1.3	344	2	23	3.957	-0.981	344.040	6.472	3063467.776	627168.029	1314.108	

Tribhuvan University
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Group no: 3

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Weather:
Temperature:
Date:

DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	942	1.3	297	31	30	5.406	-1.085	297.525	319.957	3063467.983	627164.105	1314.004	
	943	1.3	270	35	9	6.897	-0.682	270.586	293.018	3063466.541	627161.235	1314.407	
	944	1.3	254	29	5	7.808	-0.377	254.485	276.917	3063464.785	627159.832	1314.712	
	945	1.3	231	2	48	10.524	-0.409	231.047	253.479	3063460.852	627157.494	1314.680	
	946	1.3	218	2	10	11.224	-0.197	218.036	240.469	3063458.312	627157.817	1314.892	
	947	1.3	171	19	25	11.271	-0.213	171.324	193.756	3063452.897	627164.903	1314.876	
	948	1.3	77	5	32	12.382	-0.203	77.092	99.525	3063461.796	627179.795	1314.886	
	949	1.3	65	6	5	14.095	-0.695	65.101	87.534	3063464.451	627181.665	1314.394	
	950	1.3	56	4	43	18.909	-0.706	56.079	78.511	3063467.611	627186.113	1314.383	
	951	1.3	65	2	3	22.080	-0.262	65.034	87.467	3063464.821	627189.642	1314.827	
	952	1.3	70	19	39	30.683	-0.241	70.328	92.760	3063462.367	627198.231	1314.848	
	953	1.3	79	51	30	33.204	0.117	79.858	102.291	3063456.776	627200.026	1315.206	
	954	1.3	75	0	35	36.742	0.607	75.010	97.442	3063459.086	627204.016	1315.696	
	955	1.3	79	17	37	41.894	0.555	79.294	101.726	3063455.330	627208.603	1315.644	
	956	1.3	74	3	24	45.388	0.615	74.057	96.489	3063458.715	627212.681	1315.704	
	957	1.3	85	21	7	31.196	0.733	85.352	107.784	3063454.316	627197.289	1315.822	
	958	1.3	86	35	3	31.927	1.367	86.584	109.017	3063453.441	627197.768	1316.456	
	959	1.3	87	29	16	29.704	1.018	87.488	109.920	3063453.724	627195.510	1316.107	
	960	1.3	87	48	46	26.996	0.890	87.813	110.245	3063454.503	627192.912	1315.979	concrete circle centre
	961	1.3	95	8	3	27.891	0.979	95.134	117.567	3063450.937	627192.308	1316.068	building edge
	962	1.3	95	41	23	25.442	0.926	95.690	118.122	3063451.852	627190.022	1316.015	building edge
	963	1.3	103	25	39	26.050	1.375	103.428	125.860	3063448.584	627188.696	1316.464	building edge
	964	1.3	107	34	16	23.535	1.402	107.571	130.004	3063448.715	627185.611	1316.491	
	965	1.3	105	16	12	22.085	0.484	105.270	127.702	3063450.338	627185.057	1315.573	
	966	1.3	107	19	33	20.152	0.469	107.326	129.758	3063450.956	627183.075	1315.558	
	967	1.3	114	36	7	19.047	1.443	114.602	137.034	3063449.907	627180.565	1316.532	
	968	1.3	125	30	34	16.266	1.320	125.509	147.942	3063450.059	627176.217	1316.409	
	969	1.3	159	27	13	13.939	0.984	159.454	181.886	3063449.913	627167.125	1316.073	
3m5	3M17	1.3	0	0	0	91.351	-5.655	0.000	148.782	3063416.405	627319.871	1300.748	
(HI=1.45	970	1.3	229	6	54	68.417	-9.542	229.115	17.897	3063559.635	627293.550	1296.861	

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DETAILING

Weather:
Temperature:
Date:

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
m)	971	1.3	233	30	23	65.540	-9.715	233.506	22.289	3063555.172	627297.382	1296.688	
	972	1.3	236	49	15	63.552	-10.130	236.821	25.603	3063551.840	627299.988	1296.273	
	973	1.3	241	33	54	61.468	-10.101	241.565	30.347	3063547.574	627303.581	1296.302	
	974	1.3	248	58	5	58.536	-10.168	248.968	37.750	3063540.812	627308.362	1296.235	
	975	1.3	252	58	13	58.477	-10.007	252.970	41.753	3063538.154	627311.465	1296.396	
	976	1.3	259	39	20	56.492	-9.568	259.656	48.438	3063532.007	627314.794	1296.835	
	977	1.3	267	34	59	56.679	-9.527	267.583	56.365	3063525.923	627319.715	1296.876	
	978	1.3	271	20	6	53.905	-9.461	271.335	60.117	3063521.385	627319.263	1296.942	
	979	1.3	276	36	43	51.141	-9.322	276.612	65.394	3063515.822	627319.022	1297.081	
	980	1.3	280	57	46	54.315	-9.318	280.963	69.745	3063513.332	627323.481	1297.085	
	981	1.3	281	32	57	53.279	-9.097	281.549	70.332	3063512.461	627322.695	1297.306	
	982	1.3	286	22	10	58.482	-9.347	286.369	75.152	3063509.515	627329.054	1297.056	
	983	1.3	289	15	52	59.920	-9.544	289.264	78.047	3063506.939	627331.145	1296.859	
	984	1.3	287	44	47	63.211	-9.684	287.746	76.529	3063509.254	627333.996	1296.719	
	985	1.3	291	39	26	61.760	-10.304	291.657	80.440	3063504.786	627333.427	1296.099	
	986	1.3	290	32	52	60.773	-10.105	290.548	79.330	3063505.781	627332.247	1296.298	
	987	1.3	286	58	19	56.128	-8.716	286.972	75.754	3063508.341	627326.927	1297.687	
	988	1.3	287	35	22	55.600	-8.255	287.589	76.372	3063507.629	627326.559	1298.148	
	989	1.3	284	37	22	53.189	-8.431	284.623	73.405	3063509.719	627323.498	1297.972	
	990	1.3	283	31	51	56.743	-8.106	283.531	72.313	3063511.768	627326.585	1298.297	
	991	1.3	279	46	54	48.115	-8.473	279.782	68.564	3063512.113	627317.311	1297.930	
	992	1.3	276	37	19	45.798	-7.945	276.622	65.404	3063513.590	627314.167	1298.458	
	993	1.3	273	12	26	45.263	-8.470	273.207	61.990	3063515.786	627312.486	1297.933	
	994	1.3	271	20	2	43.083	-7.562	271.334	60.116	3063515.994	627309.879	1298.841	
	995	1.3	267	32	42	42.011	-8.156	267.545	56.327	3063517.821	627307.487	1298.247	
	996	1.3	263	30	16	41.966	-7.573	263.504	52.287	3063520.200	627305.723	1298.830	
	997	1.3	256	7	30	44.198	-8.126	256.125	44.907	3063525.832	627303.727	1298.277	
	998	1.3	250	39	20	45.384	-7.517	250.656	39.438	3063529.579	627301.354	1298.886	
	999	1.3	244	22	24	48.059	-8.063	244.373	33.156	3063534.763	627298.809	1298.340	
	1000	1.3	239	5	26	48.708	-7.561	239.091	27.873	3063537.586	627295.296	1298.842	
	1001	1.3	235	10	51	50.447	-7.774	235.181	23.963	3063540.627	627293.014	1298.629	

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DETAILING

Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	1002	1.3	231	59	33	50.127	-7.673	231.993	20.775	3063541.396	627290.304	1298.730	
	1003	1.3	229	8	41	52.182	-7.123	229.145	17.927	3063544.177	627288.586	1299.280	
	1004	1.3	221	31	17	55.507	-7.831	221.521	10.304	3063549.140	627282.453	1298.572	
	1005	1.3	224	44	33	57.278	-7.239	224.743	13.525	3063550.218	627285.920	1299.164	
	1006	1.3	222	19	36	60.805	-7.833	222.327	11.109	3063554.194	627284.240	1298.570	
	1007	1.3	218	48	6	59.370	-7.022	218.802	7.584	3063553.379	627280.360	1299.381	
	1008	1.3	220	47	22	56.065	-6.269	220.789	9.572	3063549.813	627281.847	1300.134	
	1009	1.3	224	26	33	53.402	-7.023	224.443	13.225	3063546.514	627284.741	1299.380	
	1010	1.3	225	32	57	50.898	-6.339	225.549	14.332	3063543.843	627285.123	1300.064	
	1011	1.3	230	9	30	47.332	-7.097	230.158	18.941	3063539.298	627287.888	1299.306	
	1012	1.3	231	9	58	44.970	-6.338	231.166	19.948	3063536.800	627287.867	1300.065	
	1013	1.3	235	16	22	43.827	-6.618	235.273	24.055	3063534.549	627290.389	1299.785	
	1014	1.3	242	12	23	41.091	-6.301	242.206	30.989	3063529.755	627293.681	1300.102	
	1015	1.3	255	3	26	39.037	-6.713	255.057	43.840	3063522.685	627299.563	1299.690	
	1016	1.3	261	59	49	36.898	-6.274	261.997	50.779	3063517.859	627301.110	1300.129	
	1017	1.3	276	19	24	38.884	-6.793	276.323	65.106	3063510.897	627307.796	1299.610	
	1018	1.3	282	23	51	40.456	-6.287	282.398	71.180	3063507.580	627310.818	1300.116	
	1019	1.3	287	18	34	47.580	-6.789	287.309	76.092	3063505.965	627318.710	1299.614	
	1020	1.3	294	1	9	41.053	-5.062	294.019	82.802	3063499.673	627313.254	1301.341	
	1021	1.3	287	32	32	38.019	-5.555	287.542	76.325	3063503.517	627309.466	1300.848	
	1022	1.3	279	11	30	33.925	-4.829	279.192	67.974	3063507.251	627303.973	1301.574	
	1023	1.3	267	32	52	33.148	-5.606	267.548	56.330	3063512.906	627300.112	1300.797	
	1024	1.3	258	47	8	32.157	-4.962	258.786	47.568	3063516.225	627296.259	1301.441	
	1025	1.3	250	48	54	34.342	-5.587	250.815	39.597	3063520.991	627294.414	1300.816	
	1026	1.3	239	33	33	33.696	-5.067	239.559	28.342	3063524.186	627288.521	1301.336	
	1027	1.3	228	7	31	34.971	-4.388	228.125	16.908	3063527.988	627282.695	1302.015	
	1028	1.3	235	19	31	30.319	-3.482	235.325	24.108	3063522.203	627284.908	1302.921	
	1029	1.3	250	31	24	26.270	-4.116	250.523	39.306	3063514.856	627289.165	1302.287	
	1030	1.3	269	19	20	25.742	-3.417	269.322	58.105	3063508.130	627294.380	1302.986	
	1031	1.3	289	31	58	33.390	-4.108	289.533	78.315	3063501.291	627305.223	1302.295	
	1032	1.3	297	39	35	35.789	-3.377	297.660	86.442	3063496.750	627308.245	1303.026	

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Instrument station	Sighted to	Target Height	Horizontal Angle			Hz. distance	Vertical distance(±)	Horizontal Angle	Bearing	Northing (N)	Easting(E)	RL of point(m)	Remarks
			degrees(d)	minutes(m)	seconds(s)								
	1033	1.3	297	41	27	28.002	-2.472	297.691	86.473	3063496.251	627300.473	1303.931	
	1034	1.3	290	54	36	23.049	-1.854	290.910	79.692	3063498.653	627295.202	1304.549	
	1035	1.3	262	31	0	16.607	-2.211	262.517	51.299	3063504.912	627285.485	1304.192	
	1036	1.3	236	20	37	16.405	-1.988	236.344	25.126	3063509.381	627279.490	1304.415	
	1037	1.3	223	22	50	21.522	-2.204	223.381	12.163	3063515.567	627277.059	1304.199	
	1038	1.3	223	10	11	16.644	-1.641	223.170	11.952	3063510.812	627275.971	1304.762	
	1039	1.3	265	11	20	14.436	-1.766	265.189	53.971	3063503.020	627284.199	1304.637	
	1040	1.3	293	30	5	18.495	-1.202	293.501	82.284	3063497.012	627290.852	1305.201	
	1041	1.3	299	33	45	17.141	-0.523	299.563	88.345	3063495.024	627289.658	1305.880	
	1042	1.3	304	16	42	16.671	-0.027	304.278	93.061	3063493.638	627289.172	1306.376	
	1043	1.3	298	19	49	10.234	-0.566	298.330	87.113	3063495.044	627282.746	1305.837	
	1044	1.3	271	15	17	8.921	-0.175	271.255	60.037	3063498.984	627280.253	1306.228	
	1045	1.3	192	49	53	7.737	-0.381	192.831	341.614	3063501.871	627270.084	1306.022	
	1046	1.3	185	58	14	13.000	-0.563	185.971	334.753	3063506.287	627266.980	1305.840	
	1047	1.3	188	9	39	21.033	-1.245	188.161	336.943	3063513.881	627264.287	1305.158	
	1048	1.3	184	1	42	27.346	-1.461	184.028	332.811	3063518.853	627260.029	1304.942	
	1049	2.15	173	57	7	22.061	-1.628	173.952	322.734	3063512.085	627259.166	1303.925	
	1050	1.3	153	50	0	17.285	-2.176	153.833	302.616	3063503.845	627257.965	1304.227	
	1051	1.3	138	55	26	13.495	-2.329	138.924	287.706	3063498.633	627259.669	1304.074	
	1052	1.3	106	20	4	12.377	-2.196	106.334	255.117	3063491.350	627260.563	1304.207	
	1053	1.3	84	51	11	8.666	-1.914	84.853	233.635	3063489.390	627265.546	1304.489	
	1054	1.3	58	29	33	6.161	-1.550	58.493	207.275	3063489.053	627269.701	1304.853	
	1055	1.3	16	12	42	6.471	-1.982	16.212	164.994	3063488.278	627274.200	1304.421	
	1056	1.3	317	15	41	9.975	-1.171	317.261	106.044	3063491.772	627282.111	1305.232	
	1057	1.3	306	19	31	9.983	-0.529	306.325	95.108	3063493.640	627282.468	1305.874	

TOPOGRAPHIC MAP (GROUP 03)

SCALE:FIT TO SCALE

LEGENDS

S.N.	DESCRIPTION	SYMBOL
1.	MAJOR STATION	◎
2.	MAJOR TRAVERSE LEG	— · —
3.	MINOR STATION	○
4.	MINOR TRAVERSE LEG	— · —
5.	MAJOR CONTOUR	1310
6.	MINOR CONTOUR	1308
7.	STRUCTURES	▨
8.	SPOT HEIGHT	△
9.	ELECTRIC POLE	
10.	FENCE	
11.	TREES	
12..	GRASS	

HORIZONTAL AND VERTICAL CONTROL POINTS

STATION CO-ORDINATES

STATION	EASTING(m)	NORTHING(m)	ELEVATION(m)
3m1	627198.807	3063355.171	1321.3360
3m2	627211.875	3063425.879	1320.5260
3m3	627167.583	3063463.845	1314.9480
3m4	627188.593	3063514.736	1307.0130
3m5	627272.525	3063494.529	1306.2530
3m6	627208.240	3063270.429	1321.4020
3m7	627266.481	3063315.248	1320.2860
3m8	627265.228	3063258.409	1320.1270
3m9	627312.905	3063226.830	1319.6480
3m10	627329.034	3063270.464	1320.0340
3m11	627374.260	3063324.529	1310.3340
3m12	627322.252	3063344.004	1311.3130

TITLE: TOPOGRAPHIC MAP
SCALE: FIT TO SCALE
All dimensions are in meters.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
PULCHOWK CAMPUS
DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMMITTEE
GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

Meters

12.5 0 12.5 25

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Group No:3

Department of Civil Engineering

Survey Instruction Committee

13

Observer :
Recorder :
Instrument :

Reciprocal Levelling

Date :
Weather:
Temperature:

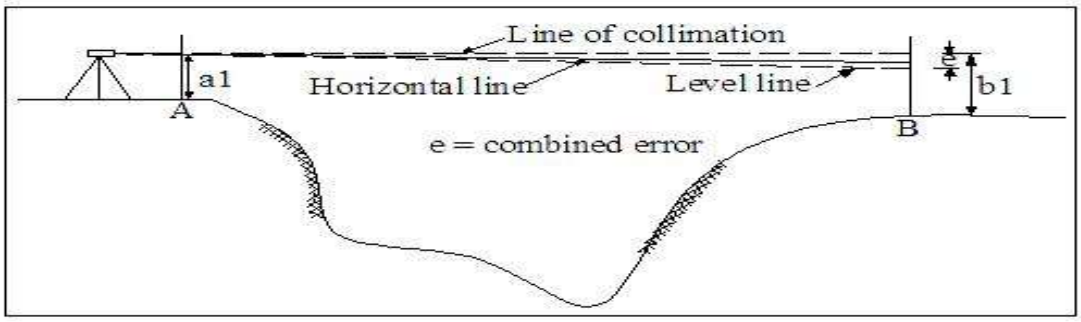
When instrument is very near to A:

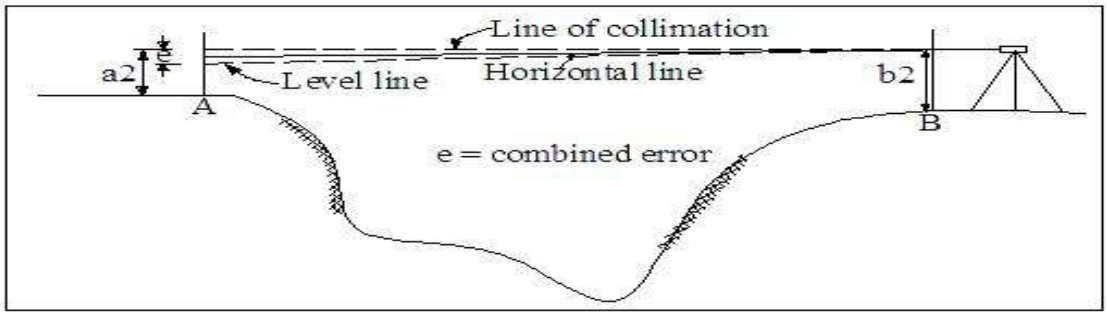
Instrument at	Sighted to	Staff Readings (m)			Mean Value = {(T+M+B) ÷ 3}	Apparent Difference;	Remarks
		Top	Mid	Bottom			
Very near to A	A	1.401	1.391	1.382	1.391	0.429	B is higher
	B	1.295	0.962	0.63	0.962		

When Instrument is very near to B:

Instrument at	Sighted to	Staff Readings (m)			Mean Value = {(T+M+B) ÷ 3}	Apparent Difference;	Remarks
		Top	Mid	Bottom			
Very near to B	A	1.899	1.566	1.233	1.566	0.437	B is higher
	B	1.139	1.129	1.119	1.129		

Check: (T+M+B) ÷ 3 = Mean - Mid = 3mm Tolerance





evel between A & B, $h_1 = |(a_1-b_1)|=$ 0.429

evel between A & B, $h_2 = |(a_2-b_2)| =$ 0.437

True difference in heights between A & B = $[(a_1-b_1)+(a_2-b_2)]\div 2 = (h_1+h_2)\div 2=$ 0.433

Error, $e = |(h_1-h_2)|=$ 0.008

Permissible error = ± 25√K mm. Where, K = loop distance in km = 2* axis distance in km= 8.886mm

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Institute of Engineering
Pulchowk Campus

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Department of Civil Engineering

Survey Instruction Committee

Group No:3

Observer :
Recorder :
Instrument :

Fly Levelling (RL Transfer) TBM2-SBM1

Date :
Weather:
Temperature:

Station chainage	BS			Mean BS	S1 (T-B)	FS			Mean FS	S2 (T-B)	Rise /Fall	Elevation	adia Interv	horz.distance	Remarks
	Top	Mid	Bot			Top	Mid	Bot							
SBM1	1.051	1.009	0.968	1.009	0.083								0.083	8.3	
	0.898	0.868	0.838	0.868	0.06	1.946	1.907	1.869	1.907	0.077	-0.898		0.137	13.7	
	0.647	0.631	0.614	0.631	0.033	1.874	1.844	1.813	1.844	0.061	-0.976		0.094	9.4	
	0.929	0.906	0.884	0.906	0.045	1.978	1.959	1.938	1.958	0.04	-1.327		0.085	8.5	
A					0	1.405	1.377	1.349	1.377	0.056	-0.471		0.056	5.6	
sum				3.414					7.086		-3.672			45.5	

station chainage	BS			Mean BS	S1 (T-B)	FS			Mean FS	S2 (T-B)	Rise /Fall	Elevation	Stadia Int	horz.distance	Remarks
	Top	Mid	Bot			Top	Mid	Bot							
A	1.486	1.466	1.446	1.466	0.04								0.04	4	
	1.774	1.754	1.734	1.754	0.04	0.759	0.738	0.716	0.738	0.043	0.728		0.083	8.3	
	1.833	1.806	1.78	1.806	0.053	0.722	0.7	0.676	0.699	0.046	1.055		0.099	9.9	
	1.728	1.687	1.646	1.687	0.082	0.789	0.764	0.738	0.764	0.051	1.042		0.133	13.3	
SBM1						0.878	0.835	0.785	0.833	0.093	0.854		0.093	9.3	
											3.679			44.8	

error=	3.679	m
permissible error=	7.21199	mm
RL of Bridge stn A=RL of SBM1-Fall=	1306.59	m

Tribhuvan University
Institute of Engineering
Pulchowk Campus

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Department of Civil Engineering

Survey Instruction Committee

Group No:3

Observer :
Recorder :
Instrument :

Fly Levelling (RL Transfer) TBM2-SBM1

Date :
Weather:
Temperature:

Station chainage	BS Top	BS Mid	BS Bot	Mean BS	S1 (T-B)	FS Top	FS Mid	FS Bot	Mean FS	S2 (T-B)	Rise /Fall	Elevation	Stadia Interval	horz.distance	Remarks
TBM2	1.766	1.716	1.666	1.716	0.1								0.1	10	
	1.224	1.183	1.136	1.181	0.088	1.046	0.998	0.956	1	0.09	0.716		0.178	17.8	
	1.098	1.063	1.029	1.063	0.069	1.099	1.055	1.013	1.056	0.086	0.125		0.155	15.5	
	1.171	1.103	1.032	1.102	0.139	1.687	1.649	1.614	1.65	0.073	-0.587		0.212	21.2	
	0.697	0.671	0.644	0.671	0.053	1.495	1.429	1.364	1.429	0.131	-0.327		0.184	18.4	
	1.109	1.05	0.996	1.052	0.113	1.649	1.625	1.599	1.624	0.05	-0.953		0.163	16.3	
	0.714	0.695	0.676	0.695	0.038	1.595	1.537	1.478	1.537	0.117	-0.485		0.155	15.5	
	0.729	0.638	0.547	0.638	0.182	1.83	1.814	1.795	1.813	0.035	-1.118		0.217	21.7	
SBM1				0	0	1.695	1.606	1.517	1.606	0.178	-0.968		0.178	17.8	
				8.118					11.715		-3.597			154.2	
SBM1	1.552	1.481	1.409	1.481	0.143					0			0.143	14.3	
	1.864	1.834	1.804	1.834	0.06	1.012	0.939	0.867	0.939	0.145	0.542		0.205	20.5	
	1.439	1.399	1.358	1.399	0.081	0.644	0.615	0.586	0.615	0.058	1.219		0.139	13.9	
	1.579	1.549	1.525	1.551	0.054	1.035	0.991	0.947	0.991	0.088	0.408		0.142	14.2	
	1.557	1.528	1.504	1.53	0.053	0.764	0.737	0.709	0.737	0.055	0.814		0.108	10.8	
	1.7	1.659	1.618	1.659	0.082	1.251	1.22	1.19	1.22	0.061	0.31		0.143	14.3	
	1.622	1.588	1.554	1.588	0.068	1.222	1.178	1.138	1.179	0.084	0.48		0.152	15.2	
	0.896	0.864	0.831	0.864	0.065	1.046	1.026	1.005	1.026	0.041	0.562		0.106	10.6	
	1.046	0.998	0.956	1	0.09	0.904	0.874	0.843	0.874	0.061	-0.01		0.151	15.1	
TBM2				0	0	1.766	1.716	1.666	1.716	0.1	-0.716		0.1	10	
				12.906					9.297		3.609			138.9	

Error=	0.012
Permissible error=	12.9933
RL of SBM1=	1308.43 m

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Group No:3

Department of Civil Engineering

Survey Instruction Committee

Observer :
Recorder :
Instrument :

Bridge Site Triangulation by Theodolite

Date :
Weather:
Temperature:

Ins stn.	sighted to	Face	HCR Observation (D:M:S)	Face Angle	Mean horizontal Angle (D:M:S)	Remarks
		L	0:00:00			
	E	R	180:00:01			
		L	59:01:35			
A	D	R	239:01:26	EAD	59:01:30	
		L	0:00:00			
	D	R	180:00:02			
		L	31:18:16			
A	B	R	211:18:26	DAB	31:18:20	
		L	0:00:00			
	B	R	180:00:00			
		L	96:56:39			
A	C	R	276:56:33	BAC	96:56:36	
		L	0:00:00			
	A	R	180:00:02			
		L	50:16:43			
C	B	R	230:16:37	ACB	50:16:39	
		L	0:00:00			
	G	R	180:00:02			
		L	58:17:27			
E	F	R	238:17:22	GEF	58:17:23	
		L	0:00:00			
	F	R	180:00:01			
		L	33:24:21			
E	D	R	213:24:06	FED	33:24:13	
		L	0:00:00			
	D	R	180:00:03			
		L	85:06:15			
E	A	R	265:06:18	DEA	85:06:15	
		L	0:00:00			
	D	R	179:59:58			
		L	92:02:16			
F	E	R	272:02:31	DFE	92:02:25	
		L	0:00:00			
	B	R	180:00:04			
		L	56:25:22			

D	A	R	236:25:12	BDA	56:25:15	
		L	0:00:00			
	A	R	180:00:04			
		L	35:52:54			
D	E	R	215:52:56	ADE	35:52:53	
		L	0:00:00			
	E	R	180:00:04			
		L	54:32:52			
D	F	R	234:32:40	EDF	54:32:44	
		L	0:00:00			
	D	R	180:00:02			
		L	92:15:59			
B	A	R	8:15:51	DBA	92:15:54	
		L	0:00:00			
	A	R	180:00:03			
		L	32:45:51			
B	C	R	212:46:06	ABC	32:45:57	
		L	0:00:00			
	E	R	180:00:02			
		L	66:40:55			
G	F	R	246:40:59	EGF	66:40:56	

Group No:3

Tribhuvan University
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Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

Observer :
Recorder :
Instrument :

Bridge Site Triangulation by Theodolite

Date :
Weather:
Temperature:

Triangle Calculation

Triangle	Angle (D:M:S)		Sum (D:M:S)	(+/-)	Error (D:M:S)	Permissible error(D:M:S)	(+/-)	Correction (D:M:S)	Corrected Angle(D:M:S)	Sides	Length
	A	96:56:36					+	0:00:16	96:56:52	AB	64.148
	B	32:45:57					+	0:00:16	32:46:13	BC	82.784
ABC	C	50:16:39	179:59:12	-	0:00:48	0:00:52	+	0:00:16	50:16:55	CA	**45.14**
	A	31:18:20					+	0:00:10	31:18:30	AB	64.172
	B	92:15:54					+	0:00:11	92:16:05	BD	**40.025**
ABD	D	56:25:15	179:59:29	-	0:00:31	0:00:52	+	0:00:10	56:25:25	DA	76.964
	A	59:01:30					-	0:00:13	59:01:17	AD	76.964
	D	35:52:53					-	0:00:12	35:52:41	DE	66.223
ADE	E	85:06:15	180:00:38	+	0:00:38	0:00:52	-	0:00:13	85:06:02	EA	45.271
	E	33:24:13					+	0:00:12	33:24:25	ED	66.223
	D	54:32:44					+	0:00:13	54:32:57	DF	36.484
EDF	F	92:02:25	179:59:22	-	0:00:38	0:00:52	+	0:00:13	92:02:38	FE	53.98
	E	58:17:23					+	0:00:06	58:17:29	EF	53.98
	F	55:01:23					+	0:00:06	55:01:29	FG	50
EFG	G	66:40:56	179:59:42	-	0:00:18	0:00:52	+	0:00:06	66:41:02	GE	48.164

Length of base line AC= 45.14
Length of base line BD= 40.025
Length of line AB from triangle ABC= 64.148
Length of line AB from triangle ABD= 64.172
Mean length of line AB= 64.16
Precision= 1 in 2673.33 (Better than 1 in 2000)

Group No:3

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

Observer :
Recorder :
Instrument :

Loop Levelling

Date :
Weather:
Temperature:

Loop Levelling form B to F

station chainage	BS	FS	IS	HI	RL	Remarks	correction	corrected RL
B	2.12			1306.437	1304.317		0	
	2.924	1.385		1307.976	1305.052		-0.00113	1305.05087
cp1			0.981		1306.995		-0.00225	1306.99275
	0.831	0.644		1308.163	1307.332		-0.00225	1307.32975
	0.595	2.449		1306.309	1305.714		-0.00338	1305.71062
F		1.875			1304.434		-0.0045	1304.4295
	6.47	6.353						

summation BS-summation FS=0.117

last Rl-First 0.117

Loop Levelling form F to B

station chainage	BS	FS	IS	HI	RL	Remarks	Correction	Corrected RL
F	1.875			1306.309	1304.434		-0.0045	1304.4295
	2.539	1.012		1307.836	1305.297		-0.00563	1305.29137
	1.301	0.662		1308.475	1307.174		-0.00675	1307.16725
D	1.062	1.511		1308.026	1306.964		-0.00788	1306.95612
	0.88	2.472		1306.434	1305.554		-0.00788	1305.54612
B		2.108			1304.326		-0.009	1304.317
	7.657	7.765						

Summation BS-Summation FS=-0.108

last Rl-First -0.108

permissible error 10mm

error 9mm

(which is under the permissible range)

Loop Levelling form C to A to C

station chainage	BS	FS	IS	HI	RL	Remarks
C	1.895			1305.8088	1303.9138	
A	1.236	1.236		1305.808	1304.5728	
C		1.895			1303.9138	
	3.131	3.131				

rise/fall 0 last RL-First RL=0

Loop Levelling form C to G to C

station chainage	BS	FS	IS	HI	RL	Remarks	Correction	Corrected Rl
C	1.831			1305.7418	1303.9138		0	1303.9138
A	0.804	1.169		1305.3798	1304.5758		-0.00125	1304.57455
	1.252	2.095		1304.5368	1303.2848		-0.0025	1303.2823
cp1	1.344	2.036		1303.8448	1302.5008		-0.00375	1302.49705
G	2.509	2.509		1303.8448	1301.3358		-0.005	1301.3308
E	2.206	1.314		1304.7368	1302.5308		-0.00625	1302.52455
	1.899	1.225		1305.4108	1303.5118		-0.0075	1303.5043
cp2	1.239	0.851		1305.7988	1304.5598		-0.00875	1304.55105
C		1.875			1303.9238		-0.01	1303.9138
	13.084	13.074						

Last RL-First 0.01 10mm

permissible error 12.635037 (which is under the permissible range)

Group No:3

Tribhuvan University
Institute of Engineering
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Department of Civil Engineering

Survey Instruction Committee

Observer :
Recorder :
Instrument :

Detailing

Date :
Weather:
Temperature:

Stn	HI	Sighted to	Signal Height	HCR Observation(D:M:S)	Horizontal Distance	Vertical Distance	Bearing	Coordinate N	Coordinate E	RL	Remarks
A								1000	1000	1304.57455	
	1.345	E	1.3	0:00:00	45.345	-2.077	265:40:17	996.583624	954.8651125	1302.52455	Station E
		1	1.3	90:20:16	4.774	-1.696	356:00:33	1004.762424	999.6677445	1302.92355	GP
		2	1.3	89:46:36	8.973	2.803	355:26:53	1008.944697	999.287877	1307.42255	GP
		3	1.3	89:43:20	14.342	-4.082	355:23:37	1014.295674	998.848193	1300.53755	GP
		4	1.3	89:27:22	19.278	-5.744	355:07:39	1019.208333	998.3625517	1298.87555	GP
		5	1.3	89:27:20	23.374	-6.596	355:07:37	1023.289511	998.014417	1298.02355	GP
		6	1.3	89:27:20	28.377	-7.169	355:07:37	1028.274427	997.5894203	1297.45055	GP
		7	1.3	89:27:19	32.388	-7.142	355:07:36	1032.270916	997.248536	1297.47755	GP
		8	1.3	89:27:19	39.049	-7.006	355:07:36	1038.907836	996.6826627	1297.61355	GP
		9	1.3	89:27:18	38.021	-6.995	355:07:35	1037.883536	996.769811	1297.62455	GP
		10	1.3	89:27:18	42.494	-6.207	355:07:35	1042.340364	996.3897937	1298.41255	GP
		11	1.3	89:27:18	56.843	-1.777	355:07:35	1056.637486	995.170731	1302.84255	GP
		12	1.3	89:27:18	60.439	-0.947	355:07:35	1060.220485	994.865222	1303.67255	GP
		13	1.3	89:27:18	63.106	-0.019	355:07:35	1062.877842	994.6386389	1304.60055	GP
		14	1.3	89:56:04	66.636	0.831	355:36:21	1066.440127	994.8945151	1305.45055	GP
		15	1.3	93:14:02	38.831	-7.121	358:54:19	1038.823912	999.2581204	1297.49855	GP
		16	1.3	82:50:30	36.977	-6.906	348:30:47	1036.236355	992.6362286	1297.71355	GP
		17	1.3	74:21:37	35.612	-6.77	340:01:54	1033.47106	987.8384758	1297.84955	GP

		18	1.3	78:20:35	27.824	-6.935	344:00:52	1026.748078	992.3374092	1297.68455	GP
		19	1.3	76:54:28	27.603	-6.926	342:34:45	1026.336893	991.7360001	1297.69355	GP
		20	1.3	93:05:10	29.615	-7.202	358:45:27	1029.608037	999.3578279	1297.41755	GP
		21	1.3	78:06:20	35.079	-6.862	343:46:37	1033.682201	990.1997166	1297.75755	GP
		22	1.3	94:07:37	37.012	-7.179	359:47:54	1037.011771	999.8697274	1297.44055	GP
		23	1.3	84:20:04	38.736	-6.036	350:00:21	1038.148198	993.2774481	1298.58355	GP
		24	1.3	80:04:47	38.73	-6.629	345:45:04	1037.538498	990.4672109	1297.99055	GP
		25	1.3	96:52:01	8.758	-7.353	2:32:18	1008.749407	1000.387872	1297.26655	GP
		26	2.15	89:30:01	26.549	-7.37	355:10:18	1026.454787	997.7653545	1296.39955	LBL
		27	1.3	73:06:51	26.865	-6.804	338:47:08	1025.044429	990.2786418	1297.81555	Gp
		28	1.3	91:52:02	23.002	-6.557	357:32:19	1022.980778	999.0121532	1298.06255	Gp
		29	2.15	84:24:44	25.324	-7.367	350:05:01	1024.945662	995.6389318	1296.40255	Gp
		30	1.3	78:54:29	21.624	-6.547	344:34:46	1020.845538	994.2501356	1298.07255	Gp
		31	1.3	89:12:16	23.236	-6.626	354:52:33	1023.143137	997.9246904	1297.99355	Gp
		32	1.3	98:13:04	23.26	-6.588	3:53:21	1023.206435	1001.577648	1298.03155	Gp
		33	1.3	90:52:38	21.55	-6.381	356:32:55	1021.510913	998.7026539	1298.23855	Gp
		34	1.3	96:01:19	21.362	-6.163	1:41:36	1021.352671	1000.631246	1298.45655	Gp
		35	1.3	73:16:42	18.914	-5.722	338:56:59	1017.651785	993.2063363	1298.89755	Gp
		36	1.3	81:51:17	19.433	-5.978	347:31:34	1018.974275	995.8025756	1298.64155	Gp
		37	1.3	75:40:18	20.382	-5.962	341:20:35	1019.310945	993.4797756	1298.65755	Gp
		38	1.3	74:21:16	17.584	-5.206	340:01:33	1016.526265	993.9933685	1299.41355	Gp
		39	1.3	83:15:37	18.37	-5.465	348:55:54	1018.028298	996.473335	1299.15455	Gp
		40	1.3	86:36:58	16.503	-4.878	352:17:15	1016.353713	997.7852581	1299.74155	Gp
		41	1.3	73:09:22	13.192	-4.878	338:49:39	1012.301504	995.2353524	1299.74155	Gp
		42	1.3	95:14:33	15.494	-3.735	0:54:50	1015.492029	1000.247125	1300.88455	Gp
		43	1.3	72:04:58	10.955	-4.343	337:45:15	1010.139598	995.8526418	1300.27655	Gp
		44	1.3	35:03:59	12.51	-3.028	300:44:16	1006.393983	989.2474616	1301.59155	Gp
		45	1.3	96:47:46	1.382	-3.282	2:28:03	1001.380719	1000.059499	1301.33755	Gp
		46	1.3	34:20:55	10.021	-2.865	300:01:12	1005.013529	991.323309	1301.75455	Gp
		47	1.3	120:10:16	14.244	-2.571	25:50:33	1012.819539	1006.208943	1302.04855	Gp

		48	1.3	173:33:47	16.363	-3.637	79:14:04	1003.056457	1016.075007	1300.98255	Gp
		49	1.3	97:20:45	7.642	-4.373	3:01:02	1007.631406	1000.402245	1300.24655	Gp
		50	1.3	48:46:34	5.88	-2.907	314:26:51	1004.117502	995.8023127	1301.71255	Gp
		51	1.3	345:52:11	4.278	-2.025	251:32:28	998.645482	995.9420985	1302.59455	Gp
		52	1.3	120:04:27	7.518	-0.475	25:44:44	1006.771703	1003.265634	1304.14455	Gp
		53	1.3	172:26:08	7.165	-2.456	78:06:25	1001.476603	1007.011196	1302.16355	Gp
		54	1.3	223:30:57	9.837	-0.36	129:11:14	993.784428	1007.624515	1304.25955	Gp
		55	1.3	288:53:38	11.468	0.323	194:33:55	988.9005614	997.1159945	1304.94255	Gp
		56	1.3	286:20:14	9.399	1.355	192:00:31	990.8066845	998.0444563	1305.97455	Gp
		57	1.3	293:31:33	9.166	0.742	199:11:50	991.3437001	996.986028	1305.36155	Gp
		58	1.3	298:39:13	7.346	0.594	204:19:30	993.3061512	996.9740945	1305.21355	Gp
		59	1.3	257:47:57	18.128	0.146	163:28:14	982.621164	1005.157562	1304.76555	Gp
		60	1.3	283:34:56	8.049	2.735	189:15:13	992.0557478	998.7056824	1307.35455	Gp
		61	1.3	248:36:33	11.66	1.717	154:16:50	989.4951585	1005.06003	1306.33655	Gp
		62	1.3	291:02:07	9.006	0.874	196:42:24	991.3741518	997.4110275	1305.49355	Gp
		63	1.3	234:10:07	10.219	0.479	139:50:24	992.1901655	1006.590481	1305.09855	Gp
		64	1.3	297:12:26	10.216	0.457	202:52:43	990.5876866	996.0282231	1305.07655	Gp
		65	1.3	231:10:58	6.714	0.245	136:51:15	995.1013618	1004.59142	1304.86455	Gp
		66	1.3	326:01:56	12.148	0.15	231:42:13	992.4715252	990.4660621	1304.76955	Gp
		67	1.3	319:52:56	10.494	0.322	225:33:13	992.6516649	992.5082707	1304.94155	Gp
		68	1.3	310:54:29	14.206	1.444	216:34:46	988.592137	991.5341216	1306.06355	Gp
		69	1.3	397:37:01	15.824	1.648	303:17:18	1008.685044	986.7724156	1306.26755	Gp
		70	1.3	237:07:18	13.633	1.726	142:47:35	989.1419067	1008.243816	1306.34555	Gp
		71	1.3	281:53:20	17.651	2.315	187:33:37	982.5024403	997.6776727	1306.93455	Gp
		72	1.3	247:35:00	14.565	1.69	153:15:17	986.9932214	1006.554612	1306.30955	Gp
		73	1.3	270:21:24	16.677	2.374	176:01:41	983.3630567	1001.155182	1306.99355	Gp
		74	1.3	254:52:28	17.526	2.388	160:32:45	983.4745906	1005.837082	1307.00755	Gp
		75	1.3	156:57:33	11.911	-1.532	62:37:50	1005.475799	1010.577691	1303.08755	Gp
		76	1.3	182:23:30	10.018	-0.032	88:03:47	1000.338605	1010.012276	1304.58755	Gp
		77	1.3	24:16:01	8.214	-2.074	289:56:18	1002.801044	992.2783456	1302.54555	Gp

		78	1.3	203:45:48	12.5	0.415	109:26:05	995.8408415	1011.787765	1305.03455	Gp
		79	1.3	218:38:34	10.445	0.331	124:18:51	994.1118371	1008.627141	1304.95055	Gp
		80	1.3	233:31:25	10.253	0.504	139:11:42	992.2391144	1006.700199	1305.12355	Gp
		81	1.3	3:27:13	11.239	-0.37	269:07:30	999.8283688	988.7623106	1304.24955	Gp
		82	1.3	17:49:38	13.071	-2.686	283:29:55	1003.051056	987.2900788	1301.93355	Gp
		83	1.3	184:48:35	20.56	-0.275	90:28:52	999.8273603	1020.559275	1304.34455	Gp
		84	1.3	36:55:22	13.597	-3.402	302:35:39	1007.3245	988.544429	1301.21755	Gp
		85	1.3	118:32:31	23.017	-0.187	24:12:48	1020.992072	1009.440084	1304.43255	Gp
		86	2.15	73:59:02	29.948	-7.167	339:39:19	1028.079779	989.5880503	1296.60255	Gp
		87	1.3	88:49:37	26.667	-8.034	354:29:54	1026.544156	997.4433092	1296.58555	Gp
		88	1.3	80:40:25	26.033	-7.742	346:20:42	1025.297173	993.854259	1296.87755	Gp
		89	1.3	73:47:50	25.904	-7.964	339:28:07	1024.258583	990.9149368	1296.65555	Gp
		90	1.3	88:49:37	17.605	-5.062	354:29:54	1017.523901	998.3121258	1299.55755	Gp
		91	2.15	96:07:08	28.64	-7.178	1:47:25	1028.62602	1000.894747	1296.59155	Gp
		92	1.3	79:58:32	39.877	-6.25	345:38:49	1038.632303	990.1146429	1298.36955	Gp
		93	1.3	119:15:43	14.151	-3.613	24:56:00	1012.832111	1005.965544	1301.00655	Gp
		94	2.15	93:41:39	58.836	-0.291	359:21:56	1058.832393	999.3485138	1303.47855	Gp
		95	1.3	143:18:09	9.744	-2.094	48:58:26	1006.39599	1007.350976	1302.52555	Gp
		96	1.3	89:52:06	66.476	0.893	355:32:23	1066.274677	994.8302991	1305.51255	Gp
		97	1.3	187:13:36	12.273	-0.082	92:53:53	999.3794888	1012.257304	1304.53755	Gp
		99	1.3	258:21:35	20.97	2.671	164:01:52	979.8392067	1005.769169	1307.29055	Gp
			1.3	304:31:45	10.8	0.545	210:12:02	990.6658848	994.5672941	1305.16455	Gp
											Gp
C								997.6780253	1045.092256	1303.9138	
	1.278	A	1.3	0:00:00	45.068		272:56:52	999.9956803	1000.083889	1304.57455	Station A
		100	1.3	344:57:15	3.207	0.165	257:54:07	997.005885	1041.956482	1304.0568	Gp
		101	1.3	48:21:51	2.672	-0.237	321:18:43	999.7636836	1043.422042	1303.6548	Gp
		102	1.3	315:34:19	5.893	1.282	228:31:11	993.7747248	1040.677316	1305.1738	Gp
		103	1.3	311:16:17	8.857	1.434	224:13:09	991.330414	1038.915341	1305.3258	Gp

		104	1.3	56:55:47	4.274	-0.261	329:52:39	1001.37484	1042.947347	1303.6308	Gp
		105	1.3	127:47:09	5.981	-0.727	40:44:01	1002.210138	1048.995116	1303.1648	Gp
		106	1.3	328:04:03	15.475	3.515	241:00:55	990.1792057	1031.555516	1307.4068	Gp
		107	1.3	153:42:30	8.485	-1.027	66:39:22	1001.040197	1052.8827	1302.8648	Gp
		108	1.3	262:16:59	8.492	2.079	175:13:51	989.2154268	1045.798294	1305.9708	Gp
		109	1.3	148:41:33	11.459	-1.496	61:38:25	1003.121116	1055.175978	1302.3958	Gp
		110	1.3	214:13:55	9.77	0.739	127:10:47	991.7738465	1052.876443	1304.6308	Gp
		111	1.3	156:14:52	15.237	1.938	69:11:44	1003.089895	1059.335775	1305.8298	Gp
		112	1.3	199:45:50	8.795	-0.172	112:42:42	994.2823296	1053.205287	1303.7198	Gp
		113	1.3	152:02:30	15.886	-2.218	64:59:22	1004.394391	1059.488624	1301.6738	Gp
		114	1.3	190:24:58	11.596	-0.46	103:21:50	994.9977866	1056.374257	1303.4318	Gp
		115	1.3	149:29:07	19.438	-2.926	62:25:59	1006.673634	1062.323474	1300.9658	Gp
		116	1.3	169:23:42	16.949	-1.573	82:20:34	999.9364163	1061.890121	1302.3188	Gp
		117	1.3	181:15:30	26.094	-2.556	94:12:22	995.7641721	1071.115976	1301.3358	Gp
		118	2.15	143:59:04	23.458	-3.176	56:55:56	1010.477432	1064.750663	1299.8658	Gp
		119	2.15	153:36:10	15.572	-1.188	66:33:02	1003.874743	1059.378189	1301.8538	Gp
		120	2.15	149:54:34	24.589	-3.749	62:51:26	1008.895759	1066.973329	1299.2928	Gp
		121	1.28	23:33:19	7.094	-0.074	296:30:11	1000.843691	1038.74376	1303.8378	Gp
		122	2.15	98:13:26	21.703	-4.454	11:10:18	1018.969777	1049.297196	1298.5878	Gp
		123	1.28	350:42:41	7.961	0.685	263:39:33	996.7987913	1037.179957	1304.5968	Gp
		124	1.28	6:59:41	18.444	0.627	279:56:33	1000.862562	1026.925257	1304.5388	Gp
		125	2.15	100:42:19	22.804	-4.839	13:39:11	1019.837649	1050.474959	1298.2028	LBL
		126	1.28	354:31:47	19.248	1.215	267:28:39	996.8308879	1025.862907	1305.1268	Gp
		127	1.28	350:43:28	13.159	1.282	263:40:20	996.2276905	1032.013425	1305.1938	Gp
		128	1.28	175:25:09	7.789	-0.486	88:22:01	997.8999988	1052.878092	1303.4258	Gp
		129	1.28	344:57:23	7.449	1.051	257:54:15	996.1171063	1037.808635	1304.9628	Gp
		130	1.28	181:45:40	11.096	-0.742	94:42:32	996.76712	1056.150803	1303.1698	Gp
		131	1.28	331:53:03	7.311	1.329	244:49:55	994.5688416	1038.475331	1305.2408	Gp
		132	1.28	174:32:22	12.947	-1.021	87:29:14	998.2456501	1058.026807	1302.8908	Gp
		133	1.28	178:31:28	14.682	-1.179	91:28:20	997.300811	1059.769409	1302.7328	Gp

		134	1.28	276:09:46	4.496	0.544	189:06:38	993.2387439	1044.380359	1304.4558	Gp
		135	1.28	180:25:07	21.906	-2.178	93:21:59	996.3916881	1066.960456	1301.7338	Gp
		136	1.28	255:27:10	5.142	0.613	168:24:02	992.6410393	1046.12615	1304.5248	Gp
		137	1.28	181:35:54	25.985	-2.583	94:32:46	995.6184183	1070.995504	1301.3288	Gp
		138	1.28	299:44:09	5.619	0.969	212:41:01	992.9487081	1042.057998	1304.8808	Gp
		139	1.28	184:58:05	27.794	-2.545	97:54:57	993.8502839	1072.621419	1301.3668	Gp
		140	1.28	265:21:01	7.639	1.631	178:17:53	990.0423952	1045.319136	1305.5428	Gp
		141	1.28	182:27:45	25.291	-2.462	95:24:37	995.2934154	1070.270586	1301.4498	Gp
		142	1.28	233:59:18	7.864	1.384	146:56:10	991.0875	1049.382649	1305.2958	Gp
		143	1.28	220:34:33	8.731	1.106	133:31:25	991.6653921	1051.423022	1305.0178	Gp
		144	1.28	209:29:04	10.394	0.86	122:25:56	992.103707	1053.865067	1304.7718	Gp
		145	1.28	84:11:49	5.647	0.813	357:08:41	1003.318015	1044.81096	1304.7248	Gp
		146	1.28	230:15:14	10.17	1.349	143:12:06	989.53441	1051.184089	1305.2608	Gp
		147	1.28	81:31:51	7.469	-1.802	354:28:43	1005.112372	1044.373609	1302.1098	Gp
		148	1.28	249:09:32	11.887	1.88	162:06:24	986.3659976	1048.744488	1305.7918	Gp
		149	1.28	77:37:52		-2.382	350:34:44	997.6780253	1045.092256	1301.5298	Gp
E								996.583624	954.8651125	1302.52455	
	1.324	G	1.28	0:00:00			268:52:19	995.6354778	906.7134465	1301.3308	Station G
		150	1.28	222:54:19	4.95	1.319	131:46:38	993.2857555	958.55653	1303.88755	Gp
		151	1.28	250:42:54	5.115	0.983	159:35:13	991.789833	956.6491509	1303.55155	Gp
		152	1.28	307:12:36	5.17	1.189	216:04:55	992.4053566	951.8202839	1303.75755	Gp
		153	1.28	355:46:51	7.103	1.386	264:39:10	995.9216868	947.7930231	1303.95455	Gp
		154	1.28	326:49:53	5.004	0.067	235:42:12	993.7639802	950.7311526	1302.63555	Gp
		155	1.28	257:56:06	8.871	2.024	166:48:25	987.9467601	956.8897663	1304.59255	Gp
		156	1.28	357:39:56	4.787	-0.097	266:32:15	996.2945119	950.086851	1302.47155	Gp
		157	1.28	249:10:07	10.507	2.42	158:02:26	986.8389197	958.7942074	1304.98855	Gp
		158	1.28	222:42:24	5.071	-0.058	131:34:43	993.21827	958.6584532	1302.51055	Gp
		159	1.28	40:15:18	6.447	-1.289	309:07:37	1000.651943	949.863854	1301.27955	Gp

		160	1.28	39:00:07	9.236	-1.358	307:52:26	1002.25384	947.5745471	1308.588613	Gp
		161	1.28	252:56:58	14.173	3.192	161:49:17	983.1180185	959.2868088	1305.76055	Gp
		162	1.5	42:21:08	1.612	-1.77	311:13:27	997.6459429	953.6526676	1300.57855	Gp
		163	1.28	37:48:16	13.998	-1.372	306:40:35	1004.944555	943.6384106	1301.19655	Gp
		164	1.6	42:39:56	13.876	-1.524	311:32:15	1005.78494	944.4786229	1300.72455	Gp
		165	2.15	47:24:20	14.508	-2.035	316:16:39	1007.068494	944.8376723	1299.66355	Gp
		166	2.05	53:32:46	15.612	-2.125	322:25:05	1008.955851	945.3434246	1299.67355	Gp
		167	1.28	260:44:50	16.368	3.508	169:37:09	980.4835386	957.8144642	1306.07655	Gp
		168	1.28	246:22:08	20.104	4.17	155:14:27	978.3276604	963.2847687	1306.73855	Gp
		169	2.05	32:19:56	20.125	-2.04	301:12:15	1007.010169	937.651665	1299.75855	Gp
		170	1.28	235:23:40	22.621	4.202	144:15:59	978.2212293	968.0761723	1306.77055	Gp
		171	1.28	47:04:18	19.934	-3.005	315:56:37	1010.909308	941.0036869	1299.56355	Gp
		172	1.28	223:28:57	20.399	2.842	132:21:16	982.840511	969.9397948	1305.41055	Gp
		173	2.15	47:47:48	24.85	-2.158	316:40:07	1014.659438	937.8126212	1299.54055	Gp
		174	1.28	215:50:03	22.329	2.738	124:42:22	983.8702236	973.2214109	1305.30655	Gp
		175	1.28	202:36:42	25.709	1.878	111:29:01	987.1680865	978.787912	1304.44655	Gp
		176	1.95	28:59:34	21	-3.075	297:51:53	1006.398721	936.2999875	1298.82355	LBL
		177	1.28	192:07:07	26.347	0.23	100:59:26	991.5606426	980.7288722	1302.79855	Gp
		178	1.28	203:10:13	34.114	1.25	112:02:32	983.7809895	986.4856366	1303.81855	Gp
		179	1.28	63:12:19	14.52	-3.072	332:04:38	1009.413199	948.0656707	1299.49655	Gp
		180					268:52:19	996.583624	954.8651125	1303.84855	Gp
		181	1.28	64:14:26	18.449	-3.2	333:06:45	1013.038217	946.5217342	1299.36855	Gp
		182	1.28	203:36:12	32.073		112:28:31	984.322605	984.5019939	1302.56855	Gp
B								1064.0077	995.5241456	1304.317	
	1.328	C	1.3	0:00:00	82.808	-0.295	143:13:45	997.6780253	1045.092256	1303.9138	Station C
		241	2.15	226:04:11	14.667	3.52	9:17:56	1078.481959	997.8941082	1307.015	Gp
		242	2.15	230:55:15	14.132	3.318	14:09:00	1077.710922	998.9788726	1306.813	Gp
		243	2.15	237:59:46	13.29	2.932	21:13:31	1076.396162	1000.335602	1306.427	Gp
		244	2.15	240:55:50	13.669	2.912	24:09:35	1076.479406	1001.118618	1306.407	Gp

		245	2.15	283:33:26	10.184	0.818	66:47:11	1068.021828	1004.883667	1304.313	Gp
		246	2.15	214:05:01	9.188	2.874	357:18:46	1073.185596	995.0933783	1306.369	Gp
		247	2.15	298:06:44	12.514	-0.102	81:20:29	1065.891642	1007.895522	1303.393	Gp
		248	2.15	203:32:39	7.493	2.645	346:46:24	1071.30193	993.8097175	1306.14	Gp
		249	2.15	329:33:24	14.238	-2.216	112:47:09	1058.493499	1008.650997	1301.279	Gp
		250	2.15	337:34:50	19.892	-3.906	120:48:35	1053.819244	1012.608847	1299.589	Gp
		251	2.15	345:45:15	23.31	-5.392	128:59:00	1049.343512	1013.643684	1298.103	Gp
		252	2.15	354:30:30	26.983	-6.9	137:44:15	1044.038353	1013.670976	1296.595	Gp
		253	2.15	343:12:26	26.754	-5.661	126:26:11	1048.117698	1017.048187	1297.834	Gp
		254	2.15	357:09:37	30.005	-7.089	140:23:22	1040.891974	1014.654311	1296.406	Gp
		255	2.15	350:45:56	28.778	-6.909	133:59:41	1044.018728	1016.227148	1296.586	Gp
		256	2.15	5:14:16	33.003	-7.244	148:28:01	1035.87797	1012.784397	1296.251	LBL
		257	2.15	5:58:15	47.291	-5.505	149:12:00	1023.386628	1019.739165	1297.99	Gp
		258	2.15	7:41:27	50.267	-4.618	150:55:12	1020.077261	1019.955433	1298.877	Gp
		259	2.15	5:31:53	42.151	-6.524	148:45:38	1027.968282	1017.384318	1296.971	Gp
		260	2.15	10:08:53	62.396	-1.46	153:22:38	1008.227163	1023.484699	1302.035	Gp
		261	2.15	2:35:13	68.642	-1.582	145:48:58	1007.224388	1034.090707	1301.913	Gp
		262	2.15	359:55:39	77.258	-0.562	143:09:24	1002.179815	1041.850285	1302.933	Gp
		263	2.15	2:59:04	84.293	0.318	146:12:49	993.9503885	1042.399331	1303.813	Gp
		264	2.15	13:27:59	55.949	-2.919	156:41:44	1012.62326	1017.658507	1300.576	Gp
		265	2.15	15:05:32	49.076	-4.523	158:19:17	1018.402819	1013.652814	1298.972	Gp
		266	2.15	14:07:59	52.768	-3.507	157:21:44	1015.305124	1015.834757	1299.988	Gp
		267	2.15	15:46:04	47.49	-4.86	158:59:49	1019.672873	1012.545404	1298.635	Gp
		268	2.15	18:23:46	47.373	-4.866	161:37:31	1019.050004	1010.457554	1298.629	Gp
		269	2.15	19:10:00	45.15	-5.329	162:23:45	1020.972134	1009.179276	1298.166	Gp
		270	2.15	15:09:58	44.681	-5.667	158:23:43	1022.465713	1011.975743	1297.828	Gp
		271	2.15	14:12:11	43.378	-5.906	157:25:56	1023.951319	1012.171584	1297.589	Gp
		272	2.15	16:59:11	36.071	-6.776	160:12:56	1030.065874	1007.733547	1296.719	Gp
		273	2.15	5:07:29	26.317	-6.905	148:21:14	1041.603907	1009.331918	1296.59	Gp
		274	2.15	4:43:46	22.735	-6.74	147:57:31	1044.736034	1007.585785	1296.755	Gp

		275	2.15	4:14:09	20.895	-6.115	147:27:54	1046.391897	1006.761784	1297.38	Gp
		276	2.15	2:13:22	19.685	-5.66	145:27:07	1047.794133	1006.687455	1297.835	Gp
		277	2.15	2:53:49	18.274	-5.332	146:07:34	1048.835412	1005.709466	1298.163	Gp
		278	2.15	4:56:59	16.707	-4.808	148:10:44	1049.811788	1004.333227	1298.687	Gp
		279	2.15	4:39:42	15.211	-4.202	147:53:27	1051.123422	1003.609311	1299.293	Gp
		280	2.15	359:30:45	14.1	-3.6	142:44:30	1052.785313	1004.060423	1299.895	Gp
		281	2.15	358:56:30	11.638	-2.799	142:10:15	1054.815508	1002.661838	1300.696	Gp
		282	2.15	356:35:38	9.222	-2.029	139:49:23	1056.961578	1001.473722	1301.466	Gp
		283	2.15	343:22:22	9.669	-1.859	126:36:07	1058.242538	1003.286392	1301.636	Gp
		284	2.15	337:08:15	7.532	-1.338	120:22:00	1060.200034	1002.022815	1302.157	Gp
		285	2.15	349:19:58	6.932	-1.386	132:33:43	1059.318986	1000.629886	1302.109	Gp
		286	2.15	347:54:12	5.511	-1.087	131:07:57	1060.38255	999.6749778	1302.408	Gp
D								1062.797768	955.5229882	1306.95612	
	1.358	B	2.15	0:00:00			88:16:03	1064.0077	995.5241456	1304.317	Station B
		287	2.15	338:20:11	3.395	-0.096	66:36:14	1064.145874	958.6388567	1306.06812	Gp
		288	2.15	339:29:53	8.14	-0.009	67:45:56	1065.877922	963.0577244	1306.15512	Gp
		289	2.15	350:05:24	13.162	0.116	78:21:27	1065.453919	968.4141909	1306.28012	Gp
		290	2.15	340:55:58	19.568	0.178	69:12:01	1069.746412	973.8156907	1306.34212	Gp
		291	2.15	345:20:11	25.534	0.134	73:36:14	1070.005412	980.0186005	1306.29812	Gp
		292	2.15	340:35:00	31.607	0.396	68:51:03	1074.201487	985.0010757	1306.56012	Gp
		293	2.15	348:15:22	36.095	0.081	76:31:25	1071.209514	990.6241499	1306.24512	Gp
		294	2.15	336:13:59	36.319	1.306	64:30:02	1078.433183	988.3041347	1307.47012	Gp
		295	2.15	325:24:38	35.9	1.348	53:40:41	1084.062121	984.4476713	1307.51212	Gp
		296	2.15	325:25:02	29.198	1.24	53:41:05	1080.089643	979.0498722	1307.40412	Gp
		297	2.15	328:13:24	22.151	1.148	56:29:27	1075.026679	973.9924368	1307.31212	Gp
		298	2.15	325:14:11	14.321	0.613	53:30:14	1071.315444	967.0356005	1306.77712	Gp
		299	1.3	323:12:46	7.013	0.317	51:28:49	1067.165352	961.0099161	1307.33112	Gp
		300	1.3	288:48:56	8.115	1.486	17:04:59	1070.554734	957.9068315	1308.50012	Gp

		301	1.3	292:11:31	13.307	1.707	20:27:34	1075.26536	960.1743741	1308.72112	Gp
		302	1.3	291:35:11	13.308	1.706	19:51:14	1075.314764	960.0426872	1308.72012	Gp
		303	1.3	292:48:11	18.001	2.292	21:04:14	1079.595193	961.9946594	1309.30612	Gp
		304	1.3	297:28:04	21.786	2.634	25:44:07	1082.422811	964.9827702	1309.64812	Gp
		305	1.3	280:34:24	13.267	1.96	8:50:27	1075.907144	957.5619945	1308.97412	Gp
		306	1.3	277:21:45	17.77	2.897	5:37:48	1080.482049	957.266296	1309.91112	Gp
		307	1.3	270:20:02	22.053	3.522	358:36:05	1084.844198	954.9847198	1310.53612	Gp
		308	1.3	277:22:03	26.185	4.042	5:38:06	1088.856232	958.0941151	1311.05612	Gp
		309	1.3	263:59:13	24.423	4.007	352:15:16	1086.997941	952.2314011	1311.02112	Gp
		310	1.3	264:16:04	27.284	4.434	352:32:07	1089.850537	951.9783677	1311.44812	Gp
		311	1.3	267:15:05	18.012	3.062	355:31:08	1080.754708	954.1157028	1310.07612	Gp
		312	1.3	262:21:13	12.111	2.043	350:37:16	1074.746871	953.5493501	1309.05712	Gp
		313	1.3	258:53:54	6.564	0.448	347:09:57	1069.19778	954.0649271	1307.46212	Gp
		314	1.3	233:42:13	7.262	0.972	321:58:16	1068.518047	951.0491698	1307.98612	Gp
		315	1.3	235:11:15	11.005	1.638	323:27:18	1071.639069	948.9700175	1308.65212	Gp
		316	1.3	238:33:48	16.11	2.507	326:49:51	1076.282786	946.7090003	1309.52112	Gp
		317	1.3	235:38:52	21.1	3.238	323:54:55	1079.849669	943.0954915	1310.25212	Gp
		318	1.3	23:29:37	25.812	4.038	111:45:40	1053.22829	979.4955651	1311.05212	Gp
		319	1.3	236:08:29	29.528	4.531	324:24:32	1086.809674	938.3377861	1311.54512	Gp
		320	2.15	234:35:43	36.309	7.037	322:51:46	1091.743008	933.6023005	1313.20112	Gp
		321	2.15	248:10:24	33.766	6.926	336:26:27	1093.749298	942.0268578	1313.09012	Gp
		322	2.15	249:04:36	39.944	7.014	337:20:39	1099.659501	940.1367677	1313.17812	Gp
		323	1.3	250:19:42	34.043	6.061	338:35:45	1094.492798	943.0991829	1313.07512	Gp
		324	1.3	253:06:52	28.327	4.633	341:22:55	1089.642355	946.4793679	1311.64712	Gp
		325	1.3	249:34:24	21.557	3.567	337:50:27	1082.76256	947.3921007	1310.58112	Gp
		326	1.3	249:24:07	15.848	2.61	337:40:10	1077.457282	949.5015483	1309.62412	Gp
		327	1.3	249:30:59	10.685	1.726	337:47:02	1072.68956	951.4829777	1308.74012	Gp
		328	1.3	249:03:29	5.518	0.071	337:19:32	1067.889282	953.3958294	1307.08512	Gp
		329	1.3	247:22:31	2.232	0.051	335:38:34	1064.831102	954.602457	1307.06512	Gp
		330	1.3	53:23:21	2.493	-0.499	141:39:24	1060.84249	957.0695766	1306.51512	Gp

		331	2.15	56:36:06	7.958	-0.587	144:52:09	1056.289396	960.1023831	1305.57712	Gp
		332	2.15	60:38:07	13.57	-2.18	148:54:10	1051.177884	962.5317821	1303.98412	Gp
		333	2.15	60:46:36	18.951	-3.916	149:02:39	1046.546071	965.27095	1302.24812	Gp
		334	2.15	46:32:11	18.554	-2.791	134:48:14	1049.723091	968.6874762	1303.37312	Gp
		335	2.15	37:08:47	21.261	-2.945	125:24:50	1050.47747	972.8504342	1303.21912	Gp
		336	2.15	40:31:26	24.952	-4.954	128:47:29	1047.165672	974.9713787	1301.21012	Gp
		337	2.15	40:31:28	24.446	-5.645	128:47:31	1047.48249	974.5768375	1300.51912	Gp
		338	2.15	40:01:40	32.9	-6.525	128:17:43	1042.409166	981.3438113	1299.63912	Gp
		339	2.15	37:13:37	31.187	-5.821	125:29:40	1044.689847	980.9145648	1300.34312	Gp
		340	2.15	29:13:13	33.638	-5.891	117:29:16	1047.271833	985.3635712	1300.27312	Gp
		341	2.15	29:14:13	37.338	-7.015	117:30:16	1045.554429	988.6408612	1299.14912	Gp
		342	2.15	29:37:09	31.353	-5.36	117:53:12	1048.133213	983.2351053	1300.80412	Gp
		343	2.15	23:35:33	28.474	-3.472	111:51:36	1052.195761	981.9496057	1302.69212	Gp
		344	2.15	23:27:48	29.287	-2.727	111:43:51	1051.954353	982.7286625	1303.43712	Gp
		345	2.15	4:32:54	28.983	-1.727	92:48:57	1061.373955	984.4709941	1304.43712	Gp
		346	2.15	11:43:34	25.188	-1.875	99:59:37	1058.426684	980.3288134	1304.28912	Gp
		347	2.15	16:43:51	21.515	-1.697	104:59:54	1057.229881	976.3050443	1304.46712	Gp
		348	2.15	6:08:44	18.67	-1.516	94:24:47	1061.361182	974.1376362	1304.64812	Gp
		349	2.15	6:03:21	13.132	0.021	94:19:24	1061.807815	968.6176213	1306.18512	Gp
		350	2.15	6:54:19	7.579	0.343	95:10:22	1062.11445	963.0711216	1306.50712	Gp
		351	2.15	6:59:15	3.151	0.562	95:15:18	1062.509173	958.6607444	1306.72612	Gp
G								995.6354778	906.7134465	1301.3308	
	1.365	F	2.15	0:00:00			22:11:14	1041.934616	925.5957418	1304.4295	Station F
		352	1.3	32:52:11	17.822	-0.0515	55:03:25	1005.843243	921.3225266	1301.3443	Gp
		353	1.3	25:45:00	16.291	-0.522	47:56:14	1006.549543	918.8080678	1300.8738	Gp
		354	1.7	7:01:51	29.762	-0.15	29:13:05	1021.610808	921.241312	1300.8458	Gp
		355	1.3	11:01:33	30.79	-0.596	33:12:47	1021.395609	923.5787884	1300.7998	Gp
		356	1.3	322:14:22	17.4	-0.557	344:25:36	1012.396682	902.0420421	1300.8388	Gp
		357	1.3	320:15:01	18.261	-0.506	342:26:15	1013.045303	901.2032634	1300.8898	Gp

		358	1.3	316:42:15	17.444	-0.431	338:53:29	1011.908975	900.4312163	1300.9648	Gp
		359	1.3	316:17:26	16.488	-0.47	338:28:40	1010.973858	900.6646248	1300.9258	Gp
		360	1.3	312:22:15	16.695	-0.482	334:33:29	1010.711414	899.5413359	1300.9138	Gp
		361	1.3	314:03:03	15.486	-0.485	336:14:17	1009.808691	900.4735564	1300.9108	Gp
		362	1.3	304:48:29	15.559	-0.359	326:59:43	1008.683655	898.2383323	1301.0368	Gp
		363	1.3	297:52:52	16.402	-0.375	320:04:06	1008.212704	896.1854368	1301.0208	Gp
		364	1.3	285:48:06	17.987	-0.346	307:59:20	1006.706632	892.5373498	1301.0498	Gp
		365	1.3	290:22:04	18.476	-0.294	312:33:18	1008.130753	893.1034988	1301.1018	Gp
		366	1.3	287:37:22	20.556	-0.137	309:48:36	1008.796329	890.9229072	1301.2588	Gp
		367	1.3	280:20:20	21.804	-0.037	302:31:34	1007.359138	888.3294803	1301.3588	Gp
		368	1.3	279:03:27	24.454	-0.038	301:14:41	1008.319633	885.8062631	1301.3578	Gp
		369	1.3	273:03:26	25.653	-0.069	295:14:40	1006.575996	883.5103977	1301.3268	Gp
		370	1.3	269:55:26	23.106	-0.035	292:06:40	1004.332667	885.3067622	1301.3608	Gp
		371	1.3	264:51:34	22.128	-0.033	287:02:48	1002.122312	885.5576113	1301.3628	Gp
		372	1.3	269:37:32	27.142	-0.007	291:48:46	1005.720764	881.5147327	1301.3888	Gp
		373	1.3	271:26:03	29.476	-0.063	293:37:17	1007.446248	879.7071458	1301.3328	Gp
		374	1.3	268:26:08	19.904	-0.169	290:37:22	1002.64594	888.084903	1301.2268	Gp
		375	1.3	270:19:13	16.109	-0.251	292:30:27	1001.802073	891.8314782	1301.1448	Gp
		376	1.3	273:03:05	11.146	-0.465	295:14:19	1000.388009	896.6314446	1300.9308	Gp
		377	1.3	294:34:36	9.258	-0.456	316:45:50	1002.380274	900.3716572	1300.9398	Gp
		378	1.3	241:18:31	7.209	-0.57	263:29:45	994.818875	899.5508464	1300.8258	Gp
		379	1.3	321:13:38	7.17	-0.688	343:24:52	1002.507167	904.6667932	1300.7078	Gp
		380	1.3	348:48:21	6.628	-0.735	10:59:35	1002.141856	907.9773399	1300.6608	Gp
		381	1.3	349:28:03	4.753	-0.779	11:39:17	1000.290484	907.6736162	1300.6168	Gp
		382	1.3	0:58:29	3.619	-0.646	23:09:43	998.9627748	908.1369126	1300.7498	Gp
		383	1.3	35:24:34	2.228	-0.455	57:35:48	996.8294093	908.5945397	1300.9408	Gp
		384	1.3	37:13:45	2.133	-0.356	59:24:59	996.7207379	908.5497197	1301.0398	Gp
		385	1.3	24:11:21	2.799	-0.501	46:22:35	997.566558	908.7396079	1300.8948	Gp
		386	1.3	21:00:42	2.978	-0.816	43:11:56	997.8063859	908.7519857	1300.5798	Gp
		387	1.3	25:01:21	5.541	-0.871	47:12:35	999.3995721	910.7796824	1300.5248	Gp

		388	2.15	27:57:52	6.323	-0.082	50:09:06	999.686988	911.5678872	1300.4638	Gp
		389	2.15	40:38:32	6.617	-0.041	62:49:46	998.6570699	912.6002682	1300.5048	Gp
		390	2.15	47:39:12	7.316	-0.022	69:50:26	998.1568188	913.5812479	1300.5238	Gp
		391	2.15	73:17:40	5.777	0.478	95:28:54	995.0836169	912.4640272	1301.0238	Gp
		392	2.15	96:24:21	5.771	0.951	118:35:35	992.8735612	911.780621	1301.4968	Gp
		393	2.15	120:36:16	5.669	1.342	142:47:30	991.1204482	910.1415756	1301.8878	Gp
		394	2.15	134:30:12	6.071	1.541	156:41:26	990.0599857	909.1157223	1302.0868	Gp
		395	2.15	168:32:05	5.286	1.524	190:43:19	990.4417628	905.7300235	1302.0698	Gp
		396	1.3	171:28:08	5.61	0.667	193:39:22	990.1840711	905.3889599	1302.0628	Gp
		397	1.3	176:01:32	6.333	0.8	198:12:46	989.6197461	904.7340878	1302.1958	Gp
		398	1.3	171:31:28	7.044	0.951	193:42:42	988.7922256	905.0437651	1302.3468	Gp
		399	1.3	185:31:02	7.848	0.891	207:42:16	988.6871916	903.0648271	1302.2868	Gp
		400	1.3	175:13:25	9.275	1.303	197:24:39	986.7854233	903.9381698	1302.6988	Gp
		401	1.3	178:13:20	10.974	1.544	200:24:34	985.3503759	902.8865214	1302.9398	Gp
		402	1.3	158:13:42	11.451	1.691	180:24:56	984.184779	906.6303953	1303.0868	Gp
		403	1.3	156:00:10	11.831	1.891	178:11:24	983.8103807	907.0871311	1303.2868	Gp
		404	1.3	144:18:23	10.543	1.791	166:29:37	985.3840562	909.1758041	1303.1868	Gp
		405	1.3	149:24:34	8.3	1.254	171:35:48	987.424588	907.9264133	1302.6498	Gp
		406	1.3	77:41:02	7.556	-0.631	99:52:16	994.3401347	914.1575866	1300.7648	Gp
F								1041.934616	925.5957418	1304.4295	
	1.355	D	1.3	0:00:00			55:07:07	1062.797768	955.5229882	1306.95612	Station D
		407	1.3	62:29:18	6.28	-0.433	117:36:25	1039.024442	931.1607476	1304.0515	Gp
		408	1.3	73:09:28	5.766	-0.49	128:16:35	1038.362835	930.1222346	1303.9945	Gp
		409	1.3	71:34:50	4.791	-0.45	126:41:57	1039.07145	929.4370906	1304.0345	Gp
		410	1.3	57:42:51	4.102	-0.231	112:49:58	1040.342864	929.3763145	1304.2535	Gp
		411	1.3	98:34:01	2.979	-0.23	153:41:08	1039.264316	926.9163241	1304.2545	Gp
		412	1.3	101:18:03	3.146	-0.388	156:25:10	1039.051312	926.8542614	1304.0965	Gp
		413	1.3	78:38:45	1.774	-0.186	133:45:52	1040.707549	926.8769062	1304.2985	Gp

		414	1.3	13:06:31	2.06	0.063	68:13:38	1042.698725	927.5087859	1304.5475	Gp
		415	1.3	346:06:42	2.599	0.202	41:13:49	1043.889237	927.3087089	1304.6865	Gp
		416	1.3	339:37:20	3.956	0.379	34:44:27	1045.185412	927.8501289	1304.8635	Gp
		417	1.3	315:36:13	2.883	0.269	10:43:20	1044.767281	926.1321173	1304.7535	Gp
		418	1.3	1:27:27	6.4	0.272	56:34:34	1045.45992	930.9372987	1304.7565	Gp
		419	1.3	338:48:26	6.682	0.422	33:55:33	1047.479077	929.3250949	1304.9065	Gp
		420	1.3	321:48:26	5.7049	0.776	16:55:33	1047.392394	927.2566297	1305.2605	Gp
		421	1.3	317:31:05	6.685	0.919	12:38:12	1048.457685	927.0582041	1305.4035	Gp
		422	1.3	320:31:04	8.34	0.92	15:38:11	1049.965966	927.8436343	1305.4045	Gp
		423	1.3	326:46:39	4.769	1.242	21:53:46	1046.359588	927.3742202	1305.7265	Gp
		424	1.3	336:46:39	10.379	0.971	31:53:46	1050.746465	931.0798052	1305.4555	Gp
		425	1.3	336:52:00	11.6	1.224	31:59:07	1051.773553	931.7402773	1305.7085	Gp
		426	1.3	337:42:10	12.9	1.397	32:49:17	1052.775316	932.5878251	1305.8815	Gp
		427	1.3	332:17:58	14.075	1.675	27:25:05	1054.428576	932.0769913	1306.1595	Gp
		428	1.3	325:46:46	14.565	1.85	20:53:53	1055.54148	930.791169	1306.3345	Gp
		429	1.3	321:28:41	16.322	2.187	16:35:48	1057.576628	930.2578373	1306.6715	Gp
		430	1.3	324:24:43	16.543	2.077	19:31:50	1057.525787	931.1262242	1306.5615	Gp
		431	1.3	327:22:01	17.58	2.32	22:29:08	1058.178114	932.3192217	1306.8045	Gp
		432	1.3	329:06:03	7.692	2.126	24:13:10	1048.949573	928.7512506	1306.6105	Gp
		433	1.3	373:55:31	7.213	1.879	69:02:38	1044.514365	932.3316355	1306.3635	Gp
		434	1.3	339:18:31	16.538	3.699	34:25:38	1055.575902	934.9456484	1308.1835	Gp
		435	1.3	339:01:56	18.224	1.791	34:09:03	1057.016117	935.8262113	1306.2755	Gp
		436	1.3	335:41:23	16.816	1.47	30:48:30	1056.377633	934.2083554	1305.9545	Gp
		437	1.3	345:05:04	15.384	1.362	40:12:11	1053.684325	935.5260895	1305.8465	Gp
		438	1.3	343:03:45	11.898	1.032	38:10:52	1051.287166	932.950482	1305.5165	Gp
		439	1.3	341:42:53	9.103	0.643	36:50:00	1049.2205	931.0528933	1305.1275	Gp
		440	1.3	341:03:57	6.739	0.53	36:11:04	1047.373802	929.5743568	1305.0145	Gp
		441	1.3	2:17:34	9.492	0.108	57:24:41	1047.047039	933.5933163	1304.5925	Gp
		442	1.3	9:43:51	9.47	0.051	64:50:58	1045.95935	934.1679304	1304.5355	Gp
		443	1.3	4:17:58	10.605	0.015	59:25:05	1047.330123	934.7256117	1304.4995	Gp

		444	1.3	4:26:48	12.304	-0.002	59:33:55	1048.167286	936.2043348	1304.4825	Gp
		445	1.3	353:02:40	9.94	0.287	48:09:47	1048.564725	933.0014997	1304.7715	Gp
		446	1.3	358:04:28	5.195	0.278	53:11:35	1045.047048	929.7551641	1304.7625	Gp

Tribhuvan University
Institute of Engineering
Pulchowk Campus
Department of Civil Engineering
Survey Instruction Committee

Group No.:3

Triangulation Computation (Gale's Table)

Triangle ABC

Station	Leg/Line	Distance	Observed Angle	Correction	Corrected Angle	Bearing (Θ)	Consecutive Co-ordinates		Independent Co-ordinates		Correction		Corrected		Adjusted	
							Latitude= lcosΘ	Departure =lsinΘ	Northing	Easting	N(+)	E(+)	Northing	Easting	Length	Bearing
A					0:00:00				1000	1000			1000	Easting		
B	AB	64.16	32:45:57	0:00:16	32:45:41	356:00:00	64.2	-4.476	1064.01	995.524	0	0	1064.01	995.524	64.16	356:00:00
C	BC	82.81	50:16:39	0:00:16	50:16:23	143:14:19	-66.34	49.56	997.678	1045.09	0	0	997.678	1045.092	82.81	143:14:19
A	AC	45.15	96:56:36	0:00:16	96:56:20	92:56:36	2.138	45.09	1000	1000	0	0	1000	1000	45.15	92:56:36
		Total	179:59:12		179:58:24		0	0								

Triangle ABD

Station	Leg/Line	Distance	Observed Angle	Correction	Corrected Angle	Bearing (Θ)	Consecutive Co-		Independent Co-		Correction		Corrected		Adjusted	
							Latitude = lcosΘ	Departur e=lsinΘ	Northing	Easting	N(-)	E(+)	Northing	Easting	Length	Bearing
A									1000	1000			1000	1000		
B	AB	64.16	92:15:54	0:00:11	92:16:05	356:00:00	64.008	-4.476	1064.01	995.524	0.00078	-0.00021	1064.01	995.524	64.16	356:00:00
D	BD	40.02	56:25:15	0:00:10	56:25:25	268:16:15	-1.208	-40	1062.8	955.522	0.00078	-0.00021	1062.8	955.522	40.02	268:16:15
A	DA	76.95	31:18:20	0:00:10	31:18:30	144:41:30	-62.8	44.48	1000	999.999	0.00078	-0.00021	1000	999.999	76.95	144:41:30
		Total	179:59:29		180:00:00		0.002	-0.001								

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Department of Civil Engineering
Survey Instruction Committee

Group No.:3

Triangulation Computation (Gale's Table)

Triangle ADE

Station	Leg/Line	Distance	Observed Angle	Correction	Corrected Angle	Bearing (Θ)	Consecutive Co-		Independent Co-		Correction		Corrected		Adjusted	
							Latitude = lcosΘ	Departure=lsinΘ	Northing	Easting	N(+)	E(+)	Northing	Easting	Length	Bearing
A									1000	1000			1000	1000		
D	AD	76.95	35:52:53	0:00:12	35:52:41	324:41:30	62.798	-44.48	1062.8	955.523	0.00076	0.00142	1062.8	955.524	76.95	324:41:30
E	DE	66.22	85:06:15	0:00:13	85:06:02	180:34:23	-66.22	-0.662	996.583	954.861	0.00076	0	996.584	954.861	66.22	180:34:23
A	EA	45.26	59:01:30	0:00:13	59:01:17	85:40:25	3.415	45.14	999.998	999.996	0.00076	0	999.998	999.996	45.26	85:40:25
Total			180:00:38		180:00:00		-0.002	-0.004								

Triangle EDF

Station	Leg/Line	Distance	Observed Angle	Correction	Corrected Angle	Bearing (Θ)	Consecutive Co-		Independent Co-		Correction		Corrected		Adjusted	
							Latitude = lcosΘ	Departure=lsinΘ	Northing	Easting	N(+)	E(+)	Northing	Easting	Length	Bearing
E									996.583	954.861			996.583	954.861		
D	ED	66.22	54:32:44	0:00:12	54:32:57	0:34:23	66.215	0.662	1062.8	955.523	0	0	1062.8	955.523	66.22	0:34:23
F	DF	36.48	92:02:25	0:00:13	92:02:38	235:07:20	-20.86	-29.93	1041.94	925.594	0	0	1041.94	925.594	36.48	235:07:20
E	FE	53.98	33:24:13	0:00:13	33:24:25	147:09:58	-45.35	29.27	996.583	954.86	0	0	996.583	954.86	53.98	147:09:58
Total			179:59:22		180:00:00		0	-0.001								

Tribhuvan University
Institute of Engineering
Pulchowk Campus
Department of Civil Engineering
Survey Instruction Committee

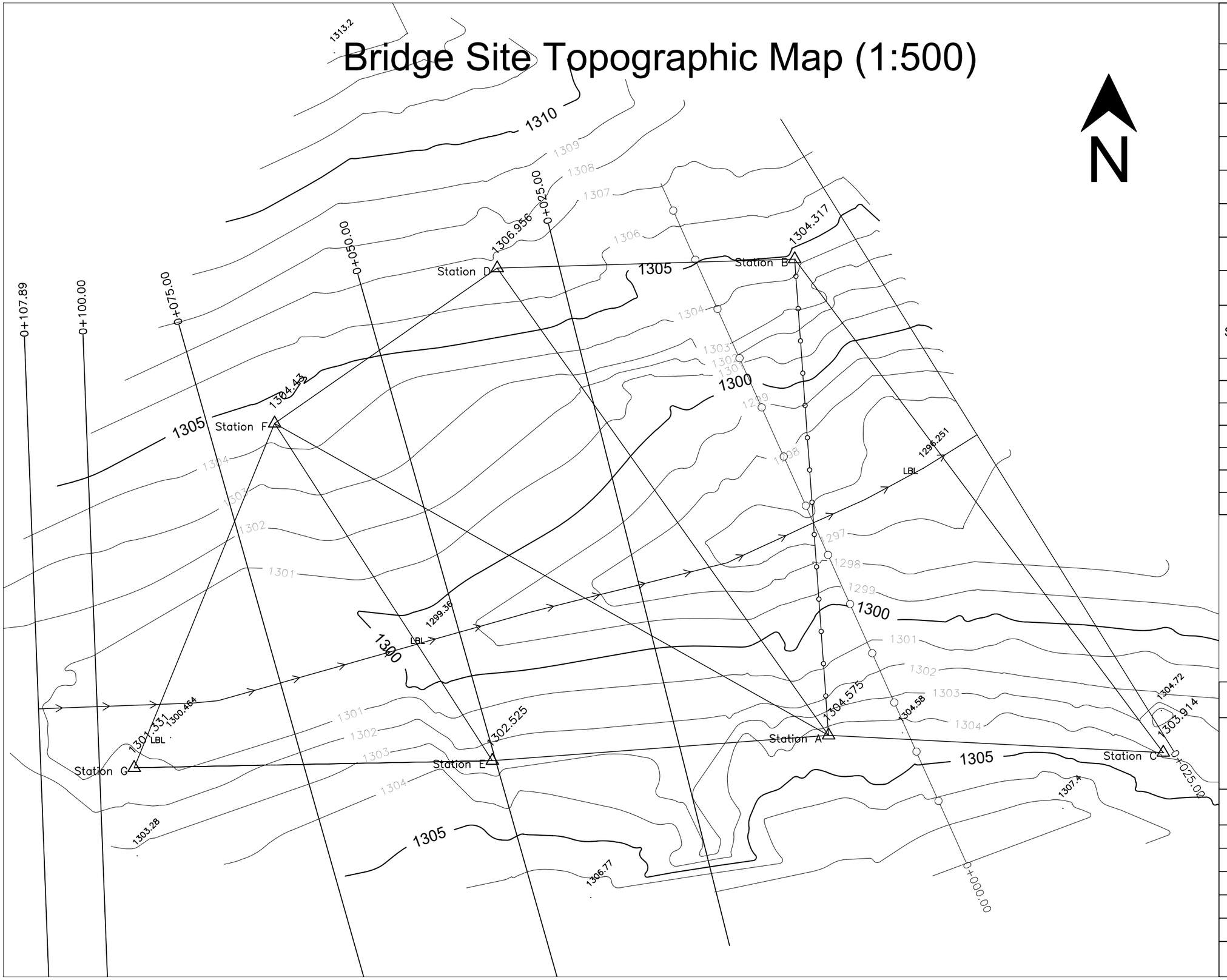
Group No.:3

Triangulation Computation (Gale's Table)

Triangle EFG

Station	Leg/Line	Distance	Observed Angle	Correction	Corrected Angle	Bearing (Θ)	Consecutive Co-		Independent Co-		Correction		Corrected		Adjusted	
							Latitude = lcosΘ	Departure=lsinΘ	Northing	Easting	N(+)	E(+)	Northing	Easting	Length	Bearing
E									996.583	954.861			996.583	954.861		
F	EF	53.98	55:01:23	0:00:06	55:01:29	327:09:58	45.353	-29.27	1041.94	925.595	0	0	1041.94	925.595	53.98	327:09:58
G	FG	50	66:40:56	0:00:06	66:41:02	202:11:27	-46.3	-18.89	995.637	906.709	0	0	995.637	906.709	50	202:11:27
E	GE	48.16	58:17:23	0:00:06	58:17:29	88:52:29	0.946	48.15	996.583	954.861	0	0	996.583	954.861	48.16	88:52:29
		Total	179:59:42		180:00:00		0	0								

Bridge Site Topographic Map (1:500)



LEGEND

SN	DESCRIPTION	SYMBOL
1	TRIANGULATION STATION	△
2	TRIANGULATION LINE	
3	INDEX CONTOUR	1315
4	MINOR CONTOUR	1311
5	FLOW LINE	
6	BRIDGE AXIS	

Coordinates

STN.	NORTHING	EASTING	RL
A	1000	1000	1304.575
B	1064.001	995.524	1304.317
C	997.678	1045.092	1303.914
D	1062.798	955.530	1306.956
E	996.584	954.865	1302.525
F	1041.935	925.596	1304.430
G	995.636	906.714	1301.331

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
PULCHOWK CAMPUS
DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

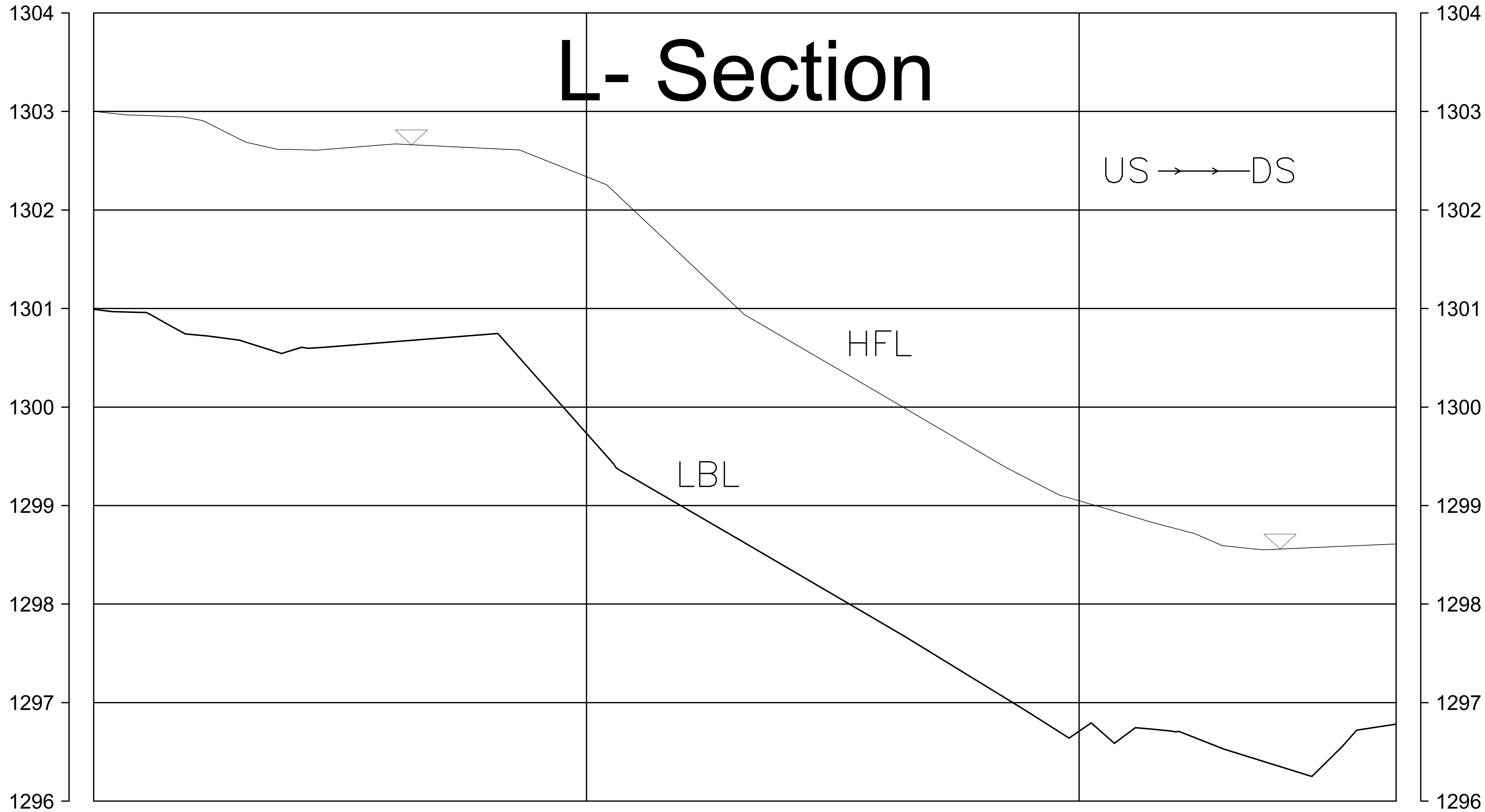
SCALE 1:500

0 6.25 12.5 25 50 m

Group 3

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO: 1

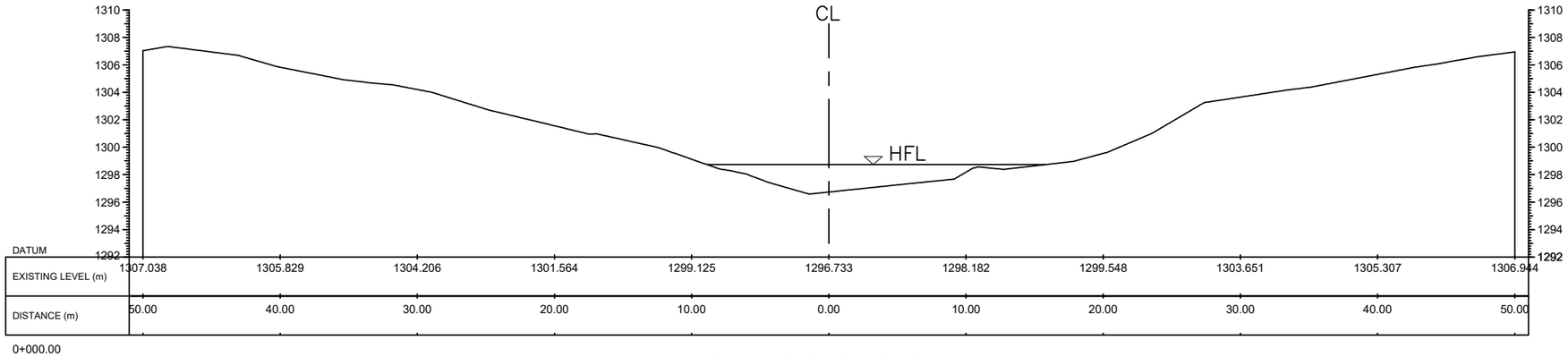


CHAINAGE (km)	EXISTING LEVEL (m)
-0+107.17	1300.991
-0+105.29	1300.968
-0+102.35	1300.959
-0+101.34	1300.934
-0+100.00	1300.859
-0+097.88	1300.741
-0+095.59	1300.721
-0+092.39	1300.678
-0+088.12	1300.543
-0+087.10	1300.574
-0+086.09	1300.606
-0+083.72	1300.607
-0+075.00	1300.676
-0+066.17	1300.746
-0+054.41	1299.423
-0+050.00	1299.140
-0+040.23	1298.571
-0+025.00	1297.679
-0+012.76	1296.929
-0+008.20	1296.639
-0+005.94	1296.794
-0+003.60	1296.587
-0+001.45	1296.746
0+000.00	1296.733
0+002.14	1296.712
0+002.97	1296.708
0+007.54	1296.528
0+016.46	1296.251
0+019.50	1296.550
0+021.00	1296.720
0+025.00	1296.781

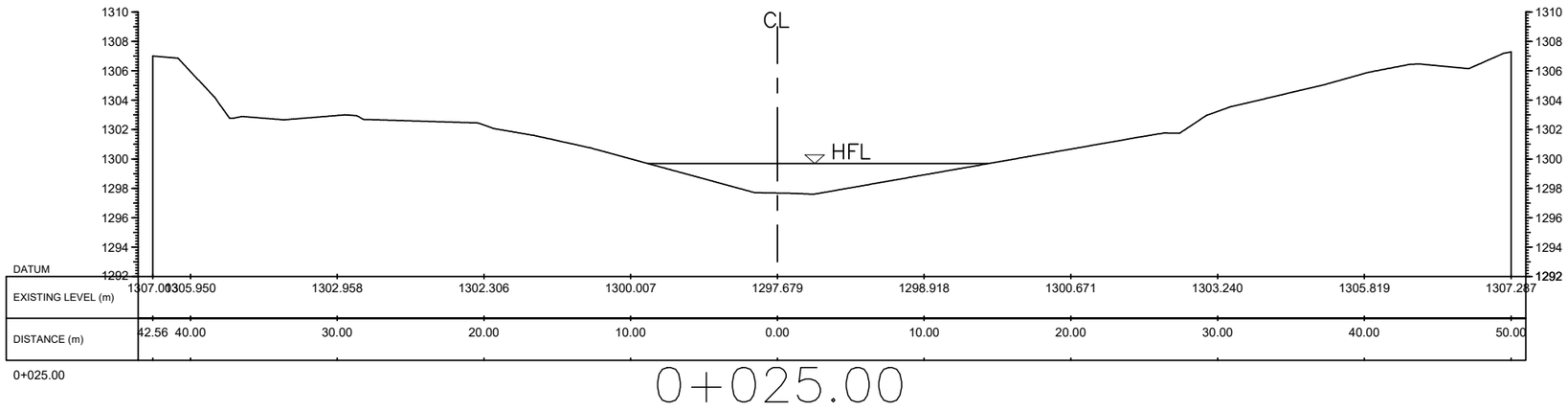
CHAINAGE : -0+107.17 - 0+025.00

TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING DEPARTMENT OF CIVIL ENGINEERING SURVEY INSTRUCTION COMMITTEE PULCHOWK, LALITPUR	L- SECTION (BRIDGE SITE)	SURVEY CAMP 2078 BATCH GROUP: 3	SCALE: H=1:500 V=1:50	CHECKED BY:	SHEET NO: 2

X-SECTION (UP STREAM)



0+000.00



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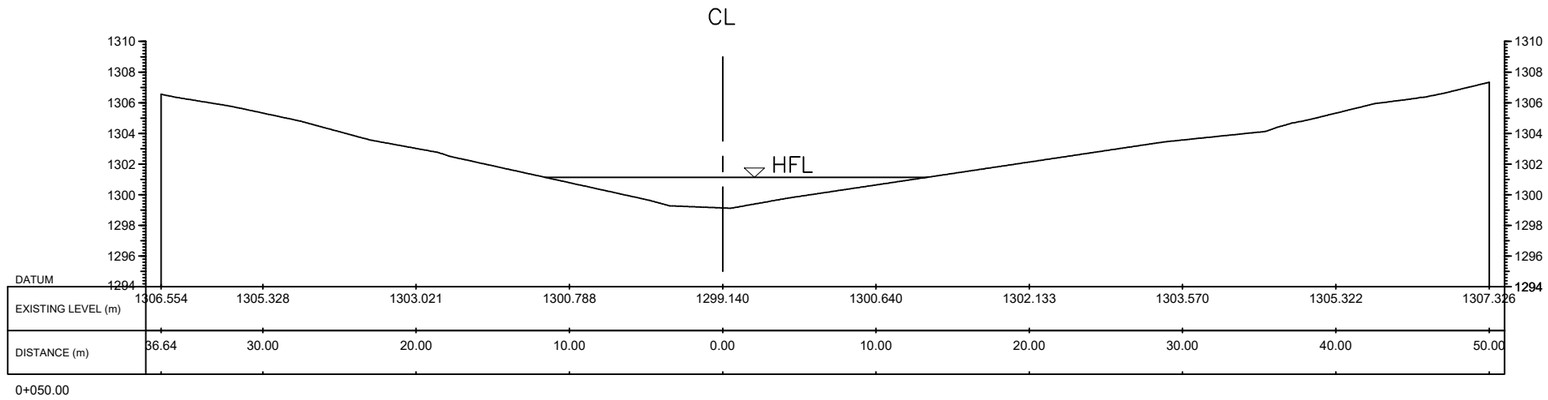
TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING DEPARTMENT OF CIVIL ENGINEERING SURVEY INSTRUCTION COMMITTEE PULCHOWK, LALITPUR	X– SECTION (BRIDGE SITE)	SURVEY CAMP 2078 BATCH GROUP: 3	SCALE: FIT TO SCALE	CHECKED BY:	SHEET NO: 3

X-SECTION (UP STREAM)



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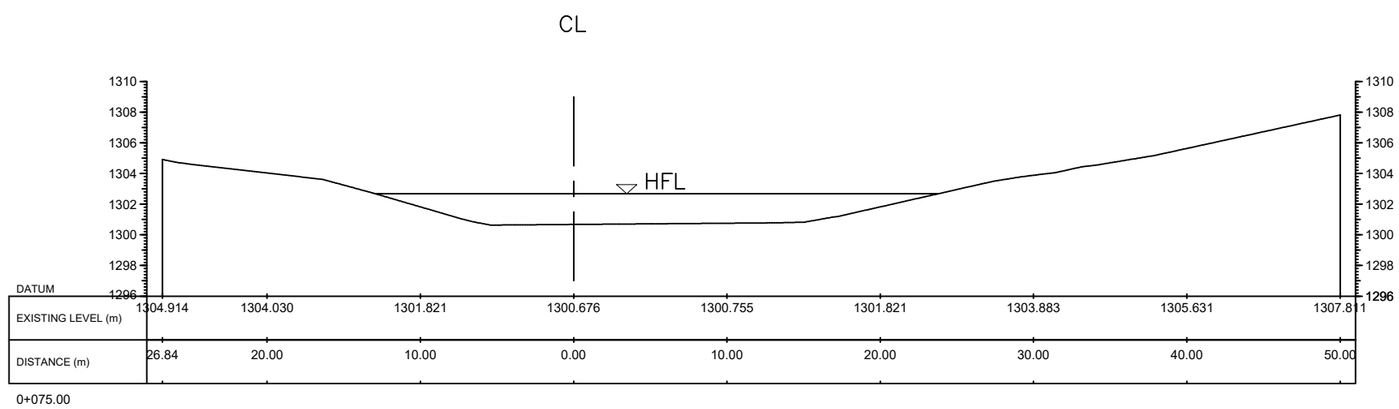

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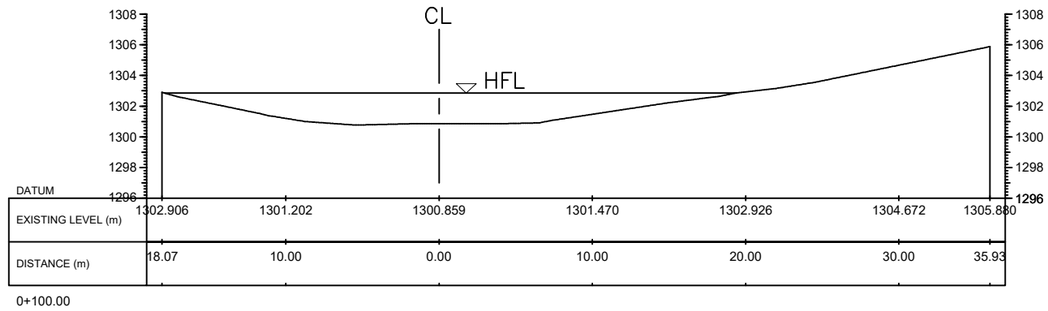
TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING DEPARTMENT OF CIVIL ENGINEERING SURVEY INSTRUCTION COMMITTEE PULCHOWK, LALITPUR	X– SECTION (BRIDGE SITE)	SURVEY CAMP 2078 BATCH GROUP: 3	SCALE: FIT TO SCALE	CHECKED BY:	SHEET NO: 4

X-SECTION (UP STREAM)



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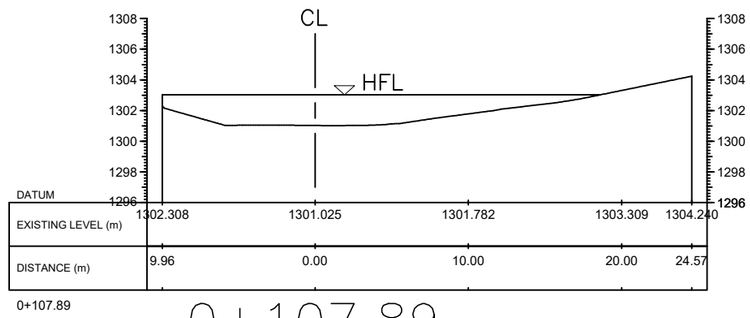

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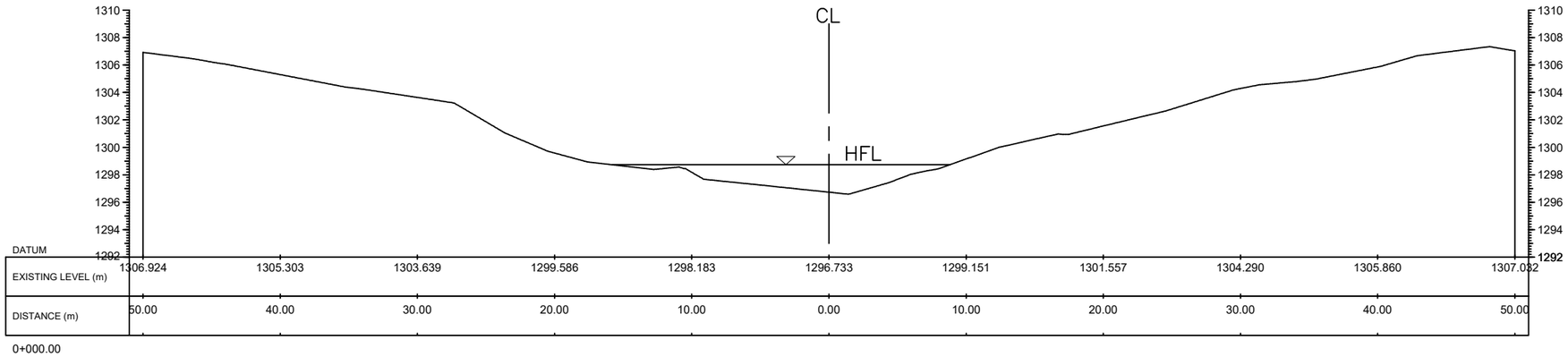
TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING DEPARTMENT OF CIVIL ENGINEERING SURVEY INSTRUCTION COMMITTEE PULCHOWK, LALITPUR	X– SECTION (BRIDGE SITE)	SURVEY CAMP 2078 BATCH GROUP: 3	SCALE: FIT TO SCALE	CHECKED BY:	SHEET NO: 5

X-SECTION (DOWN STREAM)



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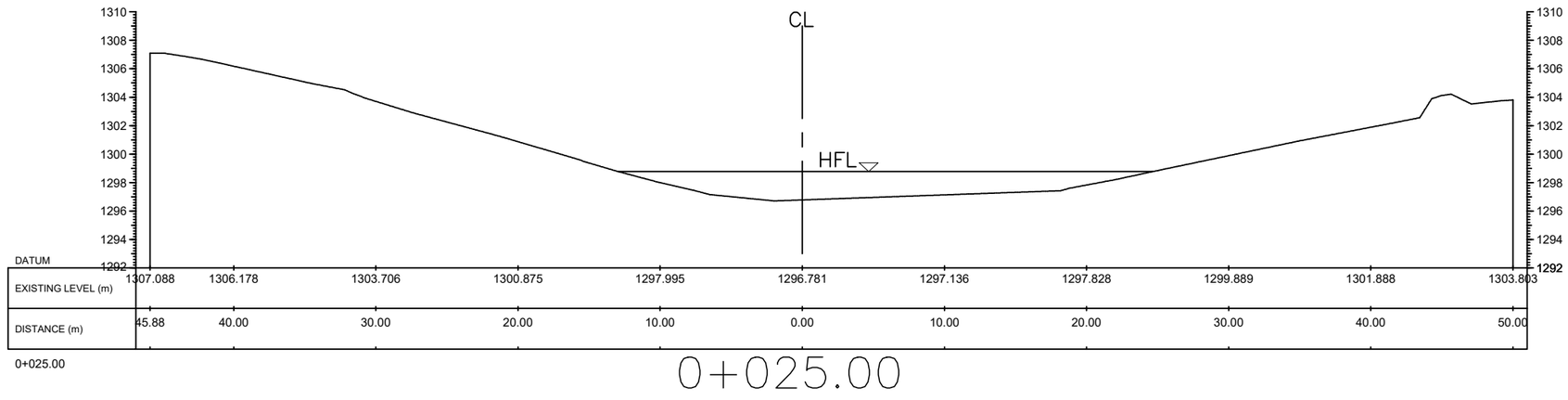

0+025.00

TRIBHUVAN UNIVERSITY INSTITUTE OF ENGINEERING DEPARTMENT OF CIVIL ENGINEERING SURVEY INSTRUCTION COMMITTEE PULCHOWK, LALITPUR	X– SECTION (BRIDGE SITE)	SURVEY CAMP 2078 BATCH GROUP: 3	SCALE: FIT TO SCALE	CHECKED BY:	SHEET NO: 6

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Group No:3

Bearing:256°54′43″

Department of Civil Engineering

Survey Instruction Committee

Chainage Computation of Curve in Road Alignment

18

Observer :
Recorder :
Instrument :

Date :
Weather:
Temperature:

Line/Leg		IP to IP	IP Station	Chainage	Deflection Angle=±Δ				Radius of	Tangent	Length of	Apex	Chainage of	Chainage	Chainage of	Remarks
From IP	To IP	Distance		of IP	±	degreea(d)	minutes(m)	seconds(s)	Curve, R(m)	Length	Curve,L(m)	Distance,E(m)	BC(km)	of	EC(km)	
		0.000	IP0	0+000.000	+	76	4	7								
IP0	IP1	49.872	IP1	0+049.872	-	32	26	37	30	8.728	16.987	1.244	41.144	49.638	58.131	IP1
IP1	IP2	25.739	IP2	0+075.142	+	14	54	21	30	3.924	7.805	0.256	71.218	75.120	79.022	IP2
IP2	IP3	46.657	IP3	0+121.755		42	37	54	20	7.804	14.881	1.469	113.951	121.391	128.832	IP3
IP3	A	25.300	A	0+146.328												A
A	B	64.160	B	0+210.488												B
B	IP4	16.132	IP4	0+226.620	+	27	31	54	20	4.900	9.610	0.591	221.720	226.525	231.330	IP4
IP4	IP5	31.367	IP5	0+257.798	+	40	18	30	20	7.340	14.070	1.304	250.457	257.492	264.527	IP5
IP5	IP6	52.209	IP6	0+309.396	-	41	9	4	20	7.508	14.364	1.363	301.888	309.071	316.253	IP6
IP6	IP7	43.591	IP7	0+352.336	-	19	28	33	30	5.148	10.198	0.439	347.188	352.286	357.385	IP7
IP7	IP8	49.008	IP8	0+401.245	-	34	32	37	20	6.219	12.058	0.944	395.026	401.055	407.084	IP8
IP8	IP9	32.806	IP9	0+433.672	-	31	29	7	20	5.638	10.990	0.779	428.034	433.529	439.024	IP9
IP9	IP10	23.764	IP10	0+457.150	-	13	12	26	20	2.315	4.610	0.134	454.835	457.140	459.445	IP10
IP10	IP11	24.806	IP11	0+481.936	-	21	16	10	20	3.755	7.424	0.350	478.180	481.893	485.605	IP11
IP11	IP12	23.449	IP12	0+505.298	+	27	53	38	30	7.450	14.605	0.911	497.848	505.151	512.453	IP12
IP12	IP13	28.285	IP13	0+533.288	-	43	58	50	30	12.115	23.028	2.354	521.173	532.687	544.201	IP13
IP13	IP14	58.716	IP14	0+590.802	+	25	39	36	100	22.775	44.785	2.561	568.028	590.420	612.813	IP14
IP14	IP15	61.478	IP15	0+651.517	+	40	44	21	50	18.565	35.552	3.335	632.952	650.728	668.504	IP15
IP15	a	34.836	a	0+684.775												a
a	b	7.631	b	0+692.406												b
b	IP16	16.686	IP16	0+709.092	-	54	34	25	20	10.317	19.050	2.504	698.775	708.300	717.825	IP16
IP16	IP17	10.816	IP17	0+718.324												IP17

Tribhuvan University

Institute of Engineering

Pulchowk Campus

12

Department of Civil Engineering

Survey Instruction Committee

Group No:3

Observer :

Recorder :

Instrument :

Fly Levelling (RL Transfer) TBM2-SBM1

Date :

Weather:

Temperature:

Station chainage	BS			Mean BS	S1 (T-B)	FS			Mean FS	S2 (T-B)	Rise /Fall	Stadia Interval	horz.distance	Remarks
	Top	Mid	Bot			Top	Mid	Bot						
TBM2	1.766	1.716	1.666	1.716	0.1							0.1	10	
	1.224	1.183	1.136	1.181	0.088	1.046	0.998	0.956	1	0.09	0.716	0.178	17.8	
	1.098	1.063	1.029	1.063	0.069	1.099	1.055	1.013	1.056	0.086	0.125	0.155	15.5	
	1.171	1.103	1.032	1.102	0.139	1.687	1.649	1.614	1.65	0.073	-0.587	0.212	21.2	
	0.697	0.671	0.644	0.671	0.053	1.495	1.429	1.364	1.429	0.131	-0.327	0.184	18.4	
	1.109	1.05	0.996	1.052	0.113	1.649	1.625	1.599	1.624	0.05	-0.953	0.163	16.3	
	0.714	0.695	0.676	0.695	0.038	1.595	1.537	1.478	1.537	0.117	-0.485	0.155	15.5	
	0.729	0.638	0.547	0.638	0.182	1.83	1.814	1.795	1.813	0.035	-1.118	0.217	21.7	
SBM1				0	0	1.695	1.606	1.517	1.606	0.178	-0.968	0.178	17.8	
				8.118					11.715		-3.597		154.2	
SBM1	1.552	1.481	1.409	1.481	0.143					0		0.143	14.3	
	1.864	1.834	1.804	1.834	0.06	1.012	0.939	0.867	0.939	0.145	0.542	0.205	20.5	
	1.439	1.399	1.358	1.399	0.081	0.644	0.615	0.586	0.615	0.058	1.219	0.139	13.9	
	1.579	1.549	1.525	1.551	0.054	1.035	0.991	0.947	0.991	0.088	0.408	0.142	14.2	
	1.557	1.528	1.504	1.53	0.053	0.764	0.737	0.709	0.737	0.055	0.814	0.108	10.8	
	1.7	1.659	1.618	1.659	0.082	1.251	1.22	1.19	1.22	0.061	0.31	0.143	14.3	
	1.622	1.588	1.554	1.588	0.068	1.222	1.178	1.138	1.179	0.084	0.48	0.152	15.2	
	0.896	0.864	0.831	0.864	0.065	1.046	1.026	1.005	1.026	0.041	0.562	0.106	10.6	
	1.046	0.998	0.956	1	0.09	0.904	0.874	0.843	0.874	0.061	-0.01	0.151	15.1	
TBM2				0	0	1.766	1.716	1.666	1.716	0.1	-0.716	0.1	10	
				12.906					9.297		3.609		138.9	

Error=	0.012
Permissible error=	12.9933
RL of SBM1=	1308.43 m

Tribhuvan University
Institute of Engineering
Pulchowk Campus

12

Department of Civil Engineering

Survey Instruction Committee

Group No:3

Observer :
Recorder :
Instrument :

Fly Levelling (RL Transfer) TBM2-SBM1

Date :
Weather:
Temperature:

Station chainage	BS			Mean BS	S1 (T-B)	FS			Mean FS	S2 (T-B)	Rise /Fall	Stadia Interval	horz.distance	Remarks
	Top	Mid	Bot			Top	Mid	Bot						
SBM1	1.051	1.009	0.968	1.009	0.083							0.083	8.3	
	0.898	0.868	0.838	0.868	0.06	1.946	1.907	1.869	1.907	0.077	-0.898	0.137	13.7	
	0.647	0.631	0.614	0.631	0.033	1.874	1.844	1.813	1.844	0.061	-0.976	0.094	9.4	
	0.929	0.906	0.884	0.906	0.045	1.978	1.959	1.938	1.958	0.04	-1.327	0.085	8.5	
A					0	1.405	1.377	1.349	1.377	0.056	-0.471	0.056	5.6	
sum				3.414					7.086		-3.672		45.5	

station chainage	BS			Mean BS	S1 (T-B)	FS			Mean FS	S2 (T-B)	Rise /Fall	Stadia Interval	horz.distance	Remarks
	Top	Mid	Bot			Top	Mid	Bot						
A	1.486	1.466	1.446	1.466	0.04							0.04	4	
	1.774	1.754	1.734	1.754	0.04	0.759	0.738	0.716	0.738	0.043	0.728	0.083	8.3	
	1.833	1.806	1.78	1.806	0.053	0.722	0.7	0.676	0.699	0.046	1.055	0.099	9.9	
	1.728	1.687	1.646	1.687	0.082	0.789	0.764	0.738	0.764	0.051	1.042	0.133	13.3	
SBM1						0.878	0.835	0.785	0.833	0.093	0.854	0.093	9.3	
											3.679		44.8	

error=	0.007	m
permissible error=	7.212	mm
RL of Bridge stn A=RL of SBM1-Fall=	1304.8	m

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

Group:3

Observer:
Recorder:
Instrument:

Forward Loop

Fly Levelling (RL Transfer)

Date:
Weather
Temperature:

Station	Backsight				S1=(T-B)	Foresight				S2=(T-B)	Rise	Fall	RL	Stadia Interval S=S1+S2	Hz. Distance (m) S*100	Remarks
	T	M	B	Mean		T	M	B	Mean							
TBM2	0.692	0.644	0.594	0.643	0.098									0.098	9.8	TBM2
TP1	1.785	1.735	1.684	1.735	0.101	1.298	1.247	1.196	1.247	0.102		0.604	-0.60367	0.203	20.3	
IP0						1.168	1.12	1.071	1.120	0.097	0.615		0.011667	0.097	9.7	IP0
SUM				**2.378**					**2.367**						**39.8**	

∑BS-∑FS=0.011
Rise-Fall=0.011

Tribhuvan University
Institute of Engineering
Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

Group:3

Observer:
Recorder:
Instrument:

Backward Loop

Fly Levelling (RL Transfer)

Date:
Weather
Temperature:

Stations	Backsight				S1=(T-B)	Foresight				S2=(T-B)	Rise	Fall	RL	Stadia Interval S=S1+S2	Hz. Distance (m) S*100	Remarks
	T	M	B	Mean		T	M	B	Mean							
IP0	1.168	1.12	1.071	1.120	0.097									0.097	9.7	IP0
TP1	1.384	1.33	1.276	1.33	0.108	1.839	1.79	1.739	1.789	0.1		0.670	-0.66967	0.208	20.8	
TBM2						0.725	0.668	0.611	0.668	0.114	0.662		-0.00767	0.114	11.4	TBM2
SUM				**2.450**					**2.457**						**41.900**	

∑BS-∑FS=0.007
Rise-Fall=0.007

Permissible Error=24√k mm=24√(.0398+.0419)=7mm
Error=0.011-0.007=.004m=4mm(Within Precision)
h=(h1+h2)/2=(0.007+0.011)/2=0.009
RL of IP0=1312.031+.009=1312.040m

Tribhuvan University
Institute of Engineering
Pulchowk Campus
Institute of Engineering
Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

Group:3 Date

Observer: **Fly Levelling (RL Transfer rise fall method)** Weather

Recorder: Temperature:

Instrument:

Staff Station	Distance/ Chainage	BS	FS	Rise +	Fall -	Reduced Level(m)	Remarks
IP17		1.334		1.334	0		Last IP
TP1		2.542	0.75	1.792	0		
TP2		2.422	1.014	1.408	0		
TP3		2.516	0.825	1.691	0		
TP4		2.788	0.691	2.097	0		
TP5		2.961	0.75	2.211	0		
TP6		3.045	0.604	2.441	0		
TP7		2.849	0.6	2.249	0		
TP8		1.981	0.703	1.278	0		
TP9		2.789	0.661	2.128	0		
TP10		0.522	2.949	0	2.427		
TP11		0.697	2.708	0	2.011		
TP12		0.682	2.851	0	2.169		
TP13		0.72	2.436	0	1.716		
B			1.906	0	1.906		Bridge Station
SUM		**27.848**	**19.448**				

∑BS-∑FS=8.400

Institute of Engineering

Pulchowk Campus

Department of Civil Engineering

Survey Instruction Committee

Group:3 Date

Observer: **Fly Levelling (RL Transfer rise fall method)** Weather

Recorder: Temperature:

Instrument:

Staff Station	Distance/ Chainage	BS	FS	Rise +	Fall -	Reduced Level(m)	Remarks
A		1.862		1.862	0		Bridge Stn.
TP1		1.635	1.003	0.632	0		
TP2		1.638	1.096	0.542	0		
TP3		1.782	1.025	0.757	0		
TP4		1.834	0.785	1.049	0		
TP5		1.902	0.806	1.096	0		
TP6		1.681	0.762	0.919	0		
TP7		1.792	0.627	1.165	0		
IP0			0.722	0	0.722		First Ip
SUM		**14.126**	**6.826**	**8.022**	**0.722**		

Rise-fall= 7.3

Pulchowk Campus

Group:3

Department of Civil Engineering

Observer: **Survey Instruction Committee** Date:

Recorder: **Profile Levelling Of Road** Weather

Instrument: First IP(IP0) to Bridge Station(A) Temperature:

Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
IP0		0+000.000		2.08			1314.120	1312.040	0.000	1312.040	IP0(Known)
			5		2.287		1314.120	1311.833	0.000	1311.833	
			10		2.45		1314.120	1311.670	0.000	1311.670	
	5				2.056		1314.120	1312.064	0.000	1312.064	
	10				1.701		1314.120	1312.419	0.000	1312.419	
		0+015.000			2.411		1314.120	1311.709	0.000	1311.709	
			5		2.804		1314.120	1311.316	0.000	1311.316	
			10		3.401		1314.120	1310.719	0.000	1310.719	
	5				1.31		1314.120	1312.810	0.000	1312.810	
	10				1.307		1314.120	1312.813	0.000	1312.813	
		0+030.000			2.934		1314.120	1311.186	0.000	1311.186	
			5		3.445		1314.120	1310.675	0.000	1310.675	
			10		3.772		1314.120	1310.348	0.000	1310.348	
	5				2.485		1314.120	1311.635	0.000	1311.635	
	10				2.457		1314.120	1311.663	0.000	1311.663	
BPC1		0+041.144			2.955		1314.120	1311.165	0.000	1311.165	
			5		3.199		1314.120	1310.921	0.000	1310.921	
			10		3.805		1314.120	1310.315	0.000	1310.315	
	5				2.484		1314.120	1311.636	0.000	1311.636	
	10				2.459		1314.120	1311.661	0.000	1311.661	
TP1				0.723		2.299	1312.544	1311.821	0.000	1311.821	
MPC1		0+049.639			1.585		1312.544	1310.959	0.000	1310.959	
			5		1.855		1312.544	1310.689	0.000	1310.689	
			10		2.169		1312.544	1310.375	0.000	1310.375	
	5				1.405		1312.544	1311.139	0.000	1311.139	
	10				1.372		1312.544	1311.172	0.000	1311.172	
EPC1		0+058.131			1.755		1312.544	1310.789	0.000	1310.789	
			5		2.025		1312.544	1310.519	0.000	1310.519	
			10		2.235		1312.544	1310.309	0.000	1310.309	
	5				1.787		1312.544	1310.757	0.000	1310.757	
	10				1.795		1312.544	1310.749	0.000	1310.749	
		0+060.000			1.729		1312.544	1310.815	0.000	1310.815	
			5		1.927		1312.544	1310.617	0.000	1310.617	
			10		2.188		1312.544	1310.356	0.000	1310.356	
	5				2.037		1312.544	1310.507	0.000	1310.507	
	10				2.015		1312.544	1310.529	0.000	1310.529	
BPC2		0+071.218			2.11		1312.544	1310.434	0.000	1310.434	
			5		2.209		1312.544	1310.335	0.000	1310.335	
			10		2.228		1312.544	1310.316	0.000	1310.316	
	5				2.118		1312.544	1310.426	0.000	1310.426	
	10				2.138		1312.544	1310.406	0.000	1310.406	
MPC2		0+075.120			2.015		1312.544	1310.529	0.000	1310.529	
			5		2.152		1312.544	1310.392	0.000	1310.392	
			10		2.181		1312.544	1310.363	0.000	1310.363	
	5				2.232		1312.544	1310.312	0.000	1310.312	
	10				2.365		1312.544	1310.179	0.000	1310.179	
EPC2		0+079.023			2.854		1312.544	1309.690	0.000	1309.690	
			5		2.469		1312.544	1310.075	0.000	1310.075	
			10		2.429		1312.544	1310.115	0.000	1310.115	
	5				3.319		1312.544	1309.225	0.000	1309.225	
	10				3.419		1312.544	1309.125	0.000	1309.125	
TP2				0.705		2.372	1310.877	1310.172	0.001	1310.171	
TP3				1.241		1.799	1310.319	1309.078	0.001	1309.077	

Pulchowk Campus

Group:3

Department of Civil Engineering

Observer:

Survey Instruction Committee

Date:

Recorder:

Profile Levelling Of Road

Weather

Instrument:

First IP(IP0) to Bridge Station(A)

Temperature:

Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
		0+090.000			1.959		1310.319	1308.360	0.001	1308.359	
			5		1.992		1310.319	1308.327	0.001	1308.326	
			10		1.976		1310.319	1308.343	0.001	1308.342	
	5				1.788		1310.319	1308.531	0.001	1308.530	
	10				1.568		1310.319	1308.751	0.001	1308.750	
		0+105.000			2.132		1310.319	1308.187	0.001	1308.186	
			5		2.214		1310.319	1308.105	0.001	1308.104	
			10		2.197		1310.319	1308.122	0.001	1308.121	
	5				2.024		1310.319	1308.295	0.001	1308.294	
	10				1.982		1310.319	1308.337	0.001	1308.336	
BPC3		0+113.952			2.246		1310.319	1308.073	0.001	1308.072	
			5		2.184		1310.319	1308.135	0.001	1308.134	
			10		2.307		1310.319	1308.012	0.001	1308.011	
	5				2.172		1310.319	1308.147	0.001	1308.146	
	10				2.249		1310.319	1308.070	0.001	1308.069	
MPC3		0+121.392			2.549		1310.319	1307.770	0.001	1307.769	
			5		2.769		1310.319	1307.550	0.001	1307.549	
			10		2.822		1310.319	1307.497	0.001	1307.496	
	5				2.456		1310.319	1307.863	0.001	1307.862	
	10				2.243		1310.319	1308.076	0.001	1308.075	
EPC3		0+128.832			2.986		1310.319	1307.333	0.001	1307.332	
			5		3.586		1310.319	1306.733	0.001	1306.732	
			10		3.729		1310.319	1306.590	0.001	1306.589	
TP4				1.062		2.735	1308.646	1307.584	0.001	1307.583	
	5				1.365		1308.646	1307.281	0.001	1307.280	
	10				1.626		1308.646	1307.020	0.001	1307.019	
TP5				0.732		2.764	1306.614	1305.882	0.002	1305.880	
		0+135.000			1.522		1306.614	1305.092	0.002	1305.090	
			5		1.447		1306.614	1305.167	0.002	1305.165	
			10		1.263		1306.614	1305.351	0.002	1305.349	
	5				1.724		1306.614	1304.890	0.002	1304.888	
	10				2.363		1306.614	1304.251	0.002	1304.249	
A		0+146.328			1.87		1306.614	1304.744	0.002	1304.742	
			5		2.359		1306.614	1304.255	0.002	1304.253	
			10		2.716		1306.614	1303.898	0.002	1303.896	
	5				2.311		1306.614	1304.303	0.002	1304.301	
	10				3.131		1306.614	1303.483	0.002	1303.481	
A		0+146.328				1.87	1306.614	1304.744	0.002	1304.742	Bridge Station A
SUM				6.543	191.666	13.839					

∑BS-∑FS=Rise-Fall=7.296

h1(IPo-A)=	7.296	m
h2(A-IPo)=	7.3	m
error=	0.004	m
k=	292.656	m
permissible(mm)=	12.9834	
error(mm)=	4	
True h=	7.298	m
RL of IPo=	1312.04	m
True RL of A=	1304.74	m
Observed RL of A=	1304.74	m
Error=	0.002	m

Pulchowk Campus

Department of Civil Engineering

Group:3 | **Survey Instruction Committee** | Date:

Observer: | **Profile Levelling Of Road** | Weather

Recorder: | Bridge Station(B) to Last IP(IP17) | Temperature:

Instrument:

Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
B		0+210.488		2.493			1306.810	1304.317	0.00000	1304.317	
TP6				2.034		0.677	1308.167	1306.133	-0.00023	1306.133	
BPC4		0+221.721			1.518		1308.167	1306.649	-0.00023	1306.649	
			5		1.85		1308.167	1306.317	-0.00023	1306.317	
			10		2.151		1308.167	1306.016	-0.00023	1306.016	
	5				1.161		1308.167	1307.006	-0.00023	1307.006	
	10				1.011		1308.167	1307.156	-0.00023	1307.156	
MPC4		0+226.525			0.702		1308.167	1307.465	-0.00023	1307.465	
			5		1.244		1308.167	1306.923	-0.00023	1306.923	
			10		1.713		1308.167	1306.454	-0.00023	1306.454	
	5				0.684		1308.167	1307.483	-0.00023	1307.483	
	10				0.631		1308.167	1307.536	-0.00023	1307.536	
TP7				1.96		0.691	1309.436	1307.476	-0.00045	1307.476	
EPC4		0+231.330			1.348		1309.436	1308.088	-0.00045	1308.088	
			5		0.865		1309.436	1308.571	-0.00045	1308.571	
			10		2.425		1309.436	1307.011	-0.00045	1307.011	
	5				1.243		1309.436	1308.193	-0.00045	1308.193	
	10				1.701		1309.436	1307.735	-0.00045	1307.735	
		0+240.000			0.711		1309.436	1308.725	-0.00045	1308.725	
			5		1.852		1309.436	1307.584	-0.00045	1307.584	
			10		2.714		1309.436	1306.722	-0.00045	1306.722	
	5				0.667		1309.436	1308.769	-0.00045	1308.769	
	10				0.691		1309.436	1308.745	-0.00045	1308.745	
TP7				2.044		0.675	1310.805	1308.761	-0.00068	1308.760	
BPC5		0+250.457			0.634		1310.805	1310.171	-0.00068	1310.170	
			5		1.346		1310.805	1309.459	-0.00068	1309.458	
			10		2.221		1310.805	1308.584	-0.00068	1308.583	
TP8				1.976		1.793	1310.988	1309.012	-0.00090	1309.011	
	5				0.828		1310.988	1310.160	-0.00090	1310.159	
	10				0.639		1310.988	1310.349	-0.00090	1310.348	
TP9				1.201		0.651	1311.538	1310.337	-0.00113	1310.336	
MPC5		0+257.492			1.201		1311.538	1310.337	-0.00113	1310.336	
			5		1.905		1311.538	1309.633	-0.00113	1309.632	
			10		3.076		1311.538	1308.462	-0.00113	1308.461	
	5				0.656		1311.538	1310.882	-0.00113	1310.881	
EPC5		0+264.527			1.026		1311.538	1310.512	-0.00113	1310.511	
	5				0.861		1311.538	1310.677	-0.00113	1310.676	
	10				0.602		1311.538	1310.936	-0.00113	1310.935	
			5		2.292		1311.538	1309.246	-0.00113	1309.245	
			10		3.135		1311.538	1308.403	-0.00113	1308.402	
		0+285.000			1.403		1311.538	1310.135	-0.00113	1310.134	
	5				1.319		1311.538	1310.219	-0.00113	1310.218	
			5		2.648		1311.538	1308.890	-0.00113	1308.889	
			10		3.711		1311.538	1307.827	-0.00113	1307.826	
	10				1.205		1311.538	1310.333	-0.00113	1310.332	
		0+300.000			1.18		1311.538	1310.358	-0.00113	1310.357	
	5				1.091		1311.538	1310.447	-0.00113	1310.446	

Pulchowk Campus

Department of Civil Engineering

Group:3 | **Survey Instruction Committee** | Date:

Observer: | **Profile Levelling Of Road** | Weather

Recorder: | Bridge Station(B) to Last IP(IP17) | Temperature:

Instrument:

Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
	10				0.781		1311.538	1310.757	-0.00113	1310.756	
			5		2.971		1311.538	1308.567	-0.00113	1308.566	
			10		4.079		1311.538	1307.459	-0.00113	1307.458	
TP10				1.987		0.934	1312.591	1310.604	-0.00135	1310.603	
BPC6		0+301.888			1.987		1312.591	1310.604	-0.00135	1310.603	
			5		4.935		1312.591	1307.656	-0.00135	1307.655	
			10		4.815		1312.591	1307.776	-0.00135	1307.775	
	5				1.652		1312.591	1310.939	-0.00135	1310.938	
	10				0.603		1312.591	1311.988	-0.00135	1311.987	
MPC6		0+309.071			1.825		1312.591	1310.766	-0.00135	1310.765	
			5		1.398		1312.591	1311.193	-0.00135	1311.192	
			10		0.621		1312.591	1311.970	-0.00135	1311.969	
	5				4.346		1312.591	1308.245	-0.00135	1308.244	
	10				4.992		1312.591	1307.599	-0.00135	1307.598	
EPC6		0+316.253			1.654		1312.591	1310.937	-0.00135	1310.936	
			5		3.748		1312.591	1308.843	-0.00135	1308.842	
			10		4.729		1312.591	1307.862	-0.00135	1307.861	
	5				1.49		1312.591	1311.101	-0.00135	1311.100	
	10				0.609		1312.591	1311.982	-0.00135	1311.981	
TP11				1.907		0.857	1313.641	1311.734	-0.00158	1311.732	
		0+330.000			2.165		1313.641	1311.476	-0.00158	1311.474	
			5		3.411		1313.641	1310.230	-0.00158	1310.228	
			10		4.993		1313.641	1308.648	-0.00158	1308.646	
	5				1.88		1313.641	1311.761	-0.00158	1311.759	
	10				0.692		1313.641	1312.949	-0.00158	1312.947	
		0+345.000			1.073		1313.641	1312.568	-0.00158	1312.566	
			5		2.124		1313.641	1311.517	-0.00158	1311.515	
			10		3.099		1313.641	1310.542	-0.00158	1310.540	
	5				0.818		1313.641	1312.823	-0.00158	1312.821	
	10				0.612		1313.641	1313.029	-0.00158	1313.027	
BPC7		0+347.188		1.316		0.782	1314.175	1312.859	-0.00180	1312.857	
	5				1.004		1314.175	1313.171	-0.00180	1313.169	
	10				0.815		1314.175	1313.360	-0.00180	1313.358	
			5		1.964		1314.175	1312.211	-0.00180	1312.209	
			10		2.521		1314.175	1311.654	-0.00180	1311.652	
MPC7		0+352.286			1.358		1314.175	1312.817	-0.00180	1312.815	
			5		1.927		1314.175	1312.248	-0.00180	1312.246	
			10		2.634		1314.175	1311.541	-0.00180	1311.539	
	5				0.179		1314.175	1313.996	-0.00180	1313.994	
	10				0.859		1314.175	1313.316	-0.00180	1313.314	
EPC7		0+357.385			1.532		1314.175	1312.643	-0.00180	1312.641	
			5		1.85		1314.175	1312.325	-0.00180	1312.323	
			10		2.581		1314.175	1311.594	-0.00180	1311.592	
	5				1.265		1314.175	1312.910	-0.00180	1312.908	
	10				0.594		1314.175	1313.581	-0.00180	1313.579	
		0+375.000			1.955		1314.175	1312.220	-0.00180	1312.218	
	5				1.625		1314.175	1312.550	-0.00180	1312.548	

Pulchowk Campus

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Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
	10				0.87		1314.175	1313.305	-0.00180	1313.303	
			5		1.739		1314.175	1312.436	-0.00180	1312.434	
			10		2.159		1314.175	1312.016	-0.00180	1312.014	
TP12				0.674		1.965	1312.884	1312.210	-0.00203	1312.208	
		0+390.000			1.852		1312.884	1311.032	-0.00203	1311.030	
			5		2.013		1312.884	1310.871	-0.00203	1310.869	
			10		2.259		1312.884	1310.625	-0.00203	1310.623	
	1.602				1.68		1312.884	1311.204	-0.00203	1311.202	
	1.922				1.119		1312.884	1311.765	-0.00203	1311.763	
	2.802				0.665		1312.884	1312.219	-0.00203	1312.217	
	4.579				0.695		1312.884	1312.189	-0.00203	1312.187	
BPC8		0+395.026			4.629		1312.884	1308.255	-0.00203	1308.253	
			5		4.739		1312.884	1308.145	-0.00203	1308.143	
			10		2.575		1312.884	1310.309	-0.00203	1310.307	
	3.918				2.012		1312.884	1310.872	-0.00203	1310.870	
	5.066				1.772		1312.884	1311.112	-0.00203	1311.110	
MPC8		0+401.055			2.319		1312.884	1310.565	-0.00203	1310.563	
	5				2.55		1312.884	1310.334	-0.00203	1310.332	
TP13				0.735		1.894	1311.725	1310.990	-0.00225	1310.988	
EPC8		0+407.084			1.649		1311.725	1310.076	-0.00225	1310.074	
	5				1.815		1311.725	1309.910	-0.00225	1309.908	
	10				1.525		1311.725	1310.200	-0.00225	1310.198	
TP14				0.6		1.981	1310.344	1309.744	-0.00248	1309.742	
		0+420.000			1.877		1310.344	1308.467	-0.00248	1308.465	
			5		1.317		1310.344	1309.027	-0.00248	1309.025	
			10		1.893		1310.344	1308.451	-0.00248	1308.449	
	5				0.362		1310.344	1309.982	-0.00248	1309.980	
BPC9		0+428.034			1.656		1310.344	1308.688	-0.00248	1308.686	
	5				1.538		1310.344	1308.806	-0.00248	1308.804	
	10				1.525		1310.344	1308.819	-0.00248	1308.817	
MPC9		0+433.529			1.695		1310.344	1308.649	-0.00248	1308.647	
	5				1.47		1310.344	1308.874	-0.00248	1308.872	
	10				1.314		1310.344	1309.030	-0.00248	1309.028	
EPC9		0+439.024			2		1310.344	1308.344	-0.00248	1308.342	
	5				1.795		1310.344	1308.549	-0.00248	1308.547	
	10				1.718		1310.344	1308.626	-0.00248	1308.624	
		0+450.000			2.183		1310.344	1308.161	-0.00248	1308.159	
	5				2.14		1310.344	1308.204	-0.00248	1308.202	
	10				1.971		1310.344	1308.373	-0.00248	1308.371	
BPC10		0+454.835			2.626		1310.344	1307.718	-0.00248	1307.716	
	5				2.55		1310.344	1307.794	-0.00248	1307.792	
	10				2.46		1310.344	1307.884	-0.00248	1307.882	
MPC10		0+457.140			2.65		1310.344	1307.694	-0.00248	1307.692	
	5				2.035		1310.344	1308.309	-0.00248	1308.307	
	10				2.285		1310.344	1308.059	-0.00248	1308.057	
EPC10		0+459.445			2.895		1310.344	1307.449	-0.00248	1307.447	
	5				1.25		1310.344	1309.094	-0.00248	1309.092	

Pulchowk Campus

Department of Civil Engineering

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Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
	10				1.16		1310.344	1309.184	-0.00248	1309.182	
BPC11		0+478.180			1.795		1310.344	1308.549	-0.00248	1308.547	
	5				1.199		1310.344	1309.145	-0.00248	1309.143	
	10				1.076		1310.344	1309.268	-0.00248	1309.266	
MPC11		0+481.893			1.641		1310.344	1308.703	-0.00248	1308.701	
	5				1.342		1310.344	1309.002	-0.00248	1309.000	
	10				0.84		1310.344	1309.504	-0.00248	1309.502	
EPC11		0+485.605			1.616		1310.344	1308.728	-0.00248	1308.726	
	5				1.236		1310.344	1309.108	-0.00248	1309.106	
	10				1.185		1310.344	1309.159	-0.00248	1309.157	
TP15				1.397		1.295	1310.446	1309.049	-0.00270	1309.046	
		0+495.000			1.59		1310.446	1308.856	-0.00270	1308.853	
	5				1.416		1310.446	1309.030	-0.00270	1309.027	
	10				1.27		1310.446	1309.176	-0.00270	1309.173	
BPC12		0+497.848			1.362		1310.446	1309.084	-0.00270	1309.081	
	5				1.413		1310.446	1309.033	-0.00270	1309.030	
	10				1.384		1310.446	1309.062	-0.00270	1309.059	
MPC12		0+505.151			1.484		1310.446	1308.962	-0.00270	1308.959	
	5				1.335		1310.446	1309.111	-0.00270	1309.108	
	10				1.265		1310.446	1309.181	-0.00270	1309.178	
EPC12		0+515.453			1.669		1310.446	1308.777	-0.00270	1308.774	
BPC13		0+521.173			1.636		1310.446	1308.810	-0.00270	1308.807	
MPC13		0+532.687			1.88		1310.446	1308.566	-0.00270	1308.563	
EPC13		0+544.201		0.968		1.788	1309.626	1308.658	-0.00293	1308.655	
		0+555.000			1.178		1309.626	1308.448	-0.00293	1308.445	
BPC14		0+568.028			1.805		1309.626	1307.821	-0.00293	1307.818	
TP16				0.638		2.493	1307.771	1307.133	-0.00315	1307.130	
MPC14		0+590.420			1.307		1307.771	1306.464	-0.00315	1306.461	
TP17				0.688		2.995	1305.464	1304.776	-0.00338	1304.773	
EPC14		0+612.813			3		1305.464	1302.464	-0.00338	1302.461	
IP17				0.601		2.885	1303.180	1302.579	-0.00360	1302.575	
TP18				0.867		2.762	1301.285	1300.418	-0.00383	1300.414	
		0+630.000			2.675		1301.285	1298.610	-0.00383	1298.606	
BPC15		0+632.952			2.445		1301.285	1298.840	-0.00383	1298.836	
MPC15		0+650.728			2.213		1301.285	1299.072	-0.00383	1299.068	
TP19				0.655		2.718	1299.222	1298.567	-0.00405	1298.563	
EPC15		0+668.504			2.139		1299.222	1297.083	-0.00405	1297.079	
TP20				0.744		2.695	1297.271	1296.527	-0.00428	1296.523	
a		0+684.775			1.456		1297.271	1295.815	-0.00428	1295.811	CULVERT
b		0+692.406			1.693		1297.271	1295.578	-0.00428	1295.574	CULVERT
BPC16		0+698.775			2.036		1297.271	1295.235	-0.00428	1295.231	
MPC16		0+708.300			2.039		1297.271	1295.232	-0.00428	1295.228	
EPC16		0+717.825			1.609		1297.271	1295.662	-0.00428	1295.658	
IP17		0+718.324				1.345	1297.271	1295.926	-0.00450	1295.922	Last IP
sum				25.485	294.856	33.876					

Pulchowk Campus

Department of Civil Engineering

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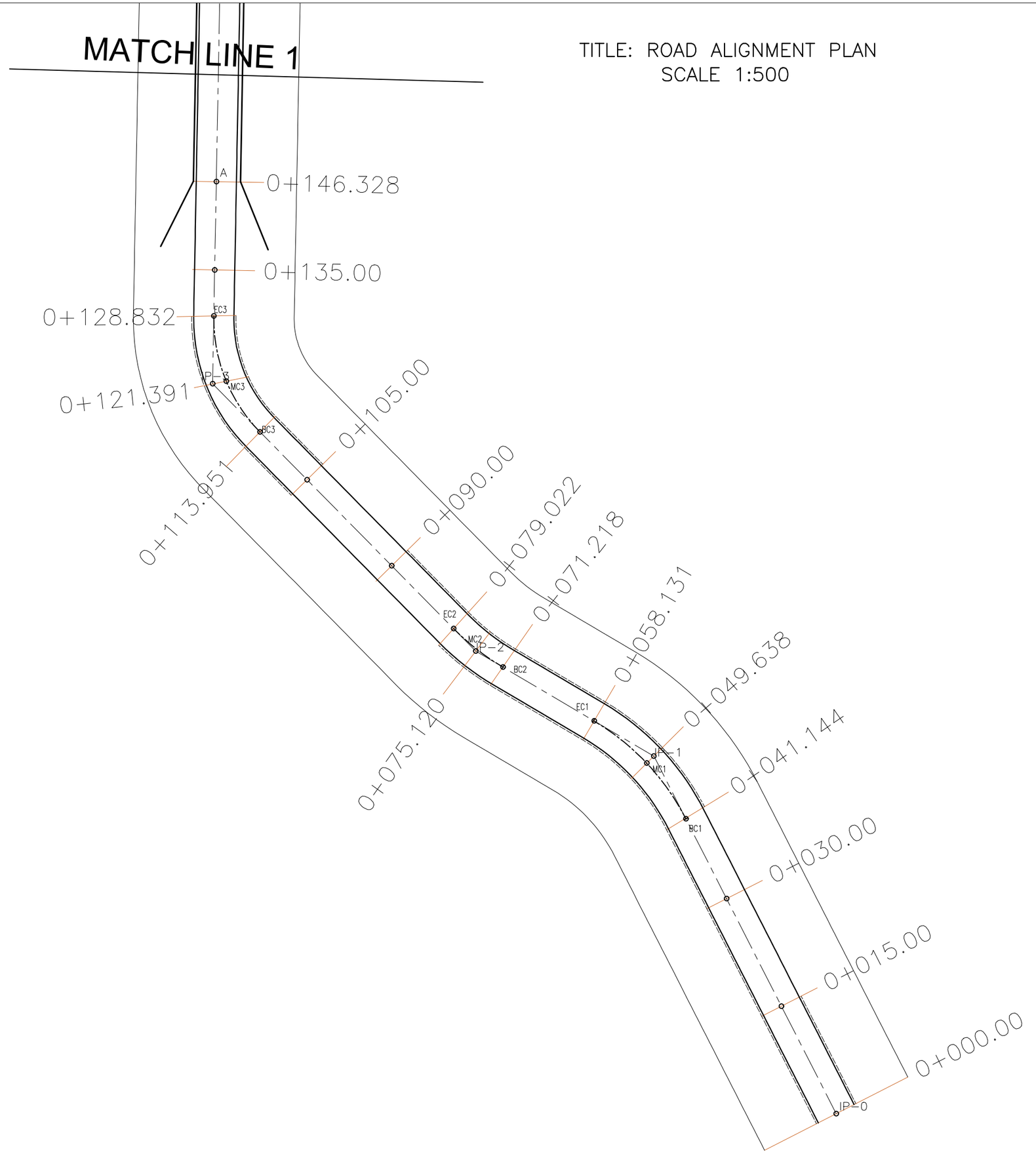
Points	Left Offset	Centre line chainage	Right Offset	BS	IS	FS	HI	Reduced Level(m)	Correction	Corrected RL(m)	Remarks
				h1(B-IP17)=		8.391					
				h2(IP17-B)=		8.4					
				error=		0.009					
				k=		1015.67					
				permissible(mm)=		24.1873					
				error(mm)=		9					
				True h=		8.3955					
				RL of B=		1304.32					
				True RL of Ip17=		1295.92					
				Observed RL of IP1		1295.93					
				Error=		0.0045					



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SCALE 1:500

N

LEGENDS

— — —	CENTER LINE
———	FORMATION WIDTH
———	ROW
○	INTESECTION POINT
	BRIDGE/CULVERT
MATCH LINE	MATCH LINE
— — —	SIDE DRAIN

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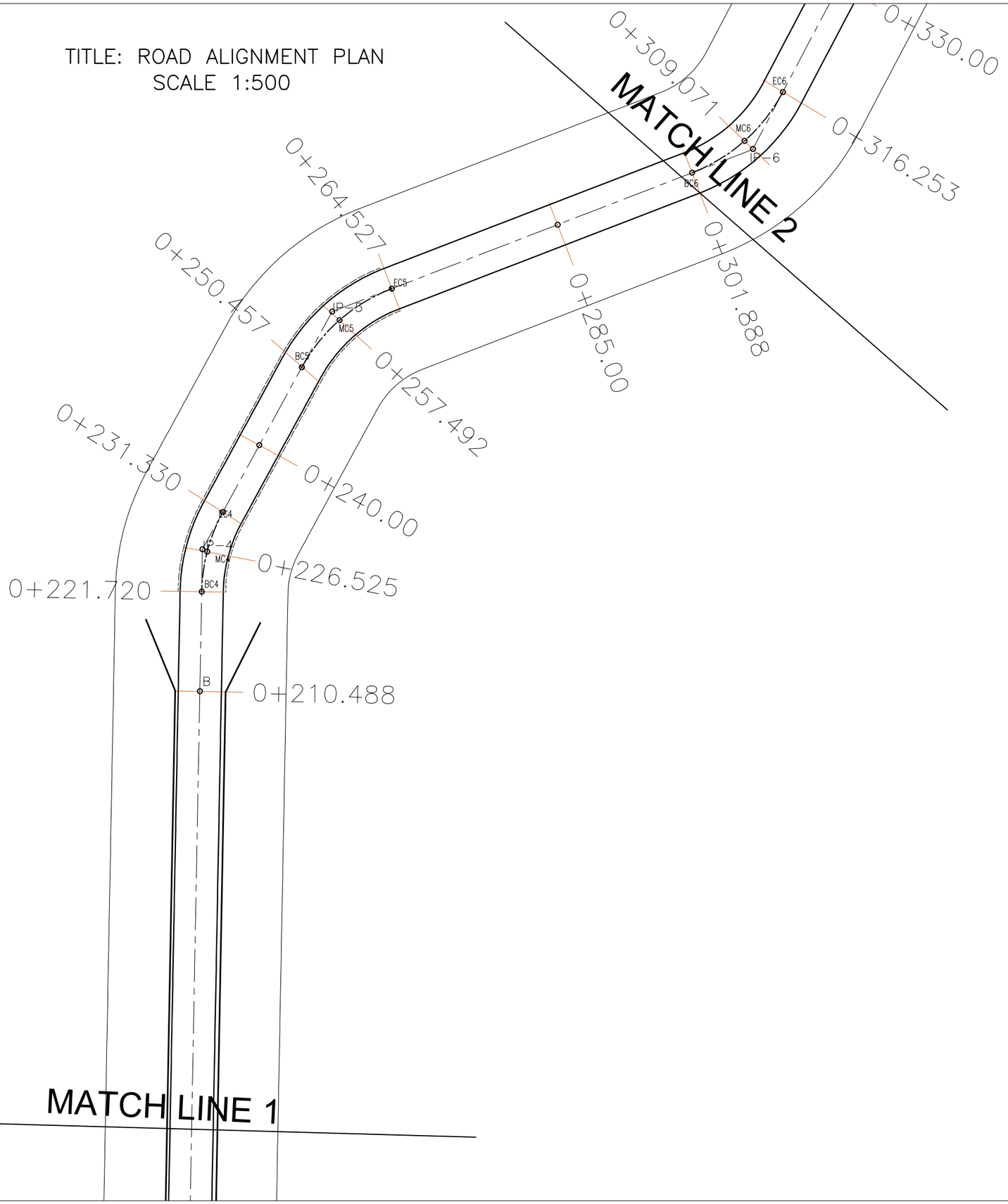
TITLE: ROAD ALIGNMENT PLAN
SCALE 1:500

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

Sheet No:
1

TITLE: ROAD ALIGNMENT PLAN
SCALE 1:500



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LEGENDS

— — —	CENTER LINE
———	FORMATION WIDTH
———	ROW
○	INTESECTION POINT
	BRIDGE/CULVERT
MATCH LINE	MATCH LINE
- - - - - - - - - -	SIDE DRAIN

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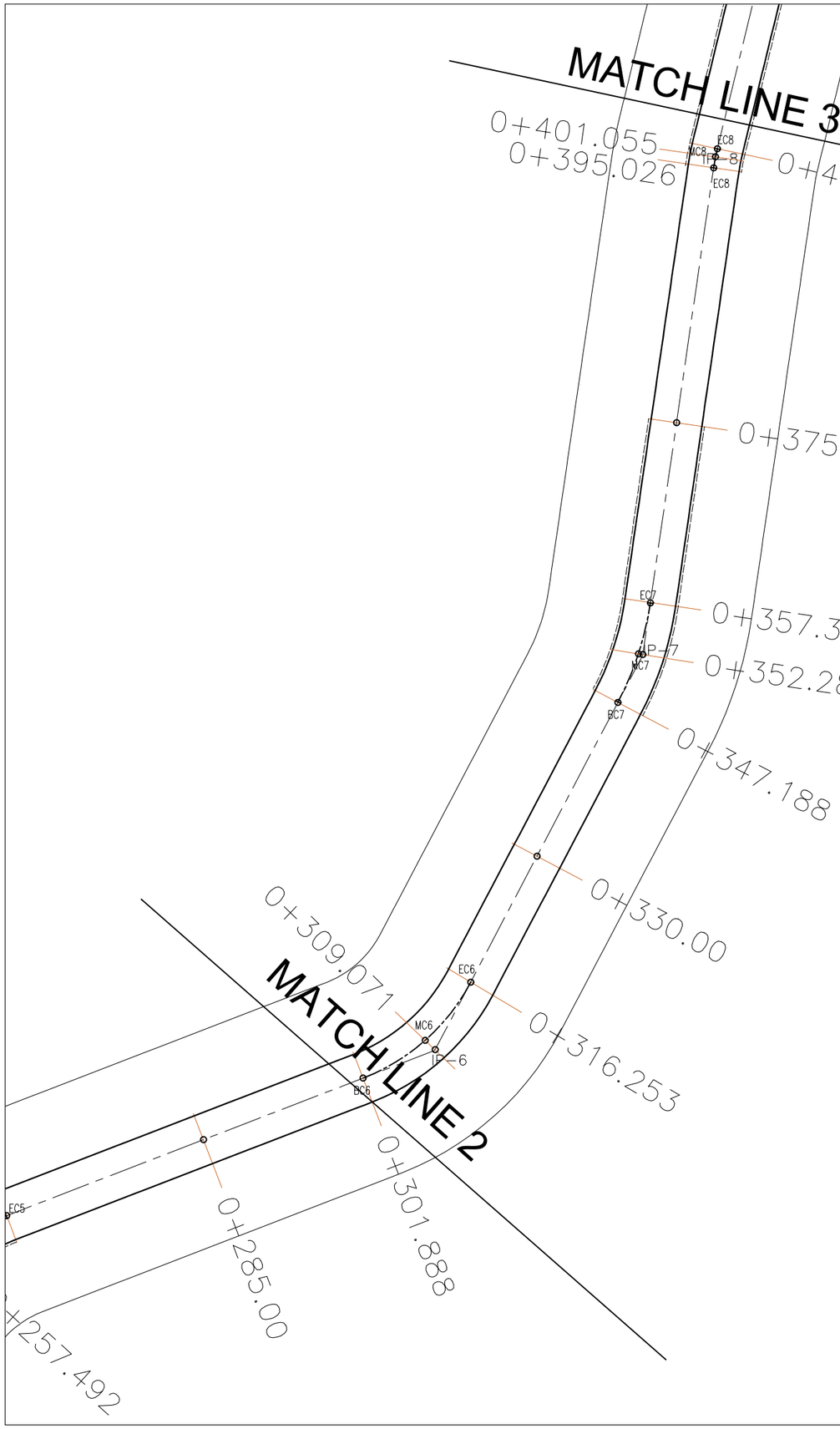
2



TITLE: ROAD ALIGNMENT PLAN
SCALE 1:500

N

LEGENDS

— — —	CENTER LINE
———	FORMATION WIDTH
———	ROW
○	INTESECTION POINT
	BRIDGE/CULVERT
MATCH LINE	MATCH LINE
----------	SIDE DRAIN

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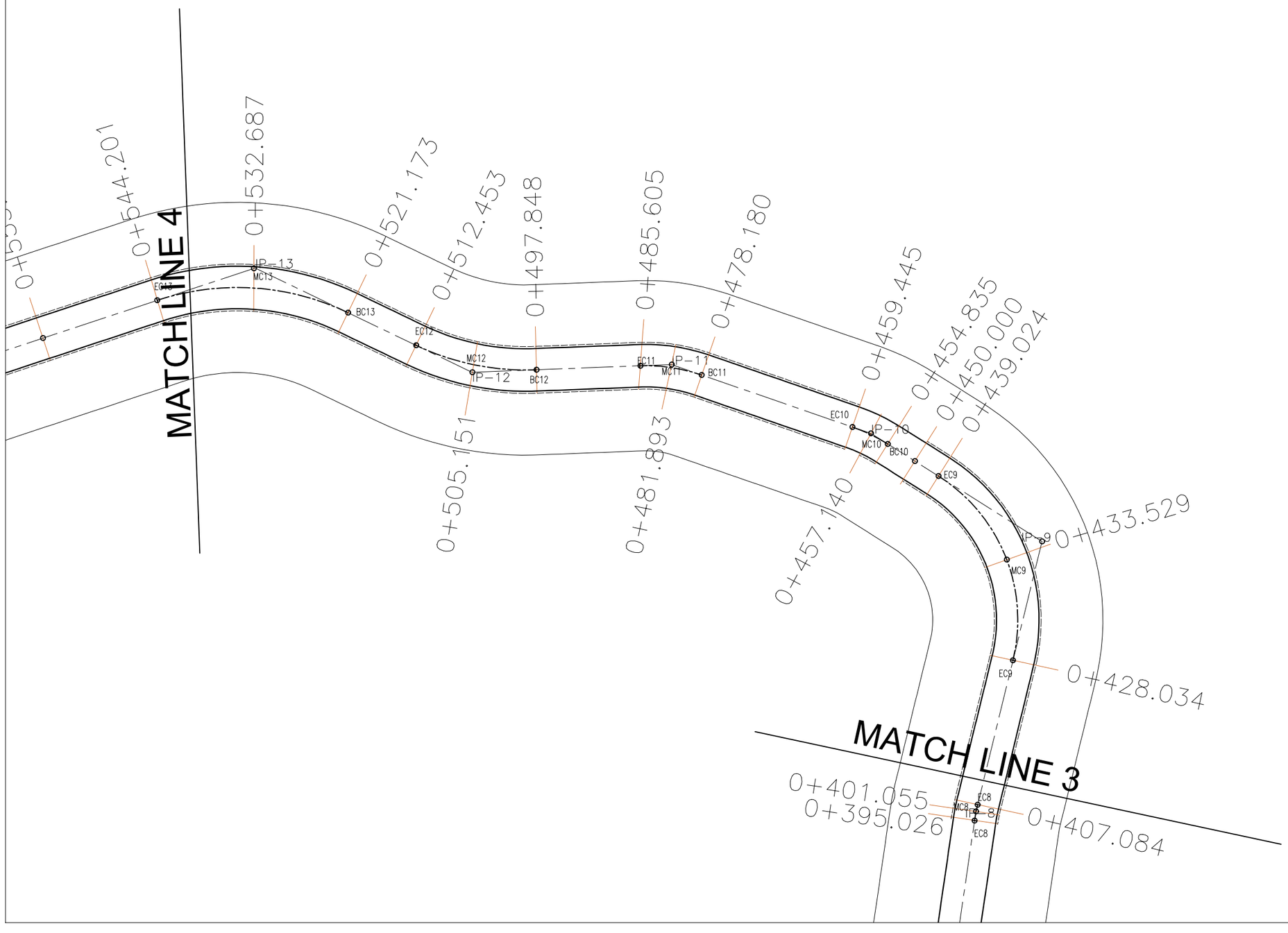

LEGENDS

— — —	CENTER LINE
———	FORMATION WIDTH
———	ROW
○	INTESECTION POINT
	BRIDGE/CULVERT
MATCH LINE	MATCH LINE
----------	SIDE DRAIN

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SURENDRA SHARMA	078BCE178

Sheet No:
4

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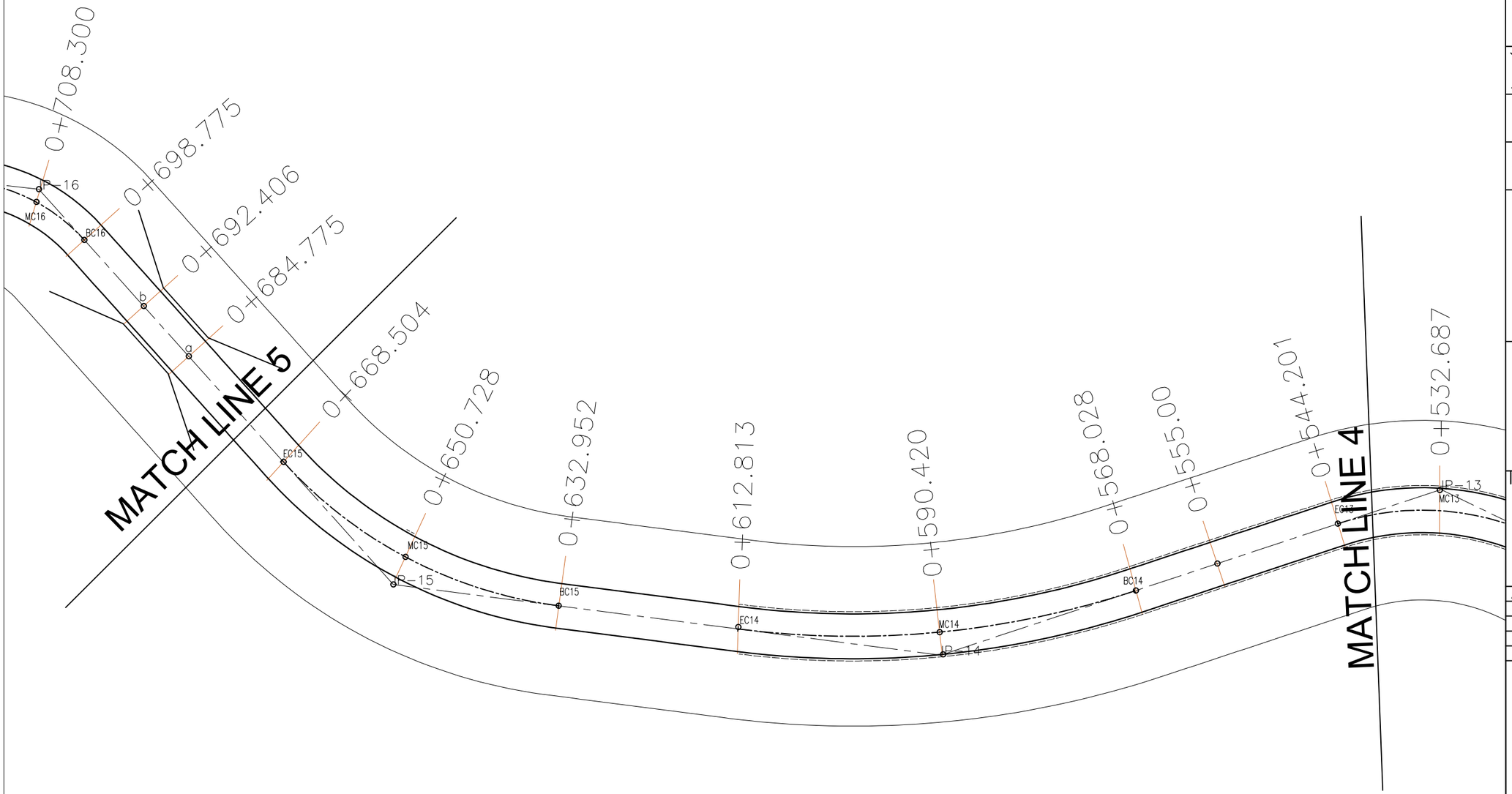

LEGENDS

— — —	CENTER LINE
———	FORMATION WIDTH
———	ROW
○	INTESECTION POINT
	BRIDGE/CULVERT
MATCH LINE	MATCH LINE
----------	SIDE DRAIN

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Sheet No: 5

TITLE: ROAD ALIGNMENT PLAN
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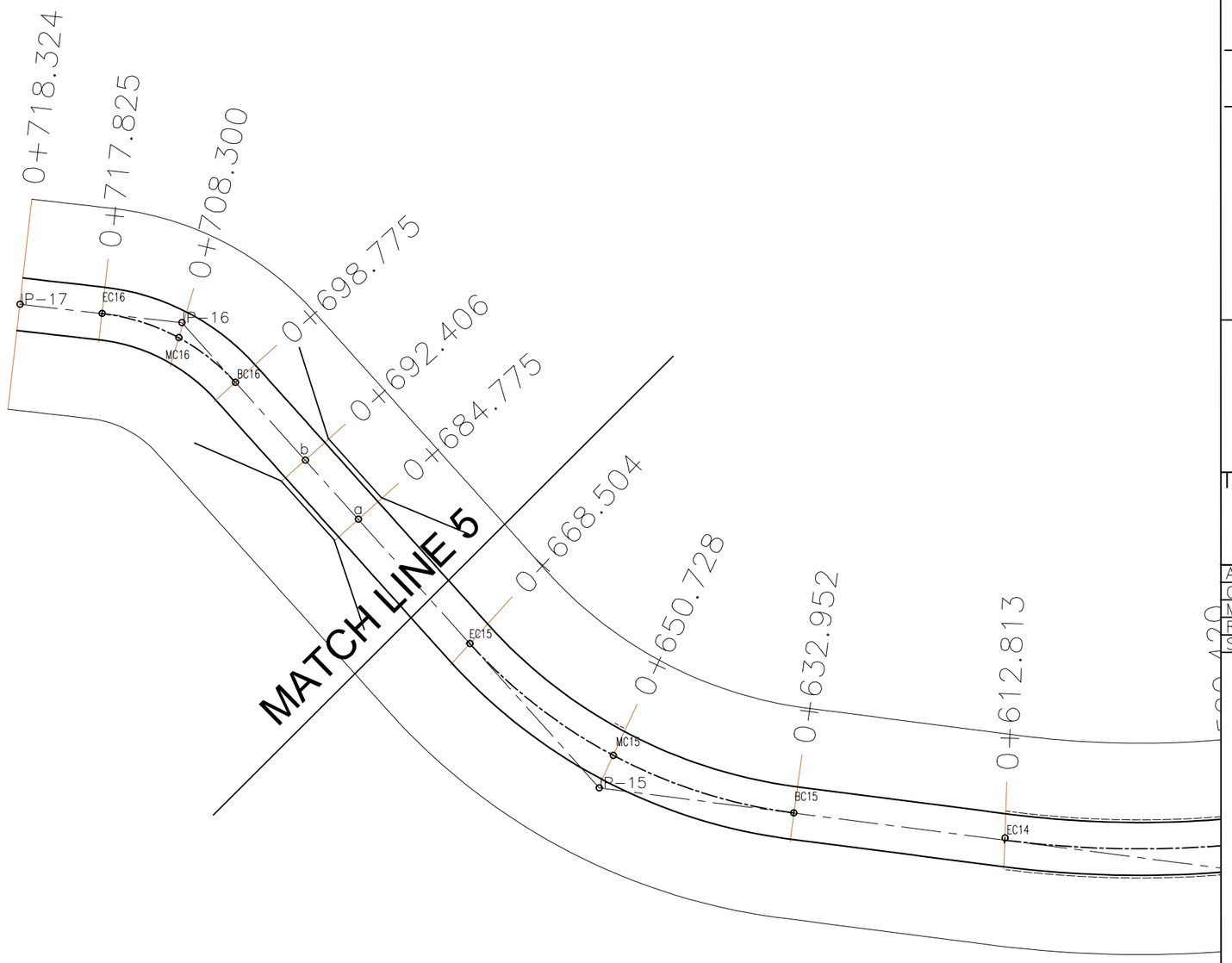

N

LEGENDS

— — —	CENTER LINE
———	FORMATION WIDTH
———	ROW
◯	INTESECTION POINT
	BRIDGE/CULVERT
MATCH LINE	MATCH LINE
----------	SIDE DRAIN

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SURENDRA SHARMA	078BCE178

Sheet No:
6

TITLE—ROAD ALIGNMENT L—SECTION

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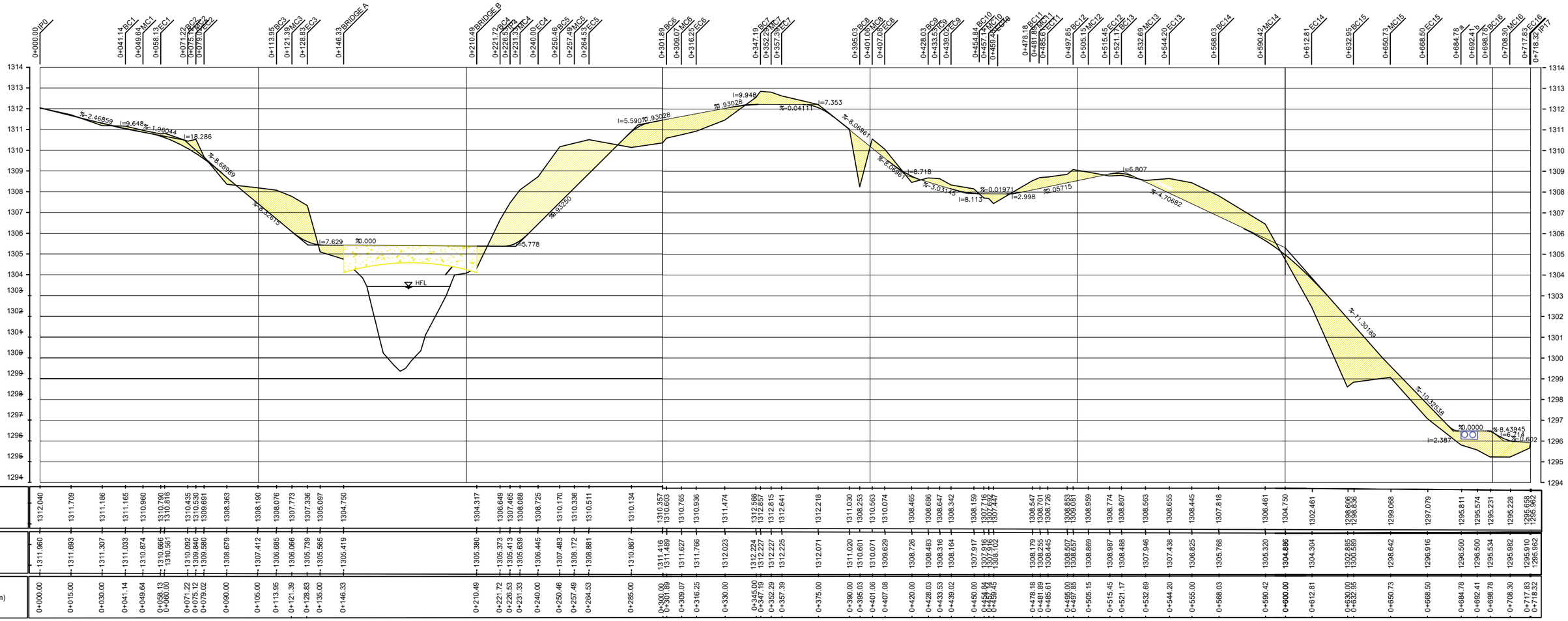

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TRIBHUVAN UNIVERSITY
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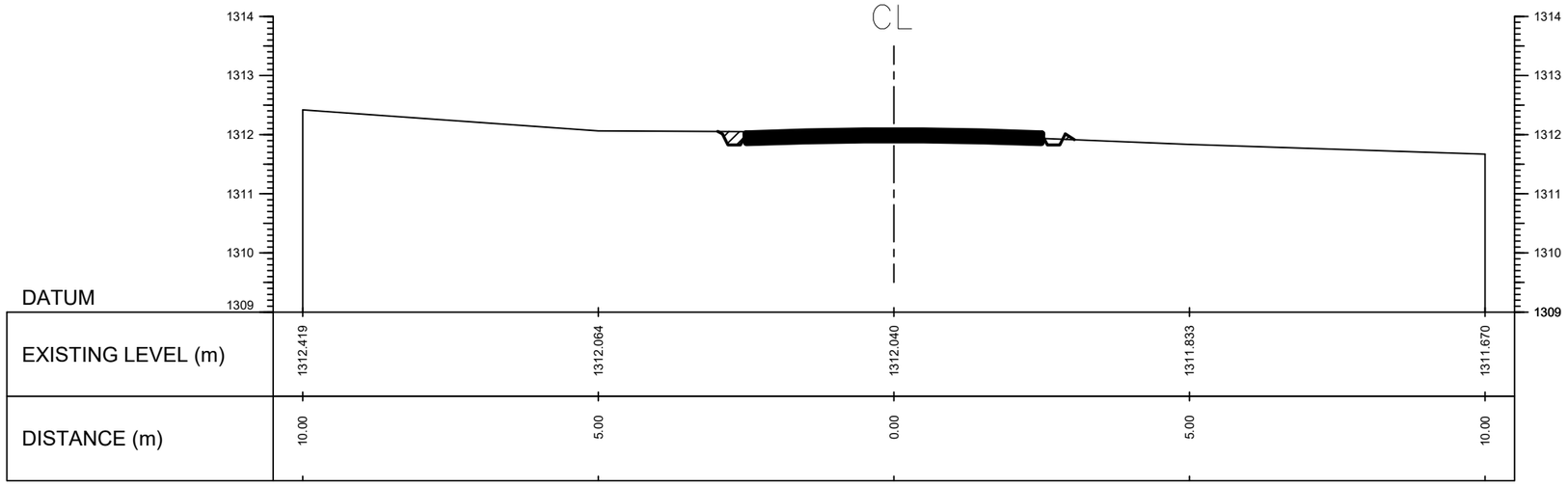
PULCHOWK CAMPUS
DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

TITLE: ROAD ALIGNMENT L—SECTION
HORIZONTAL SCALE 1:1000
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

Sheet No: 1



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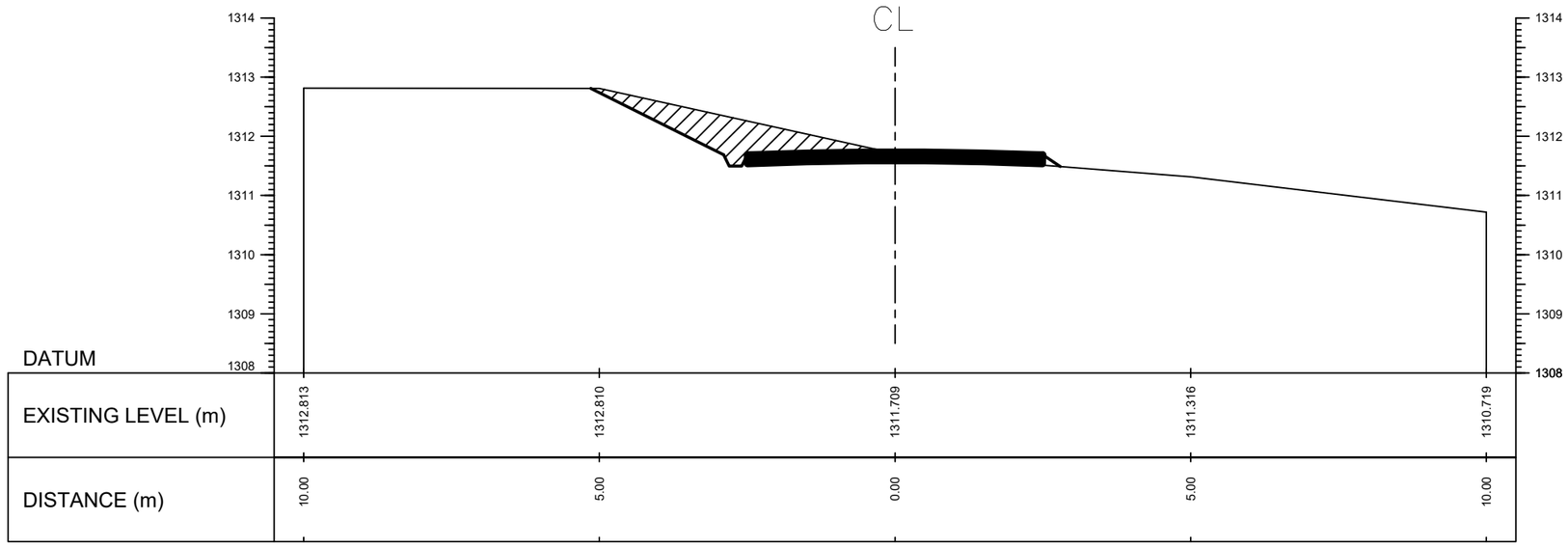

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DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

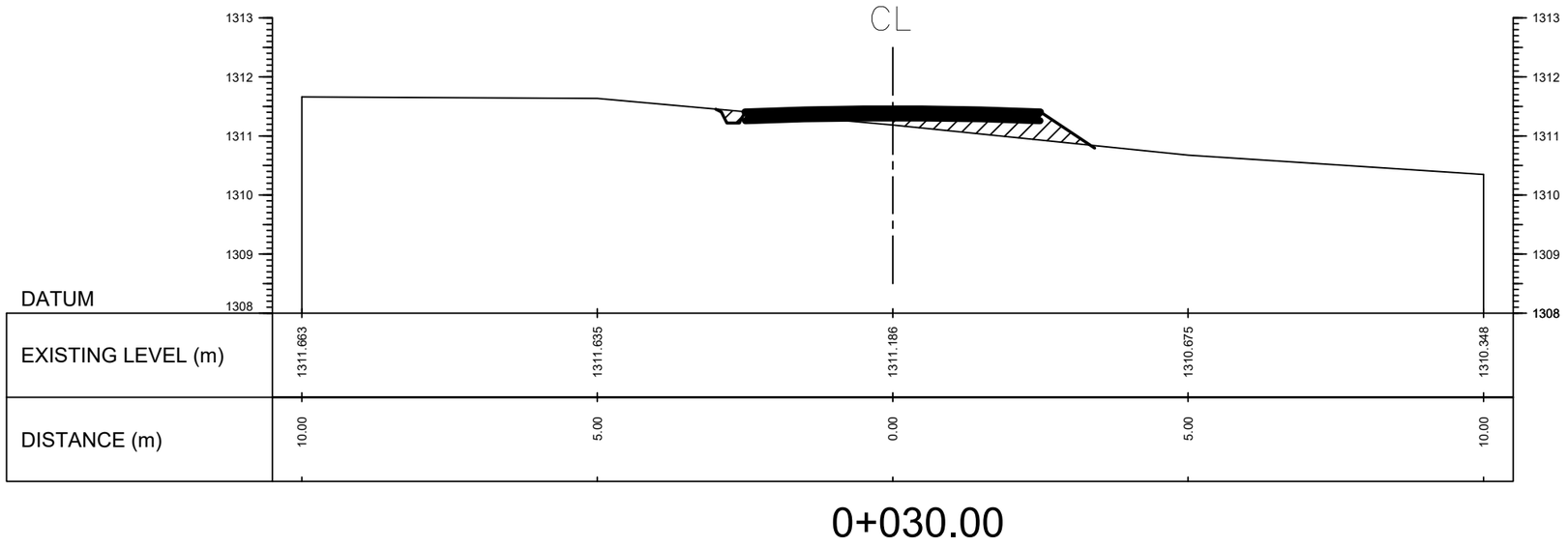
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 1



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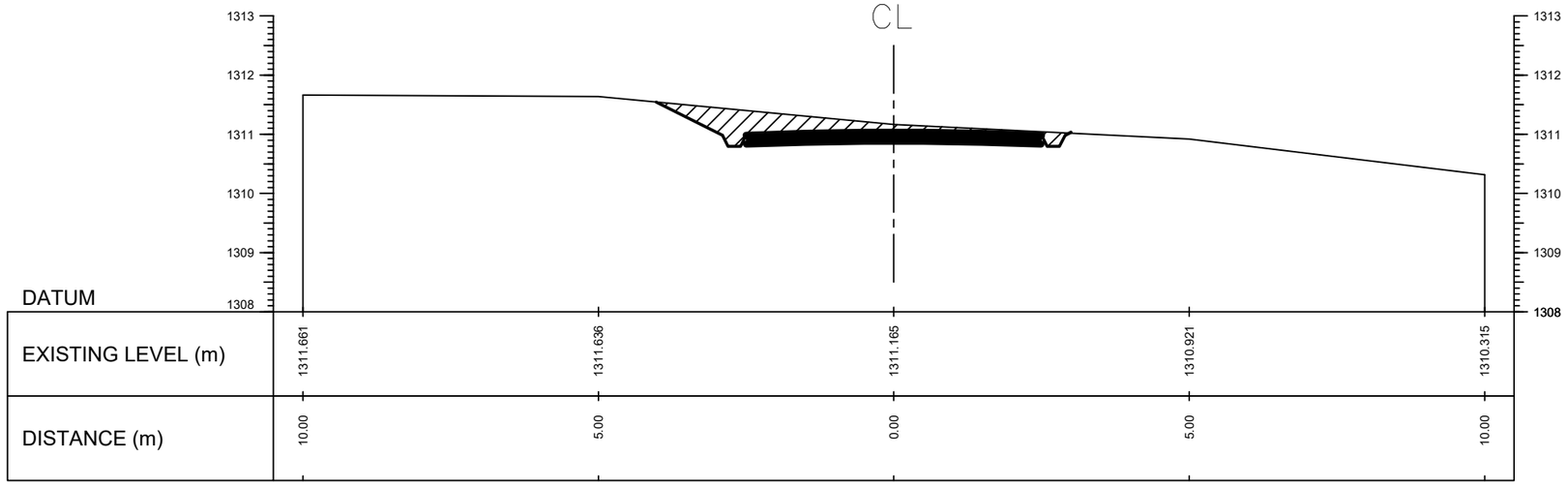

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HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
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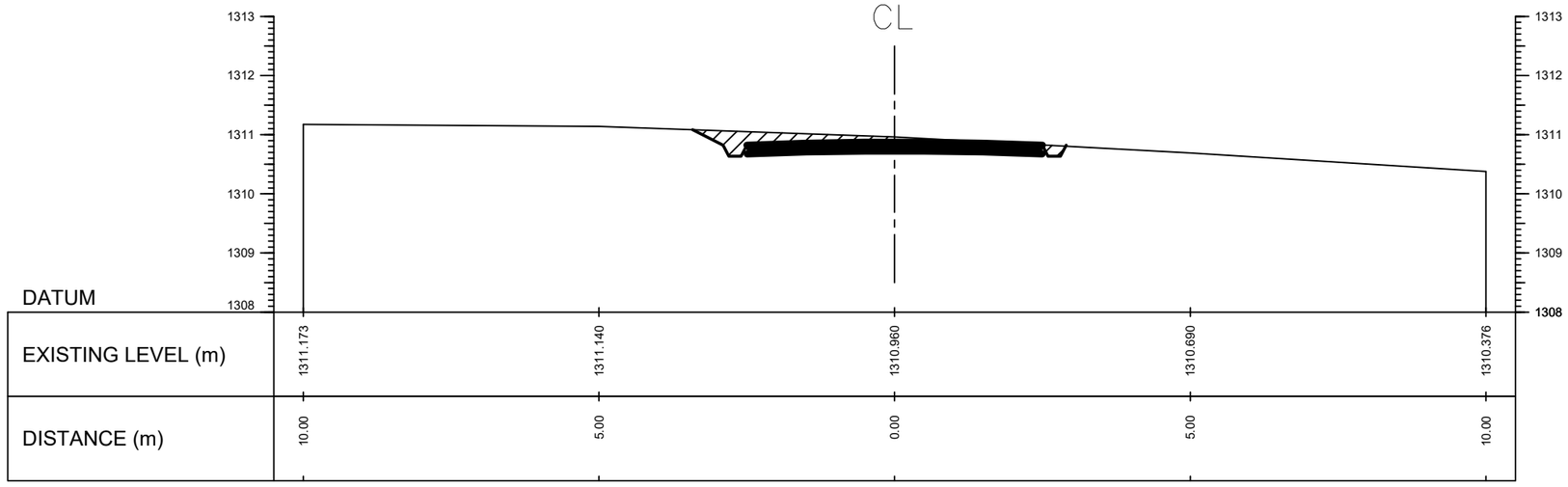
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 2



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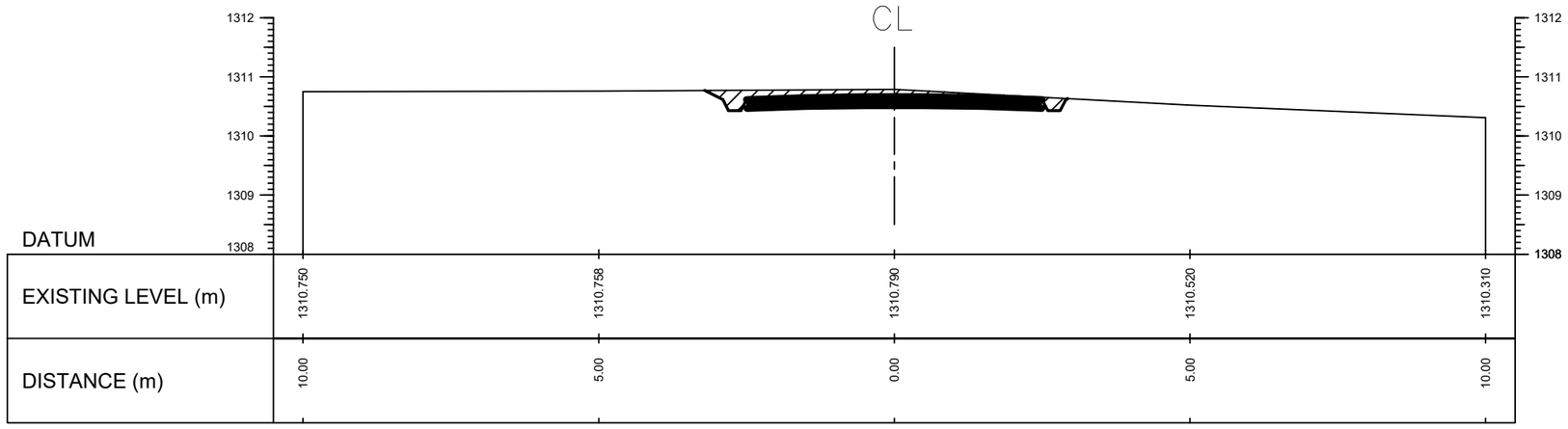

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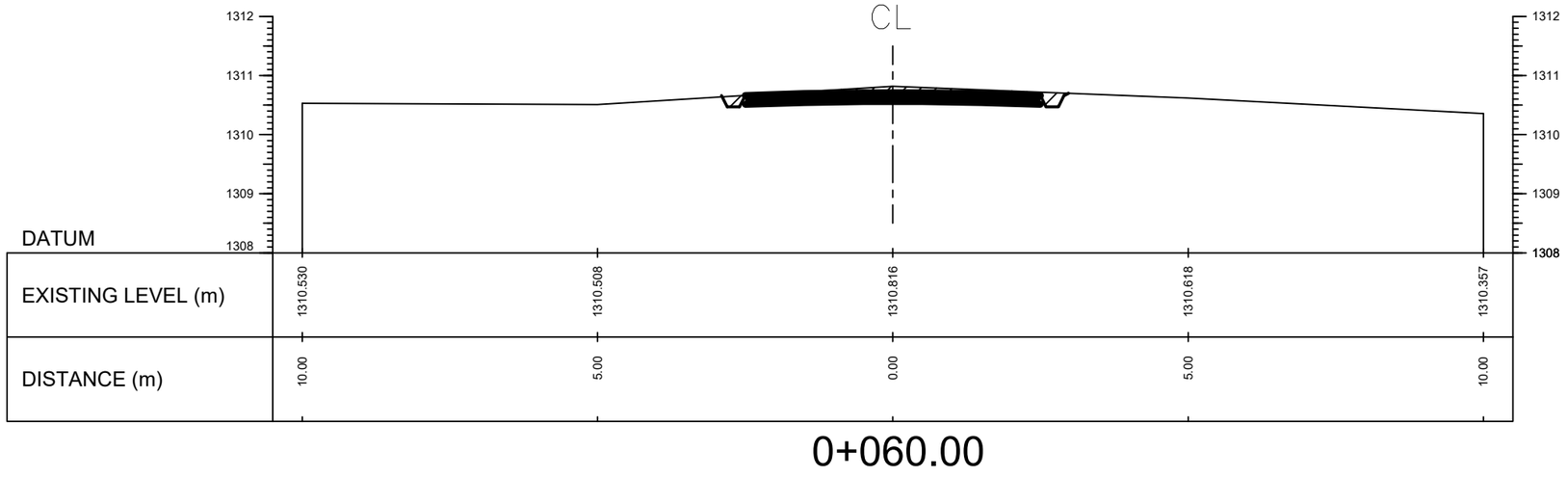
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 3



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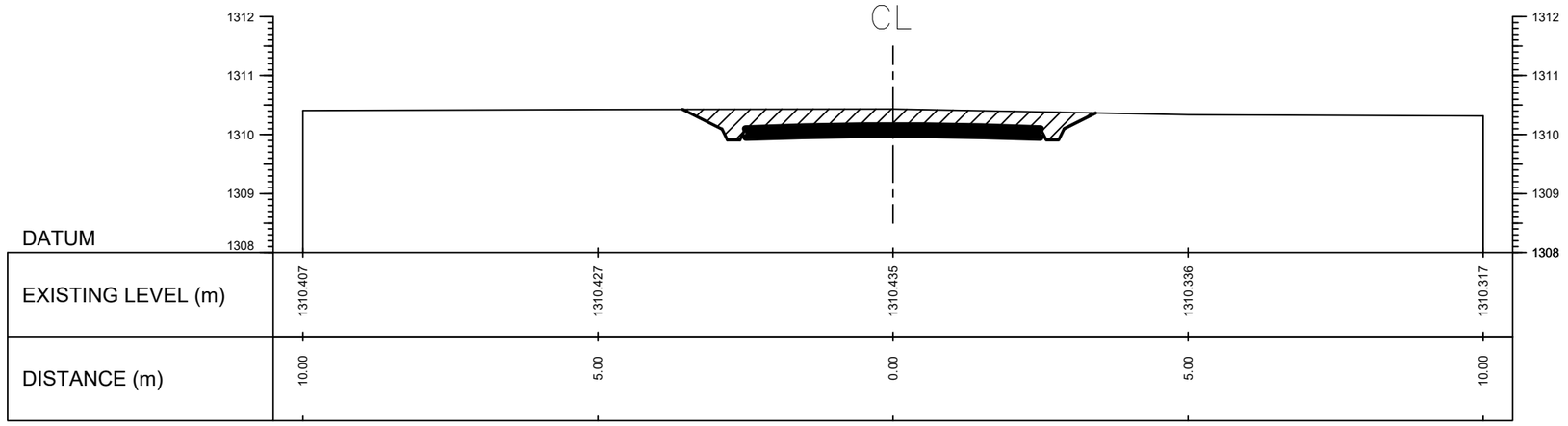

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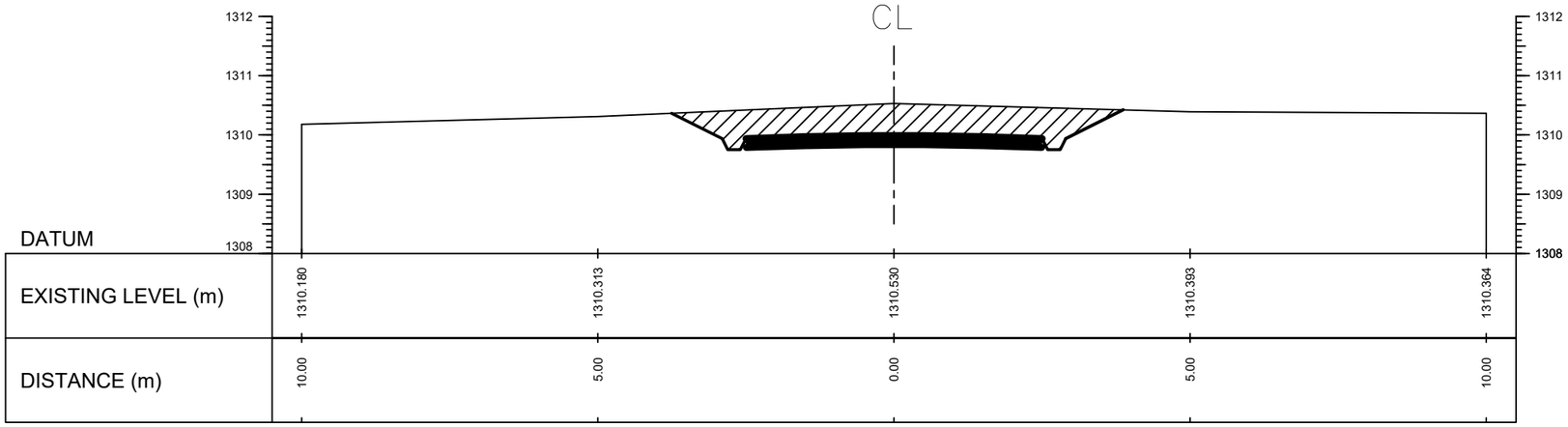
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 4



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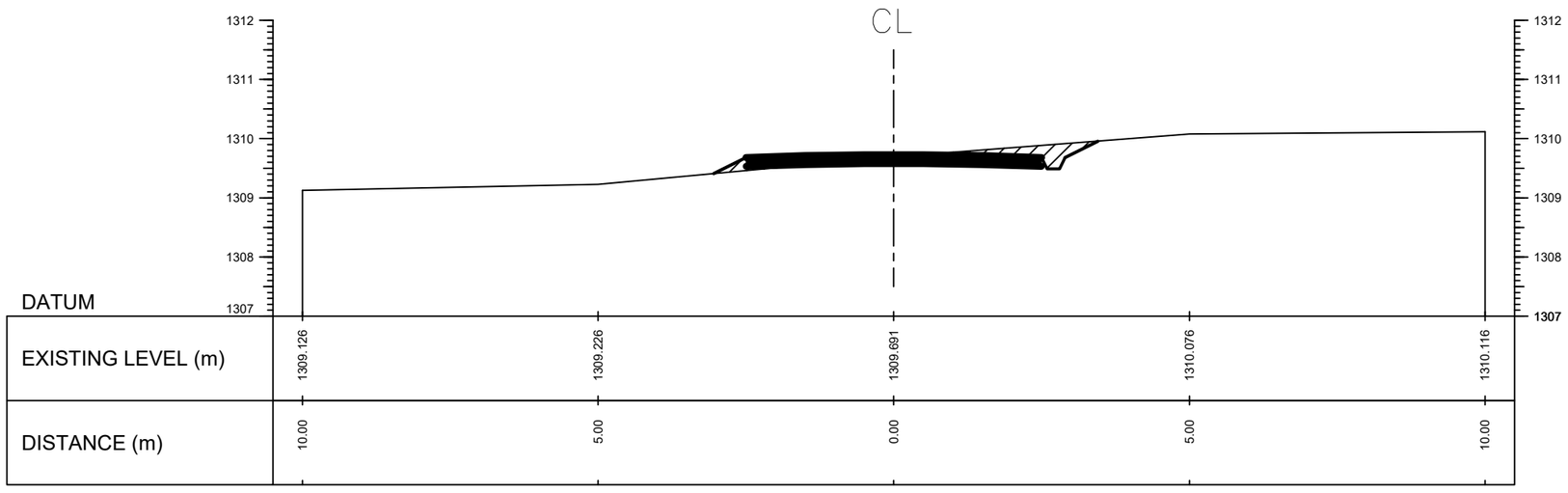

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SURVEY INSTRUCTION COMITTEE

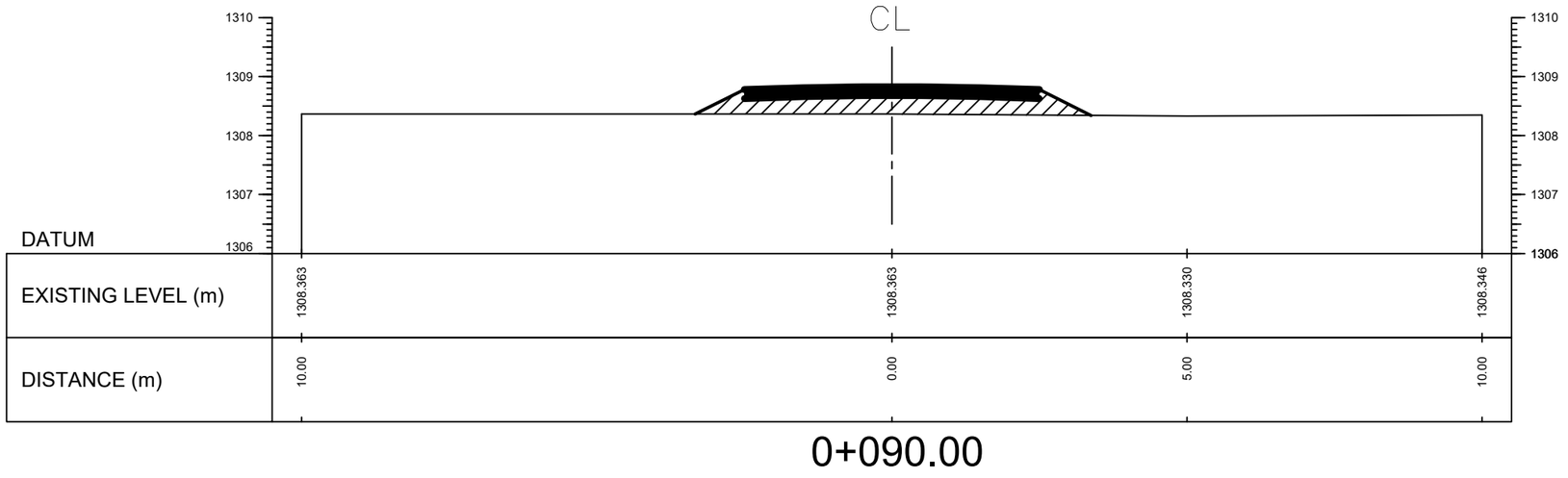
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 5



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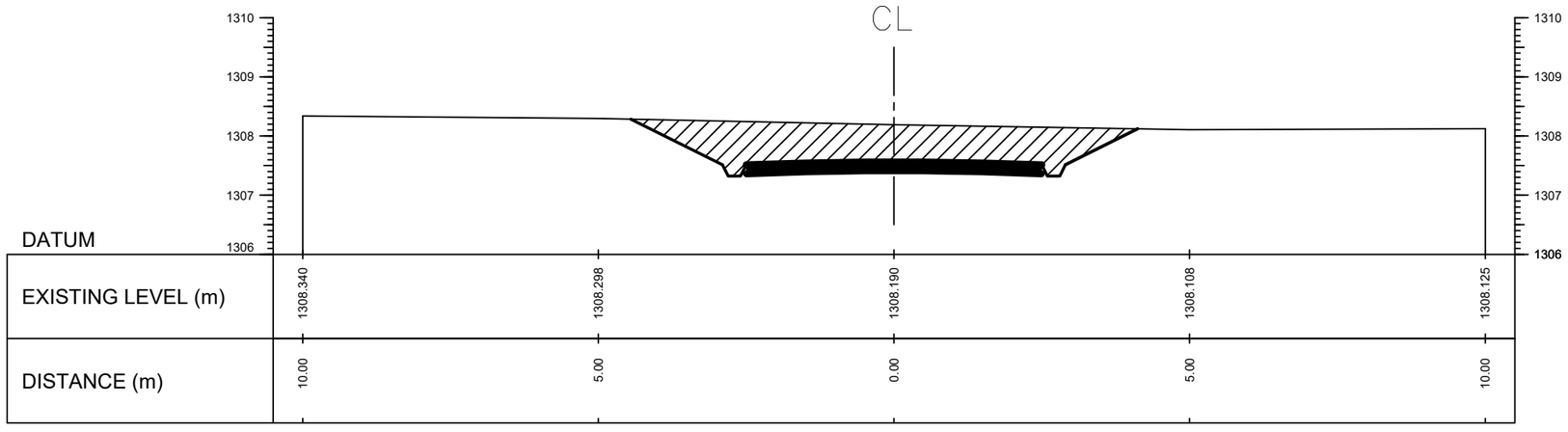

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HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

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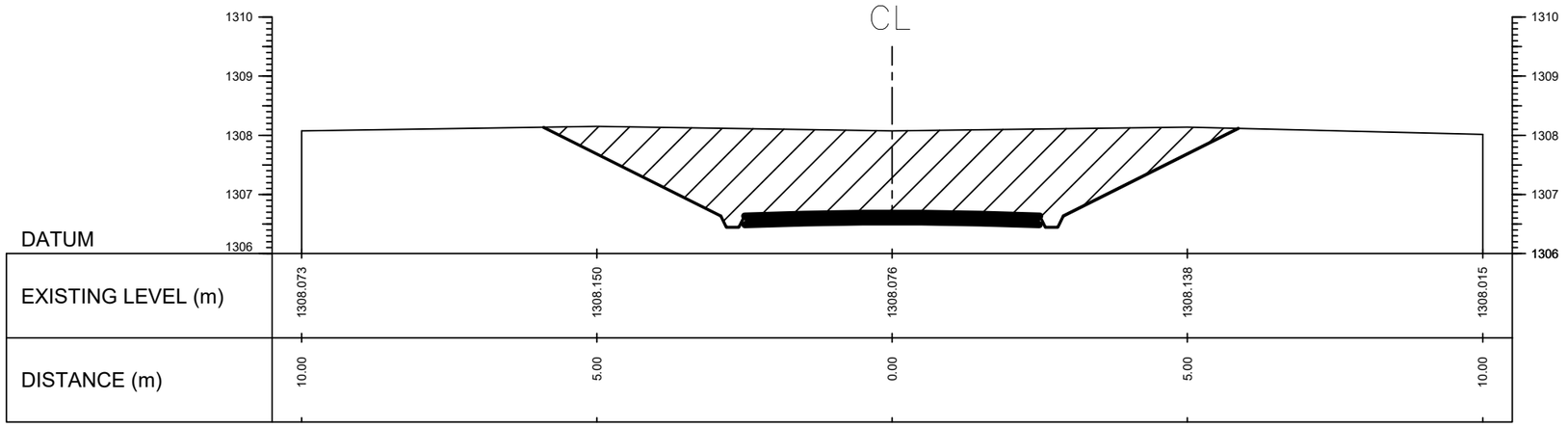

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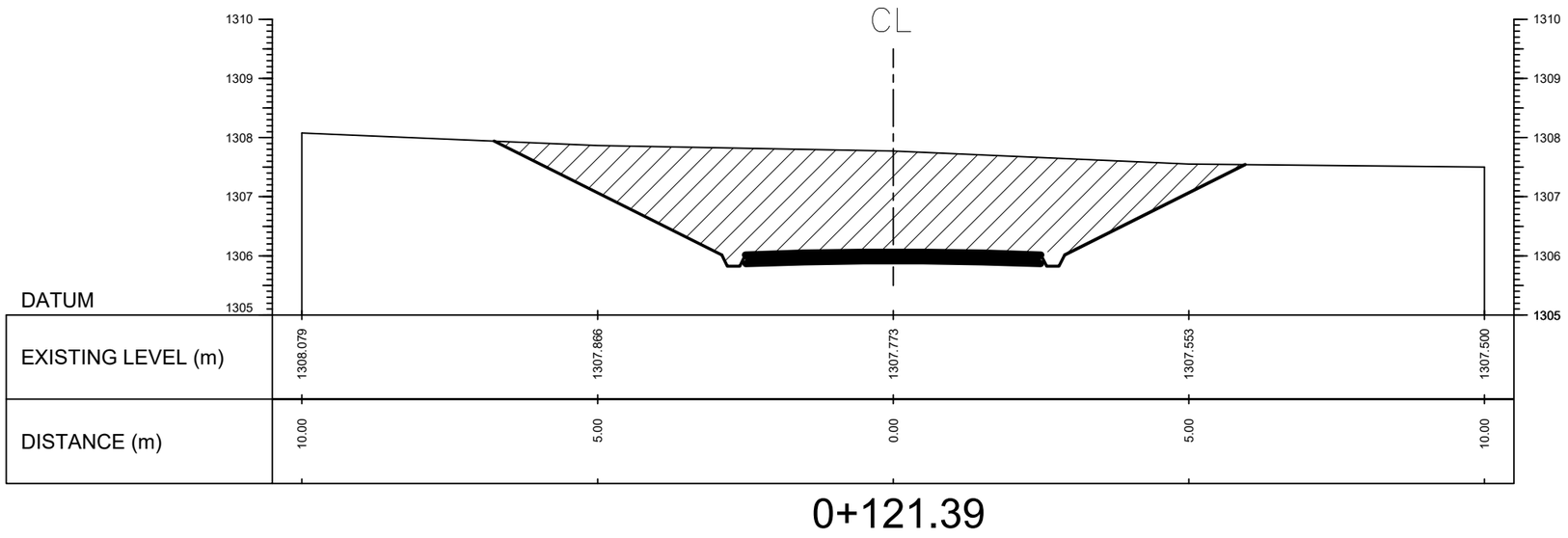
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 7



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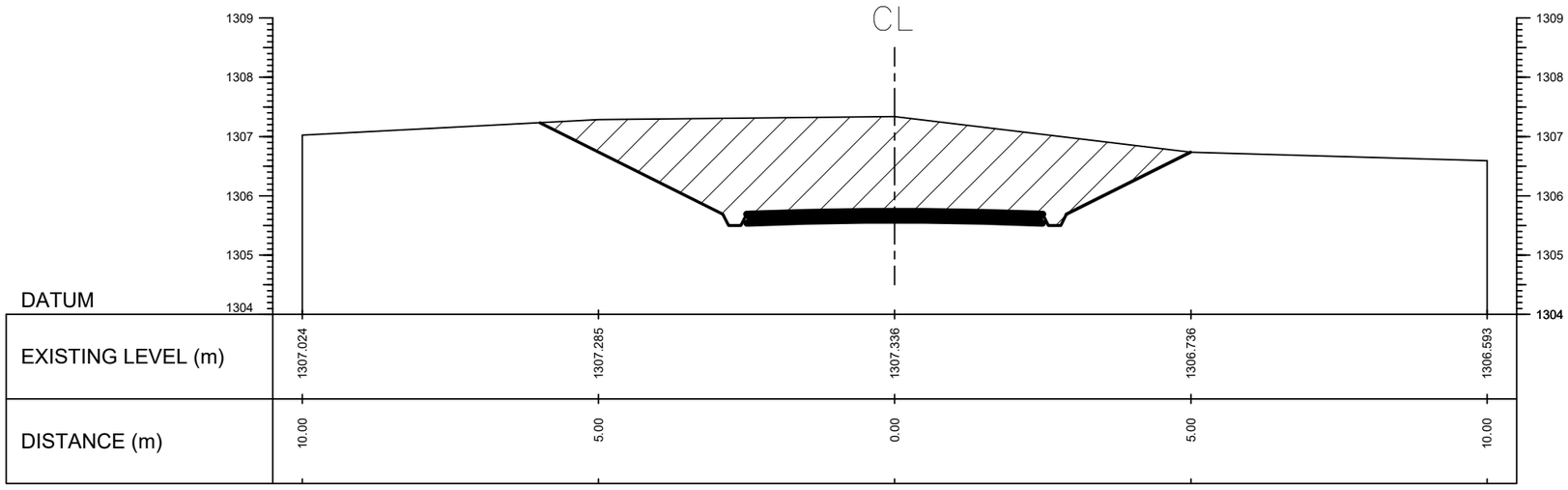

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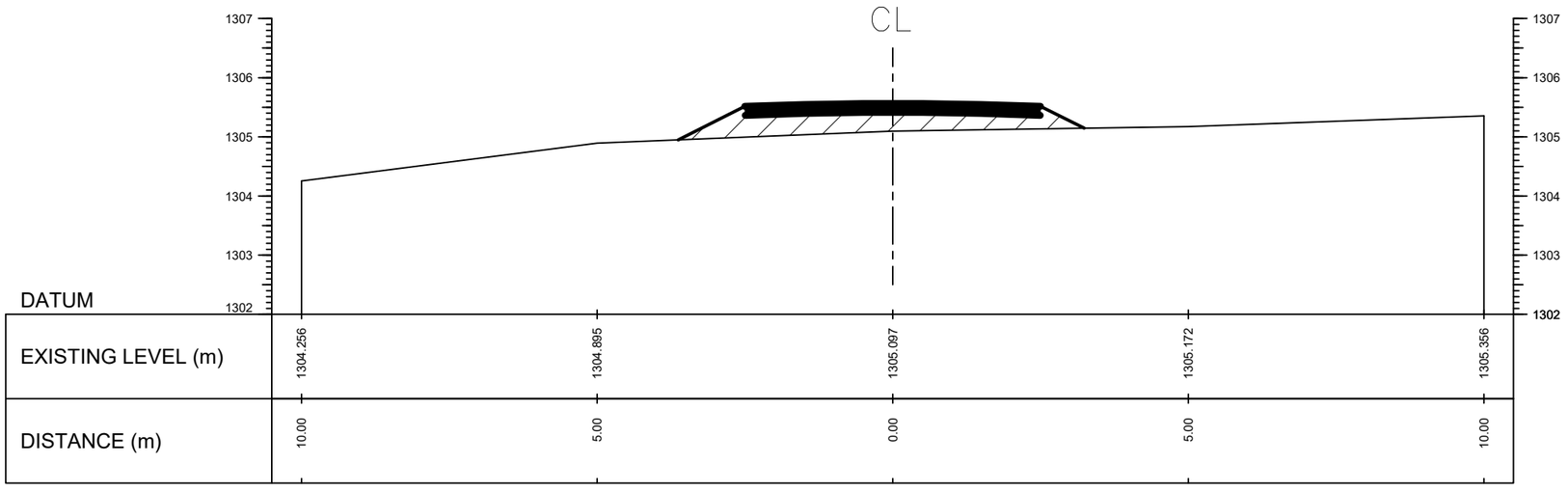
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 8



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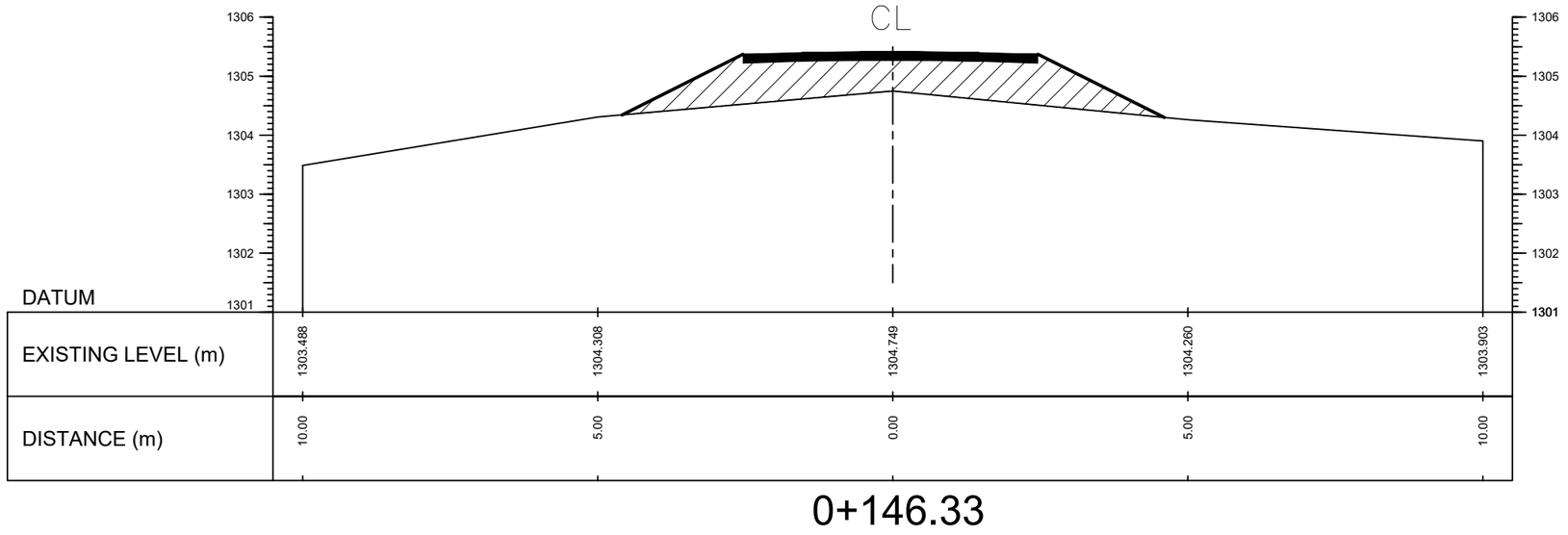
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 9



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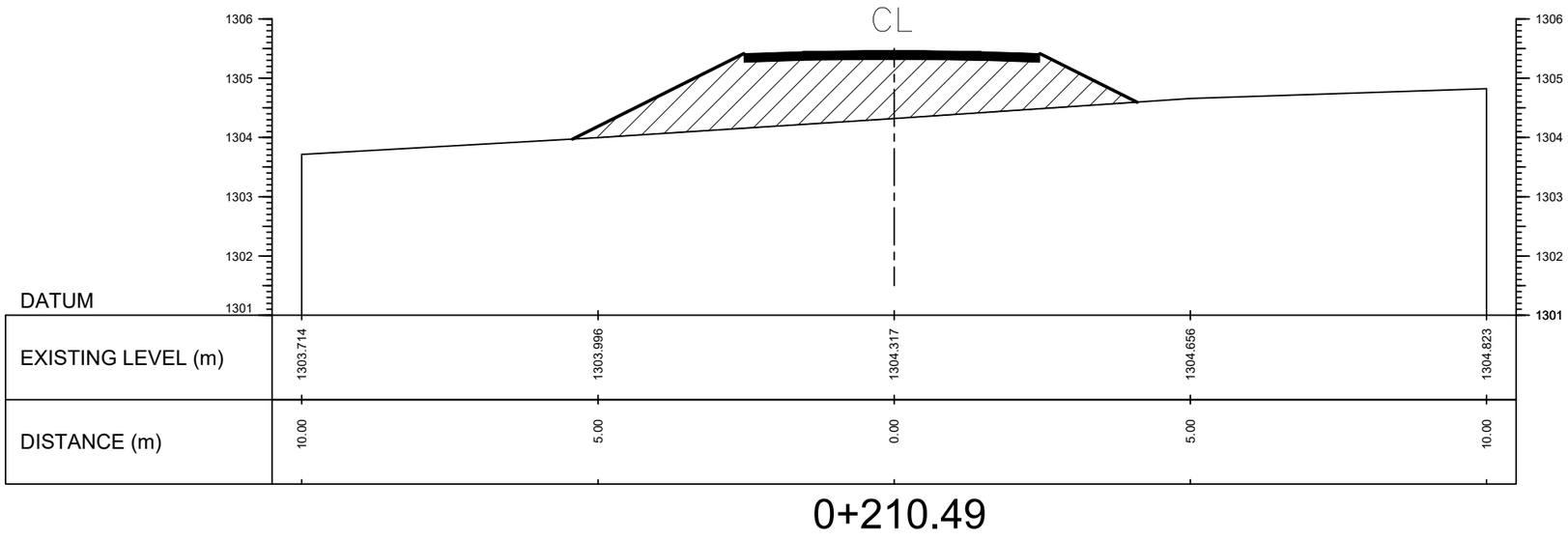

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HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

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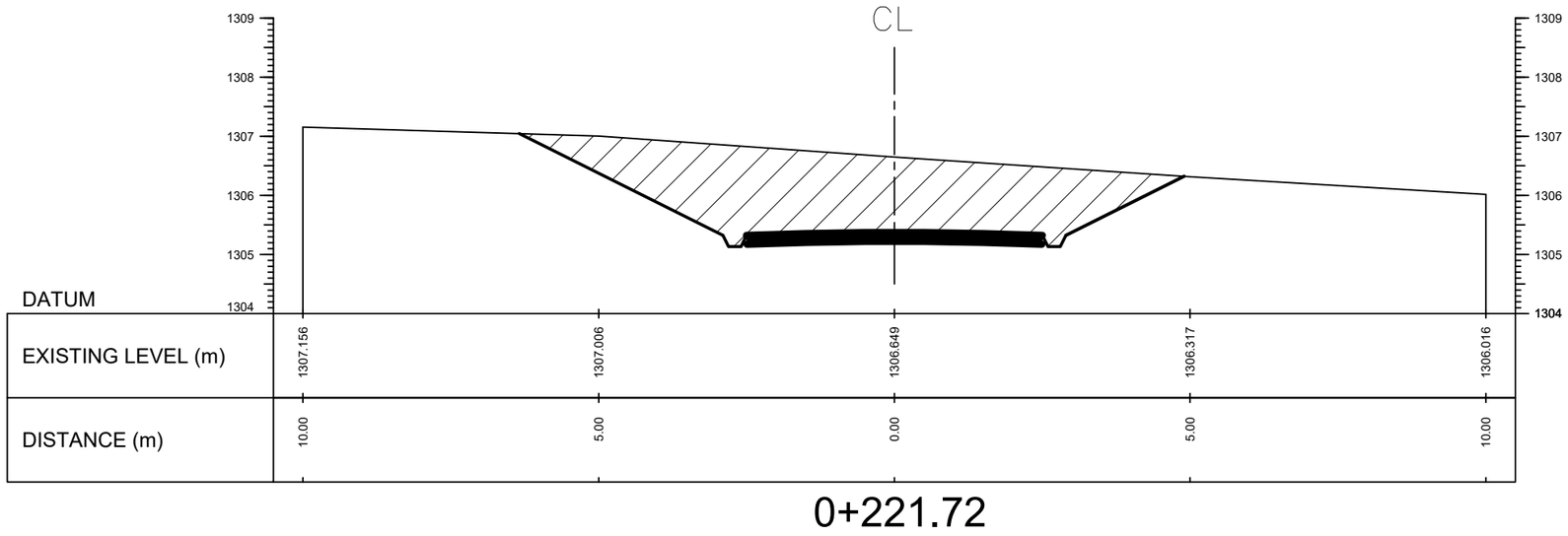
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 10



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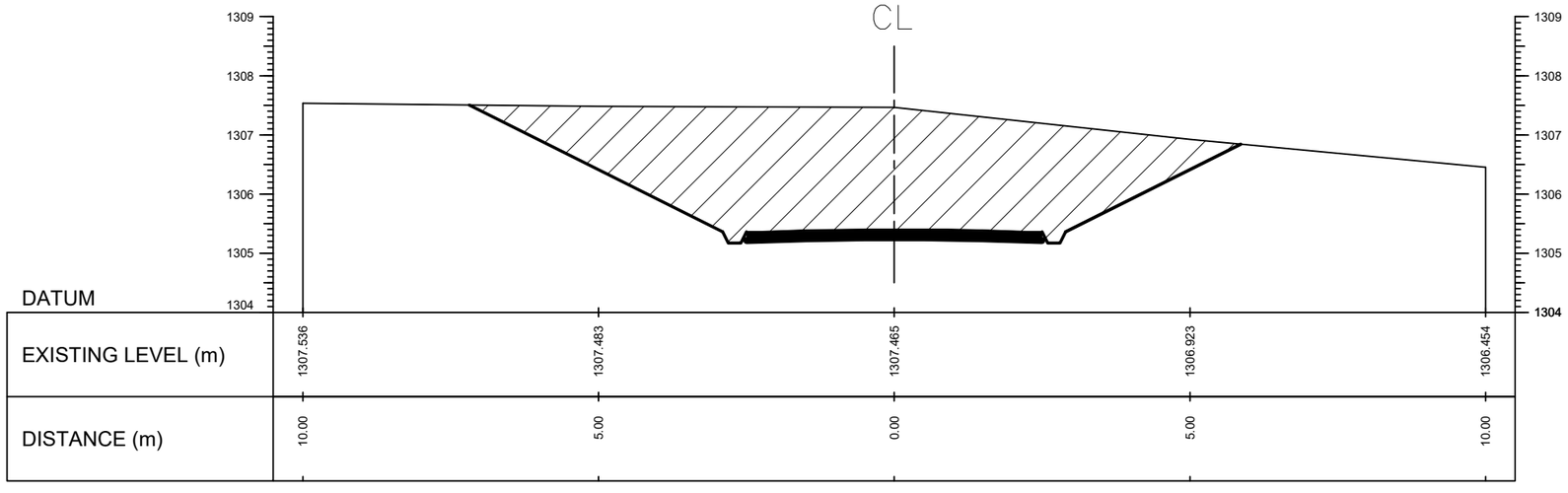

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DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

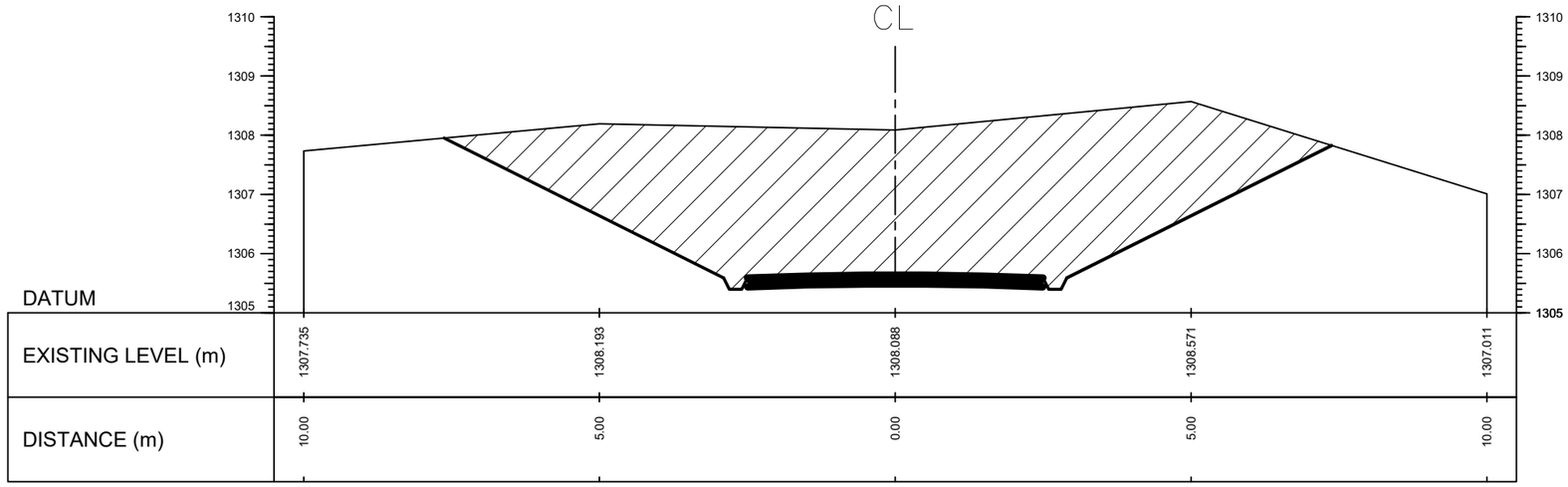
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 11



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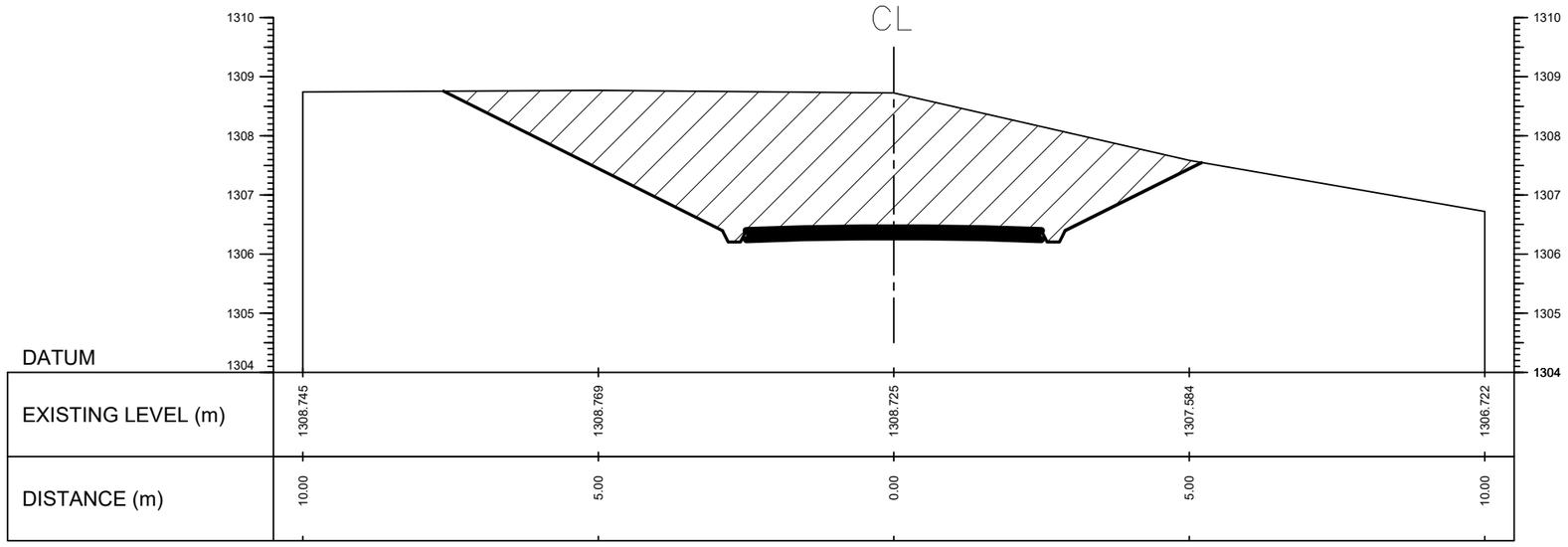

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SURVEY INSTRUCTION COMITTEE

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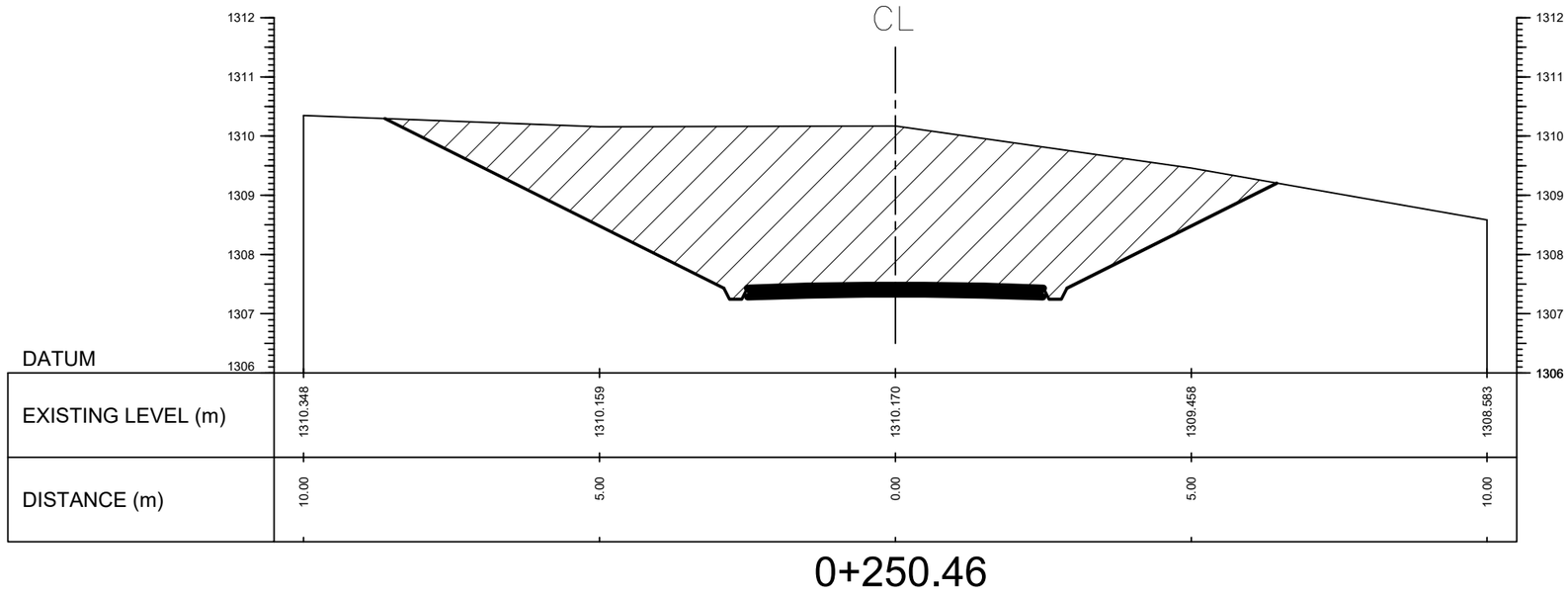
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 12



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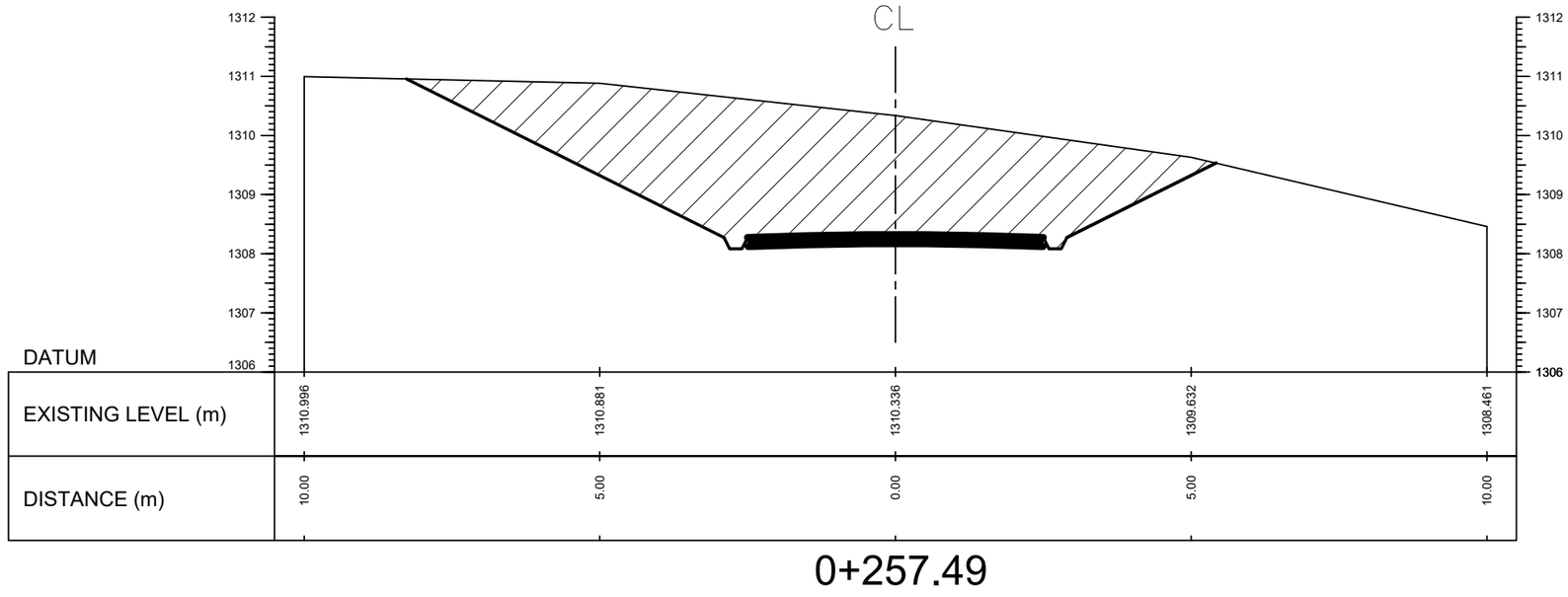

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SURVEY INSTRUCTION COMITTEE

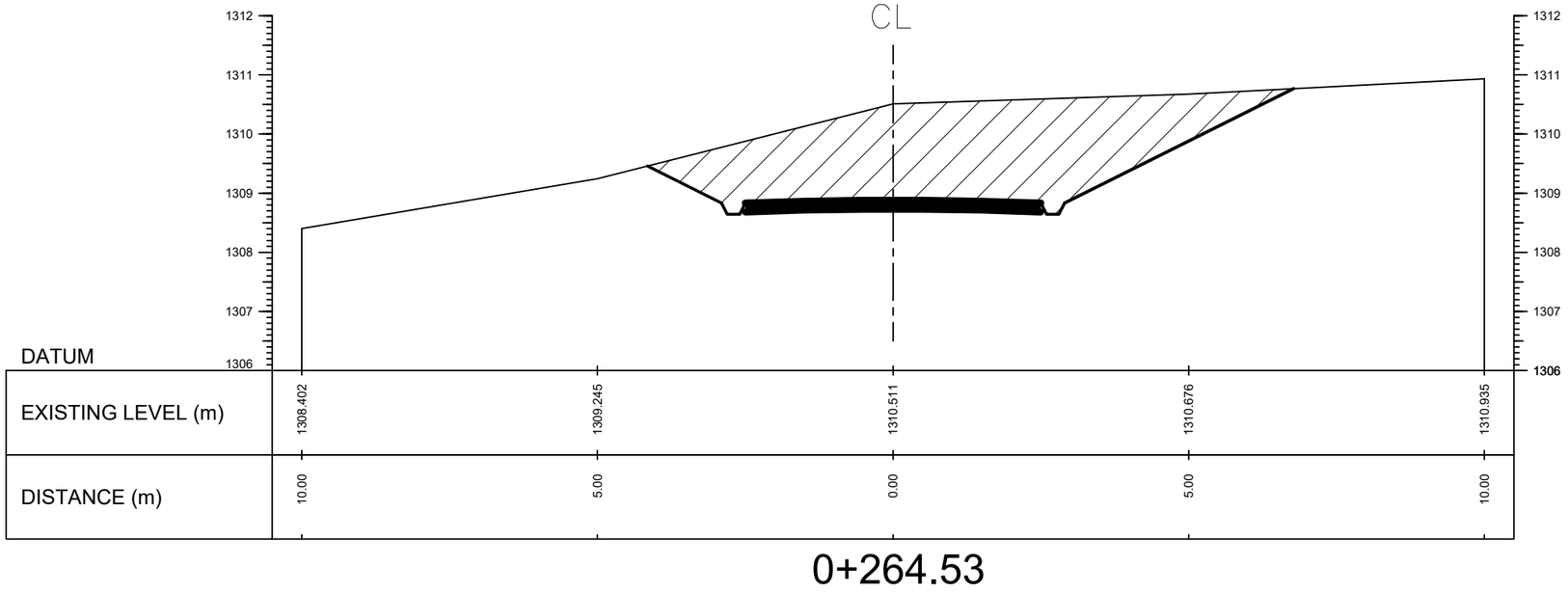
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 13



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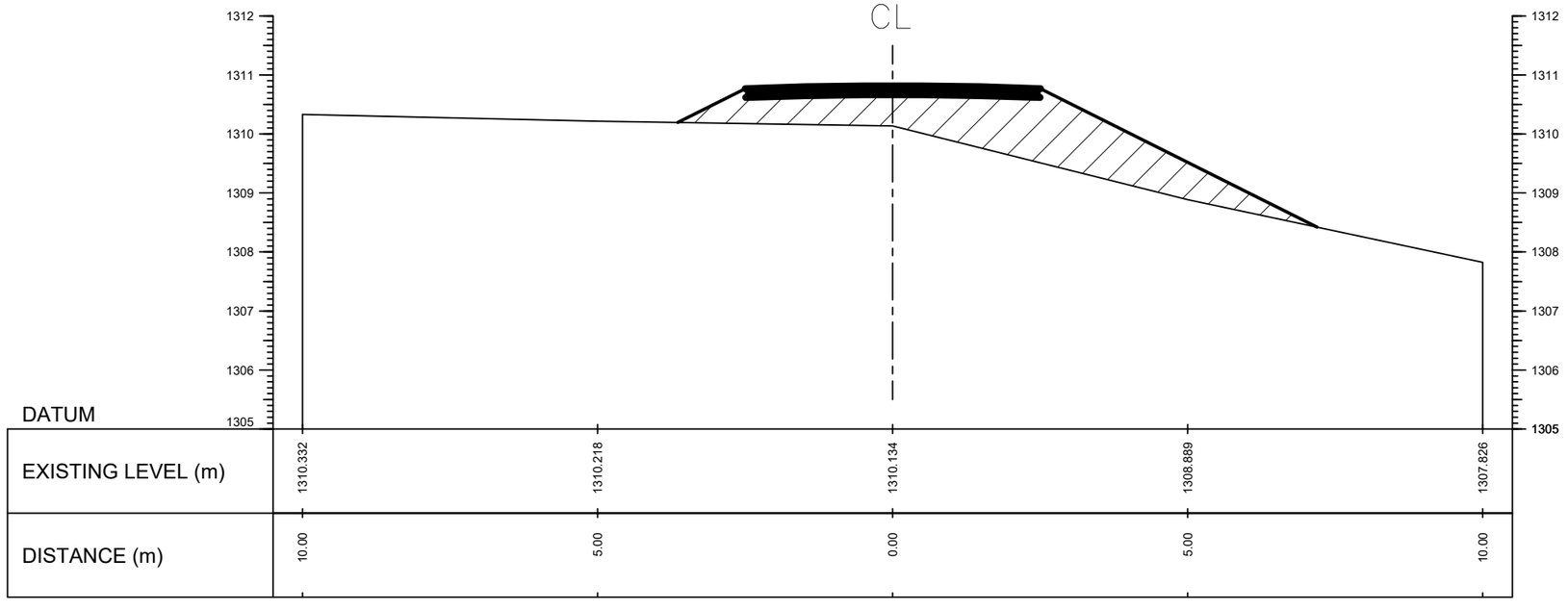

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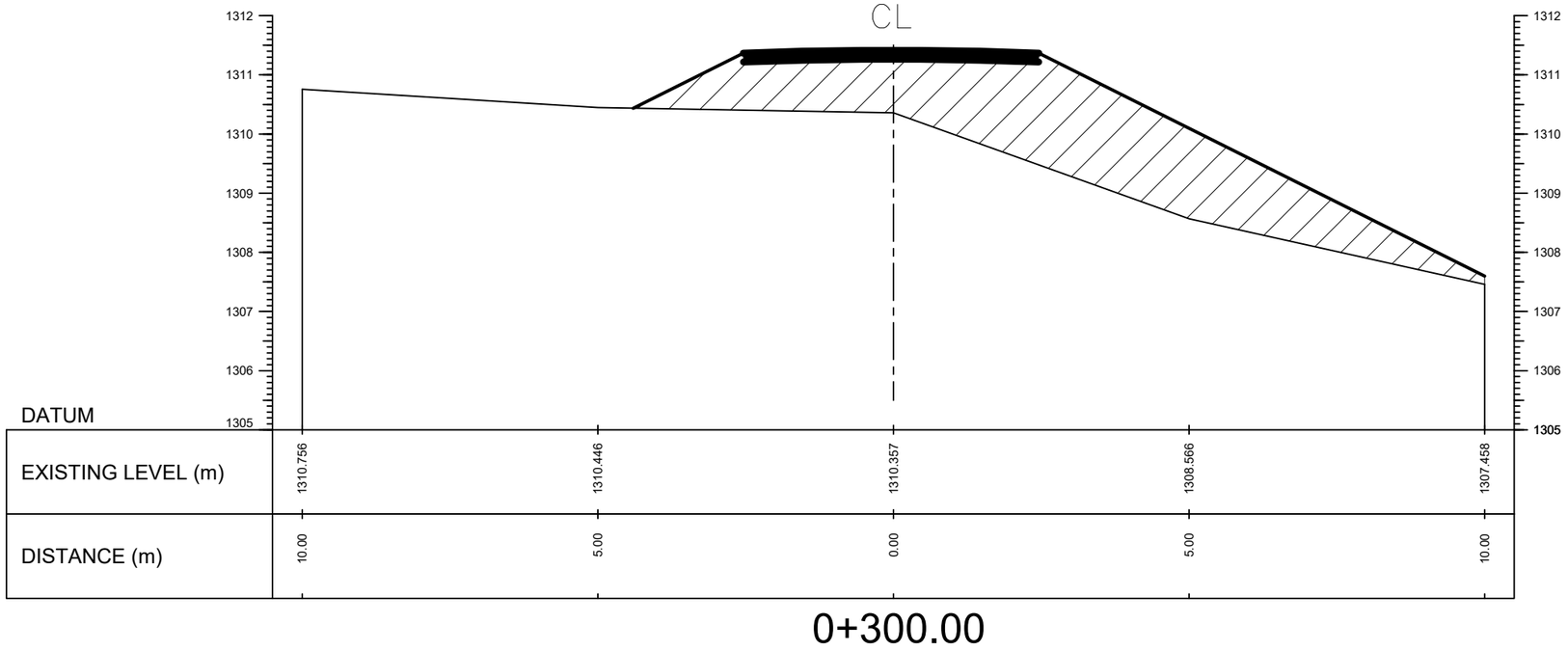
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 14



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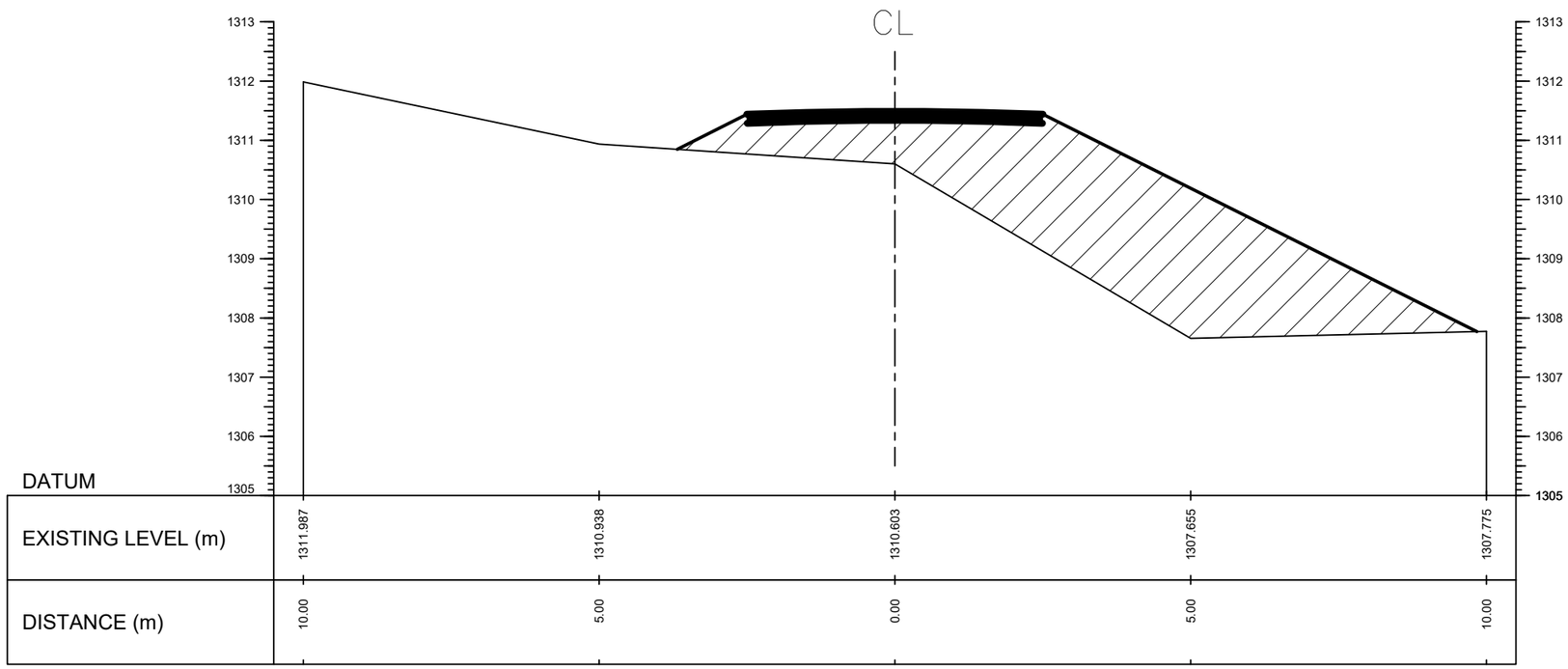

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TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

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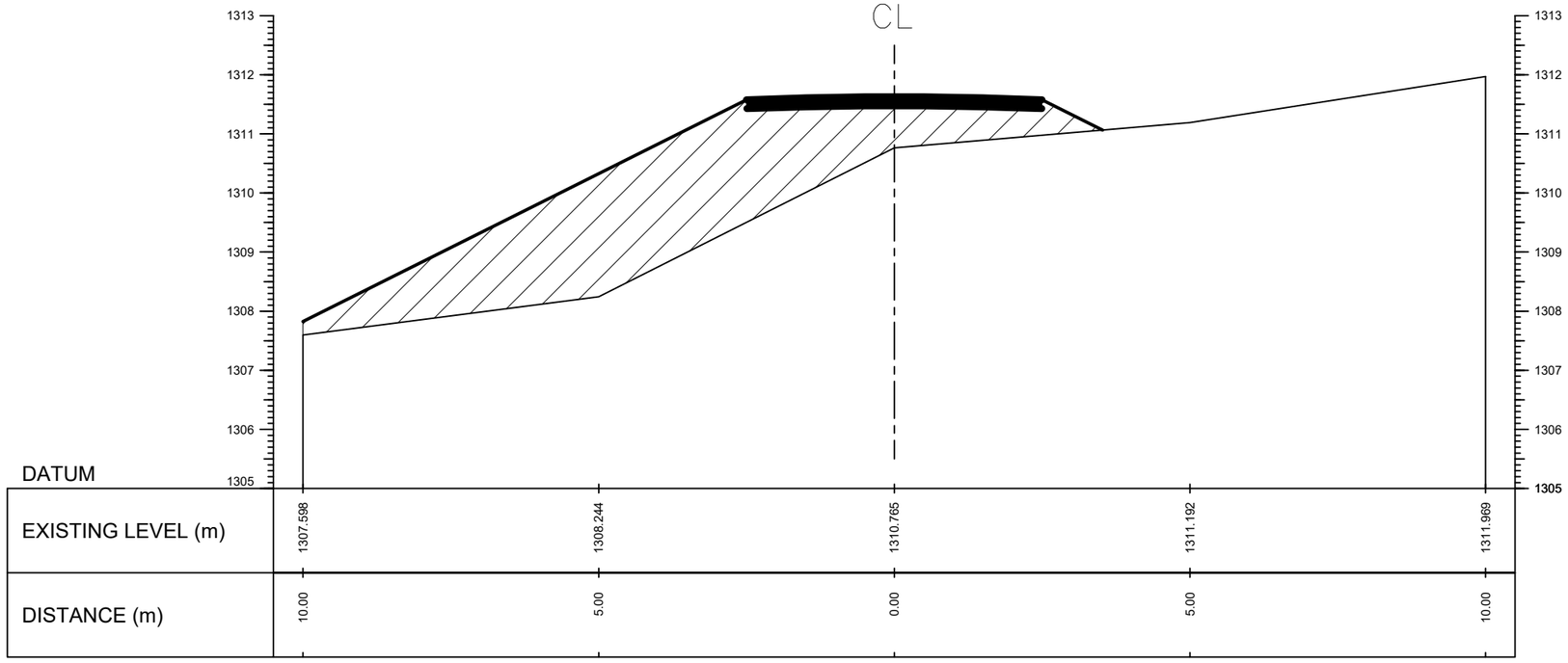

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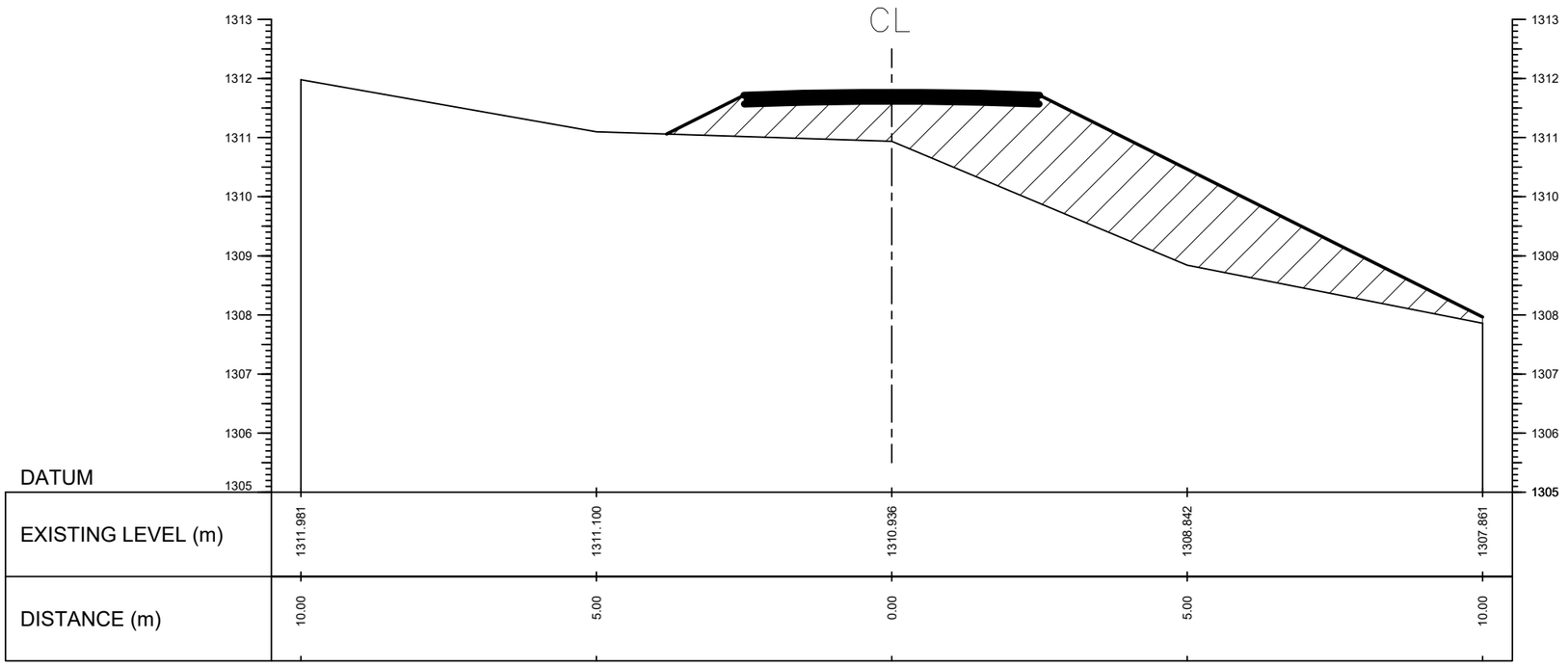

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VERTICAL SCALE 1:100

GROUP 03

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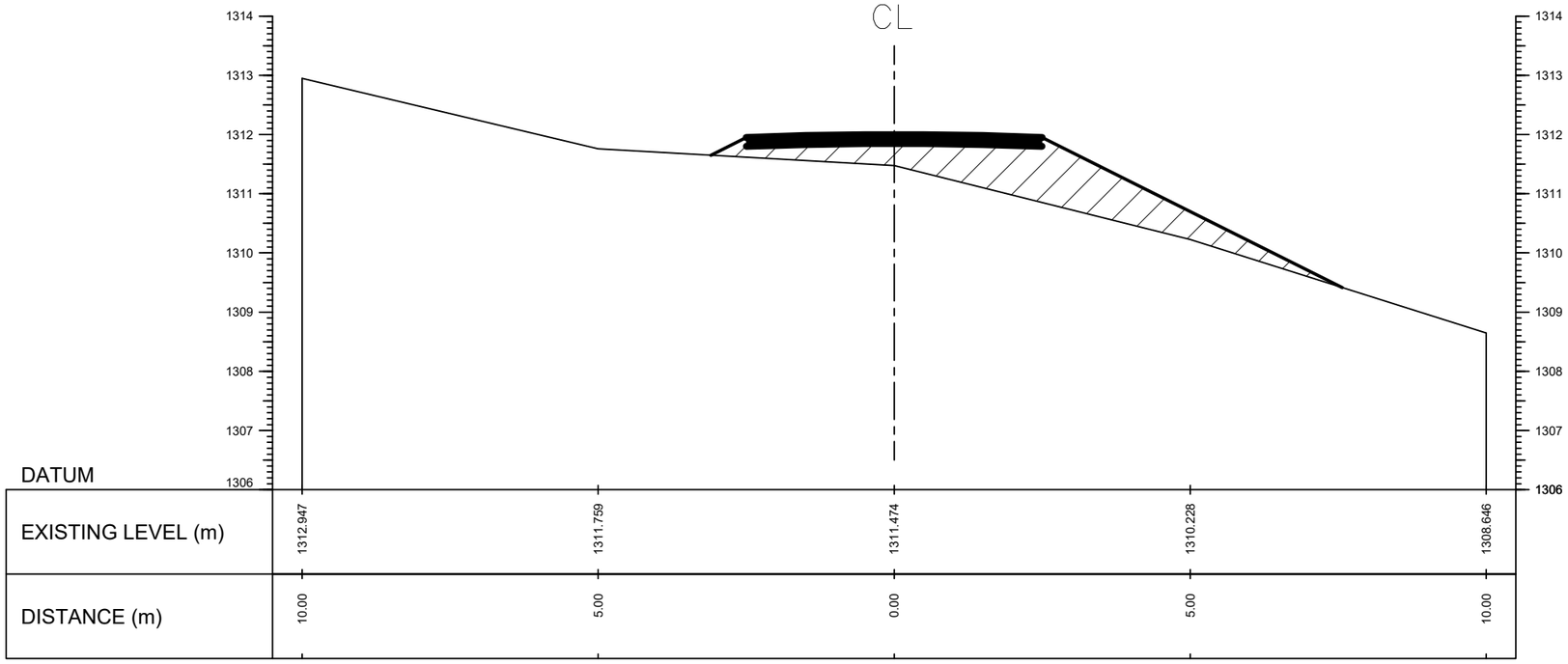
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 16



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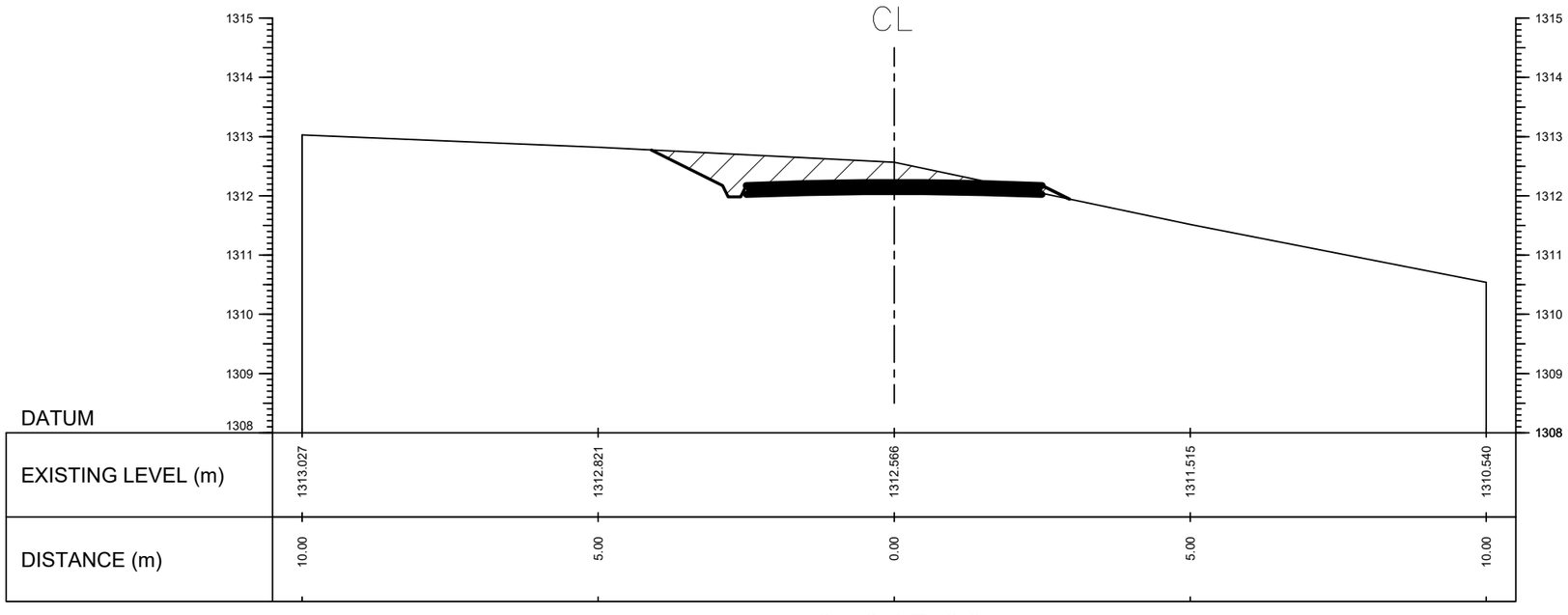

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HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

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CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

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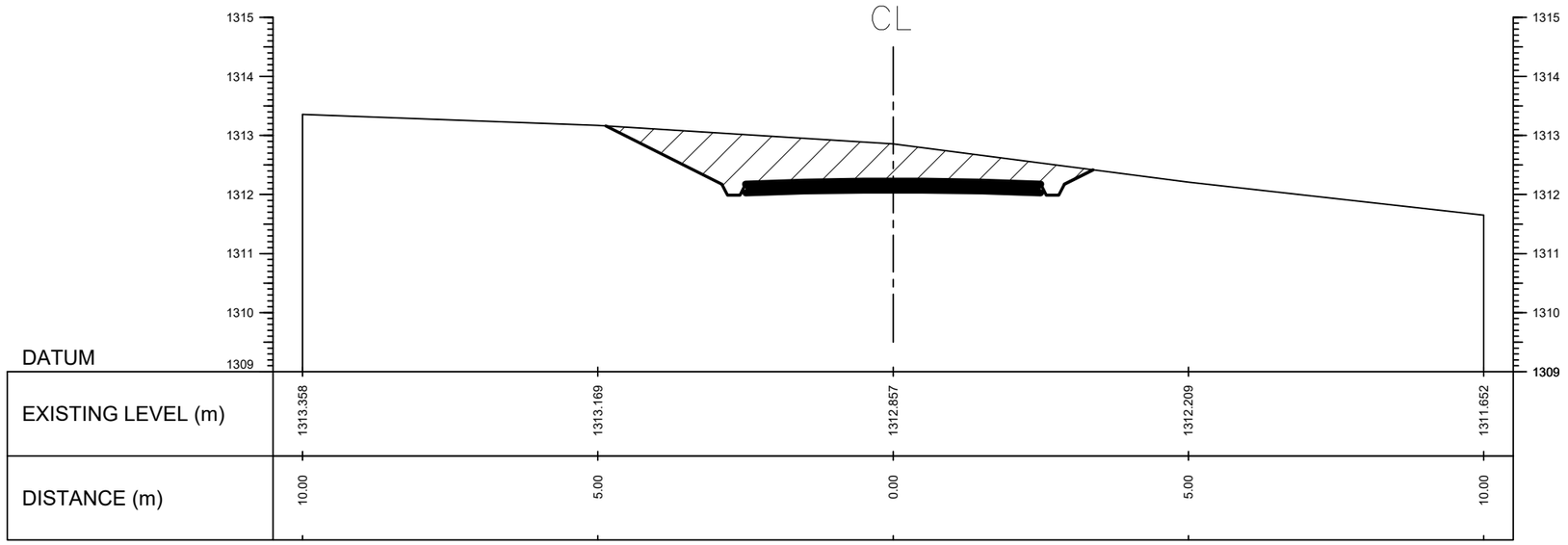

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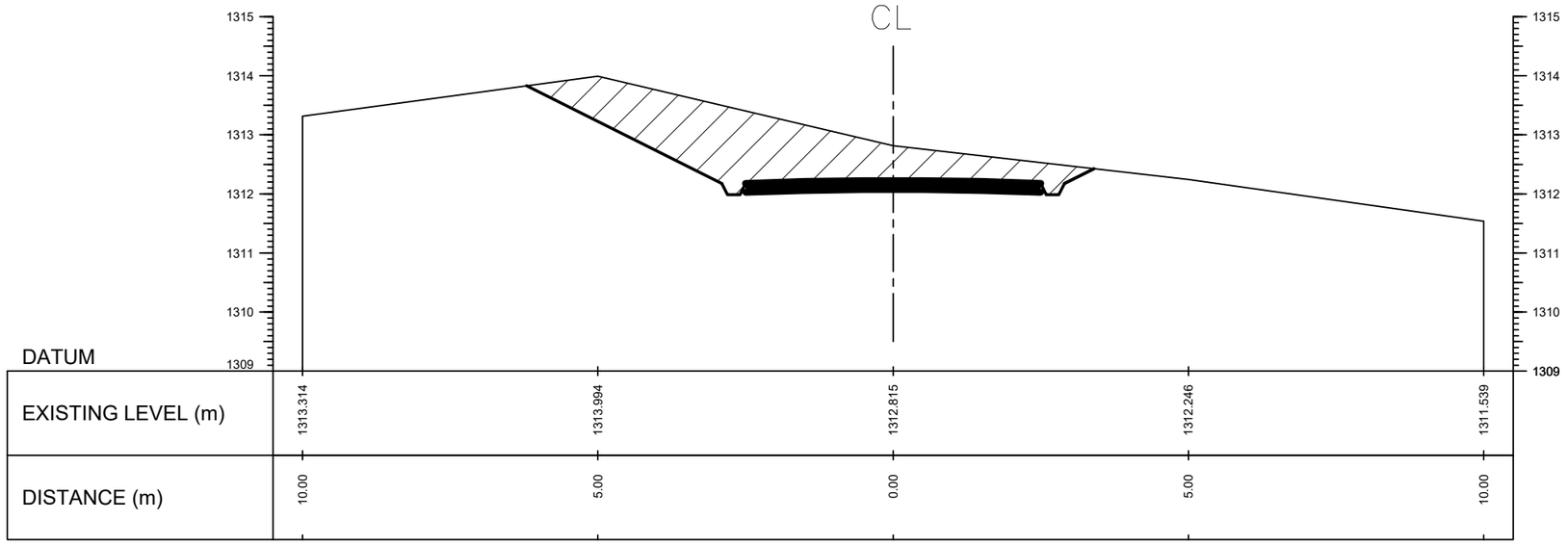

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HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

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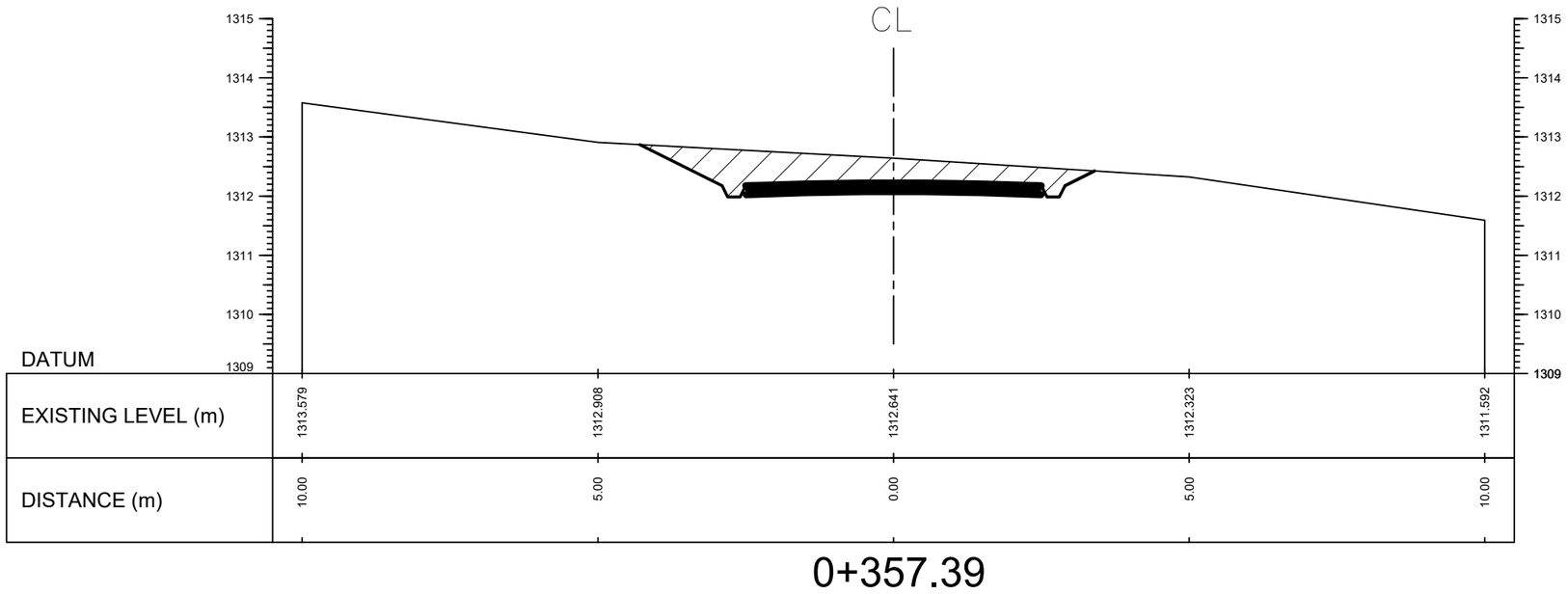
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 18



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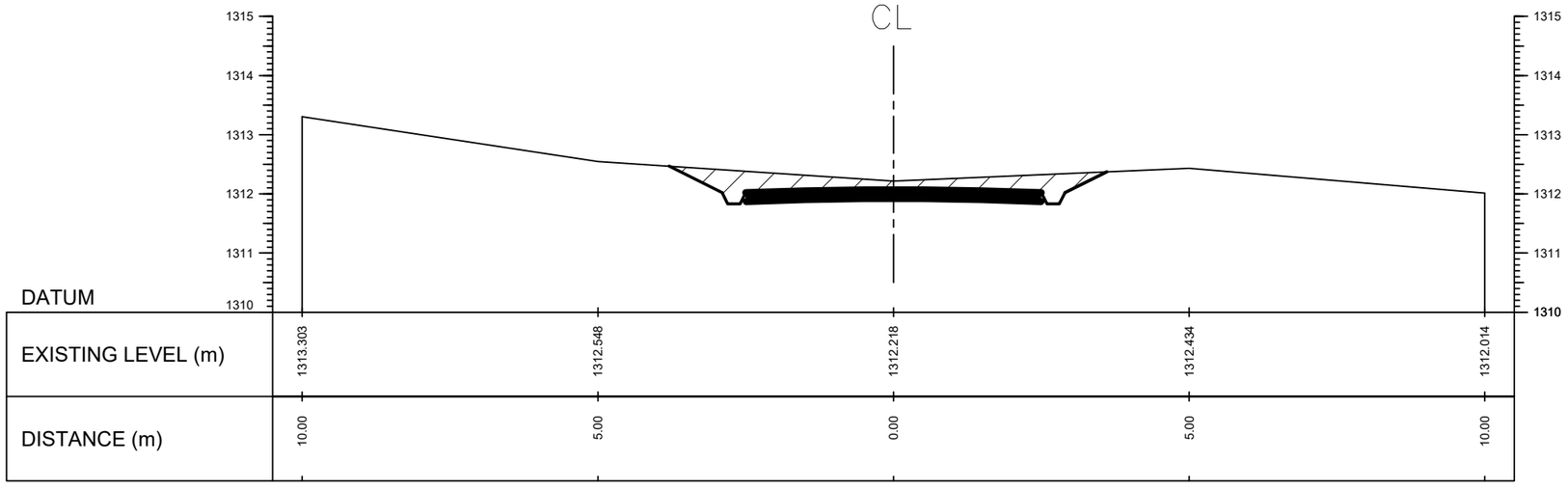

0+375.00

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PULCHOWK CAMPUS
DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

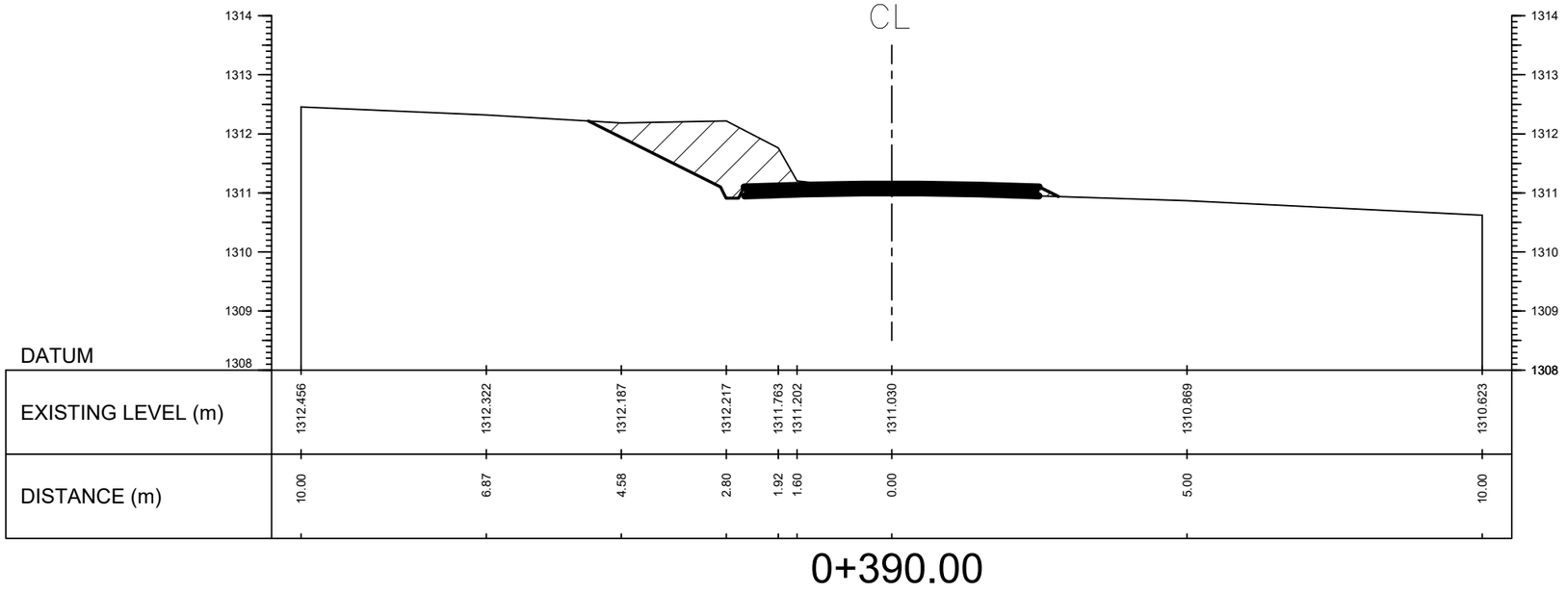
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 19



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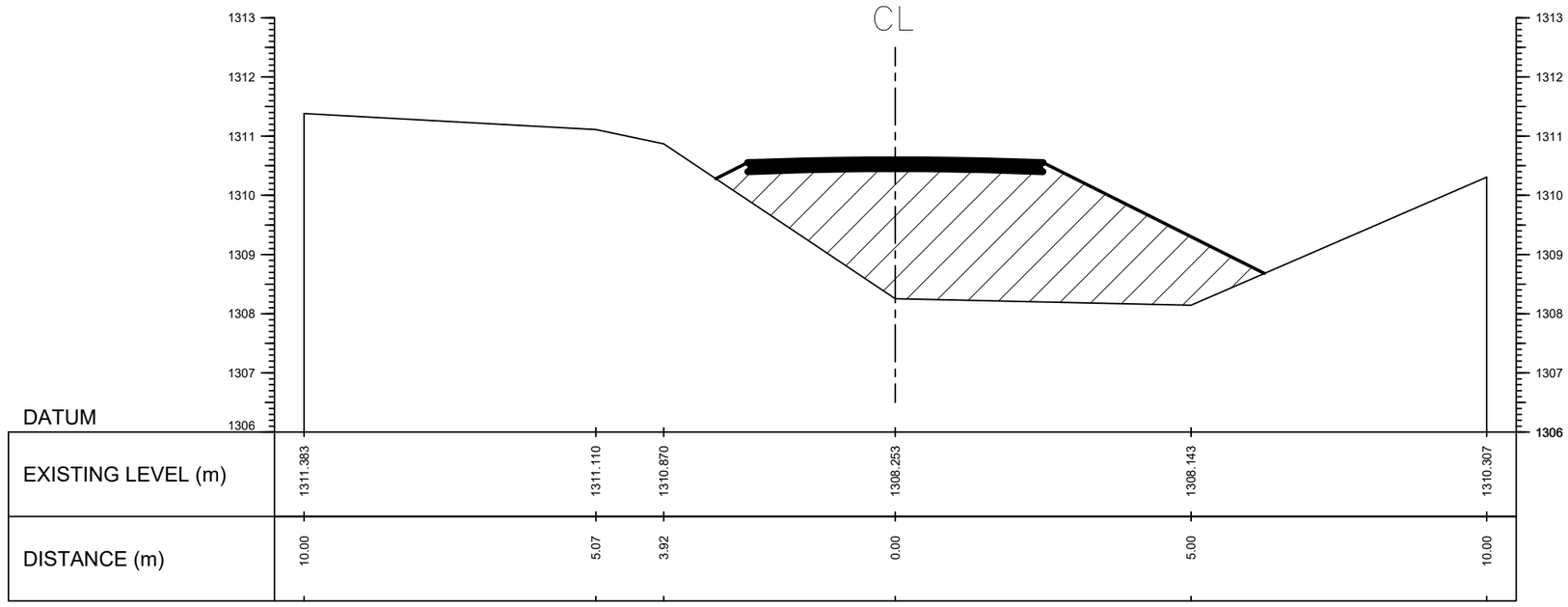

0+395.03

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DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

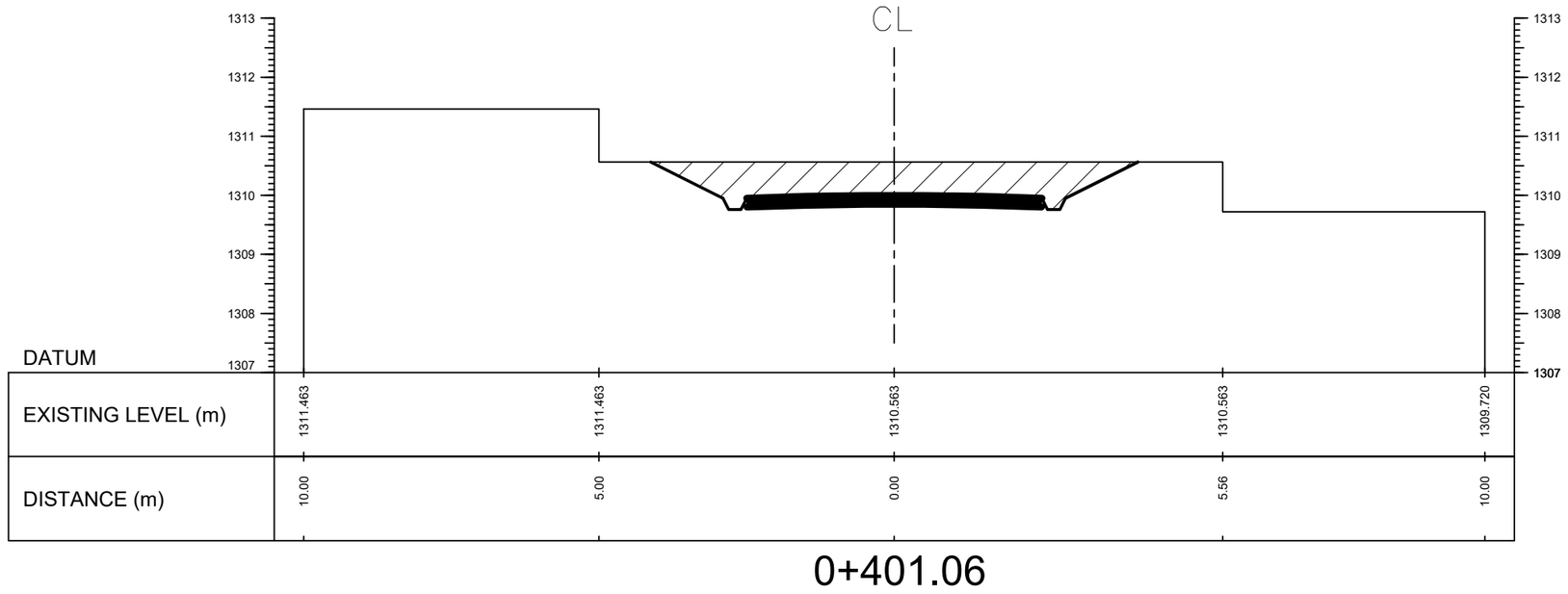
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 20



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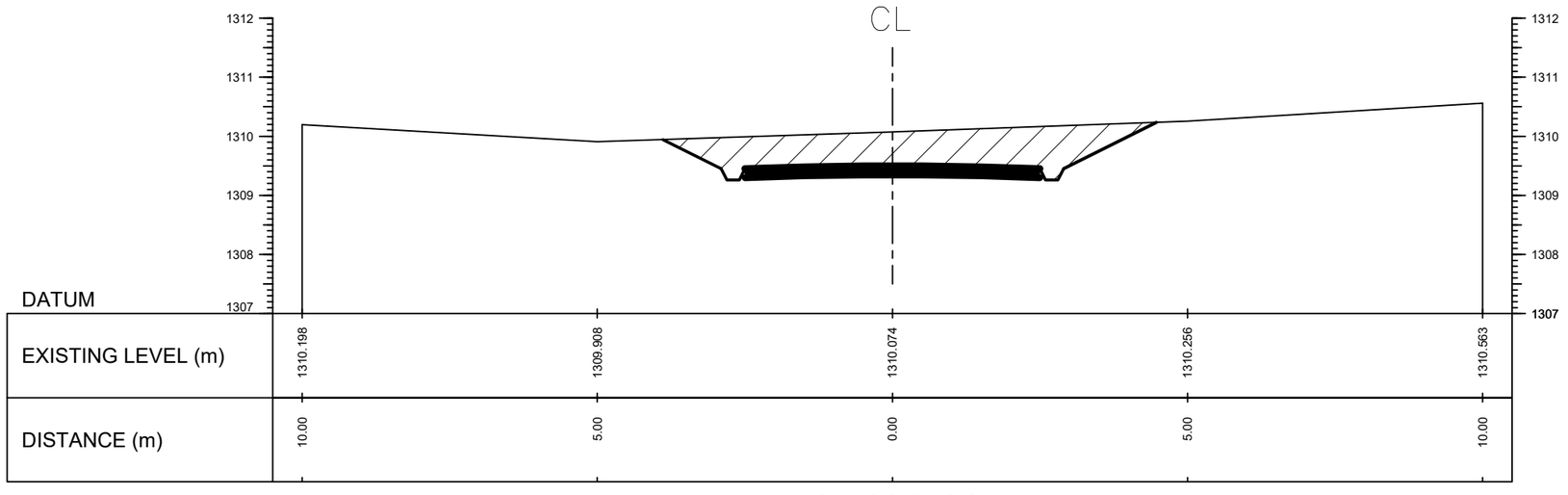

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DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

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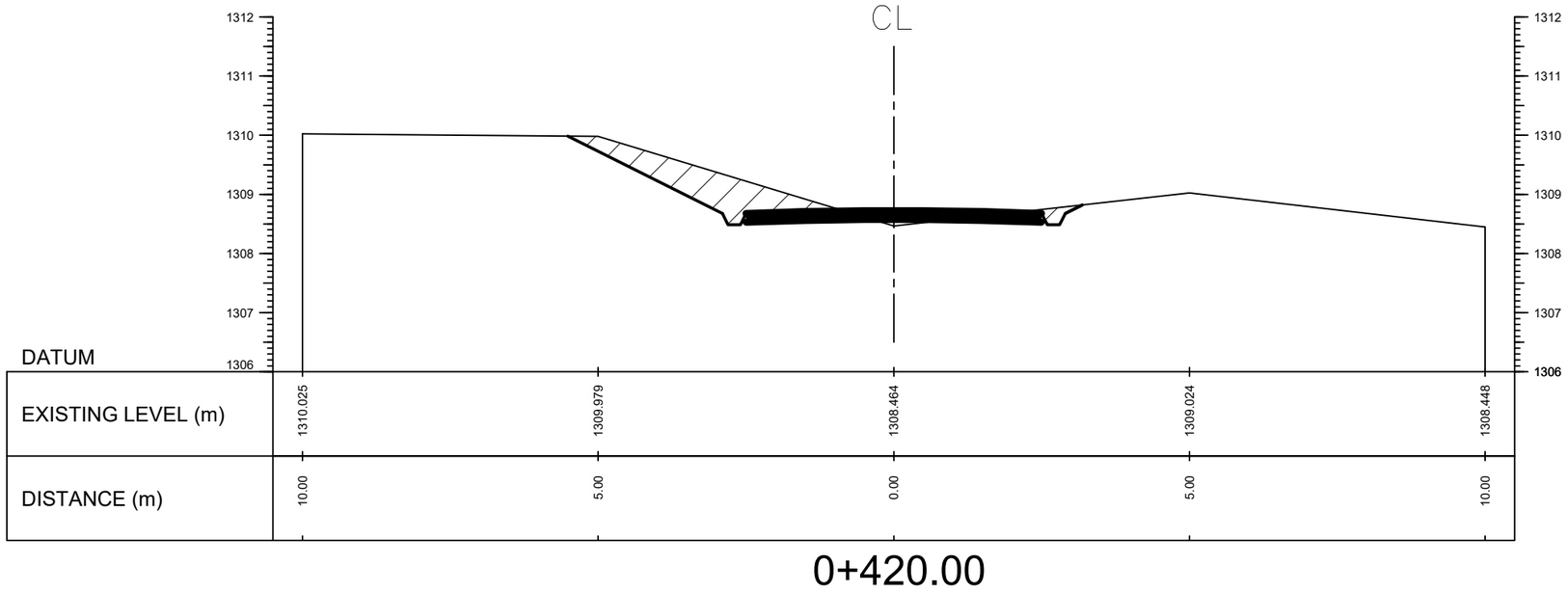
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 21



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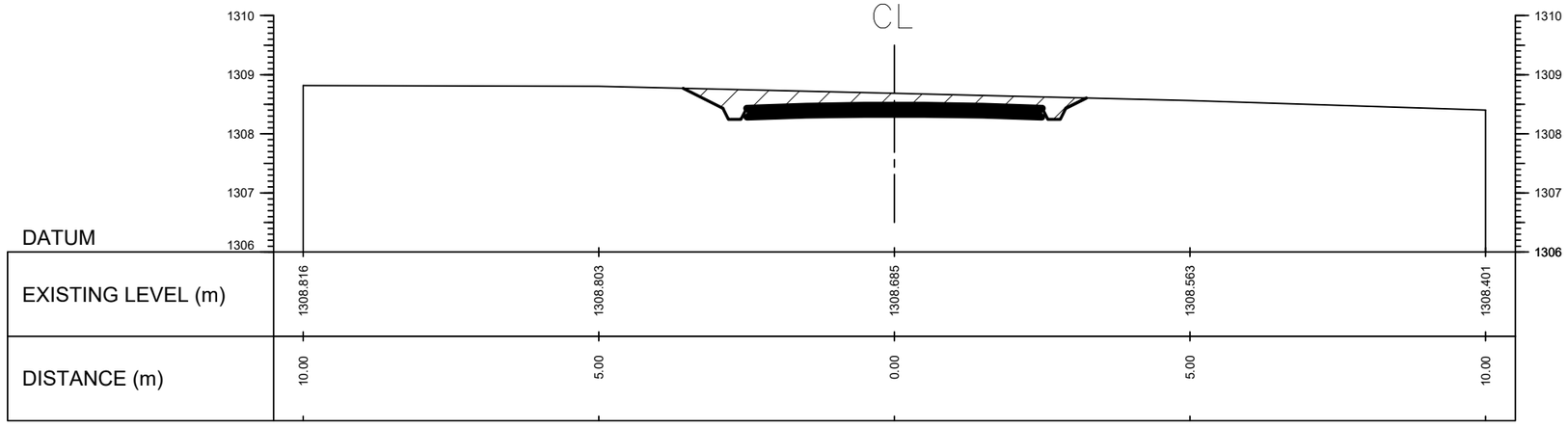

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SURVEY INSTRUCTION COMITTEE

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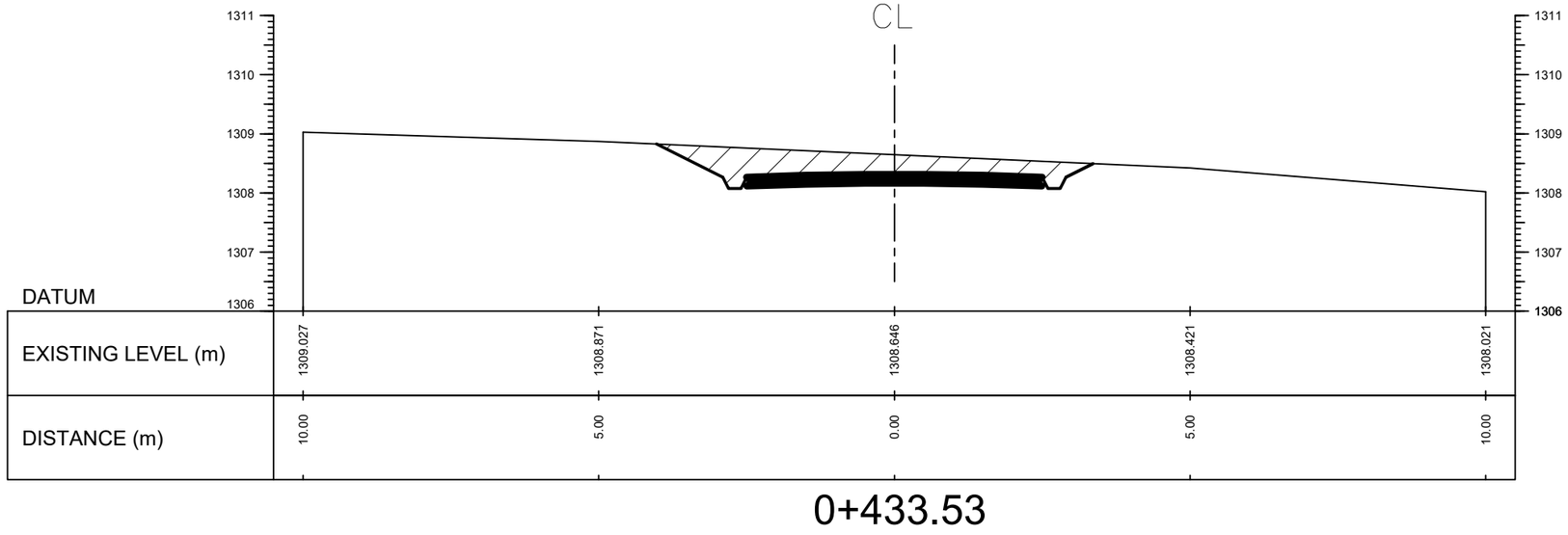
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 22



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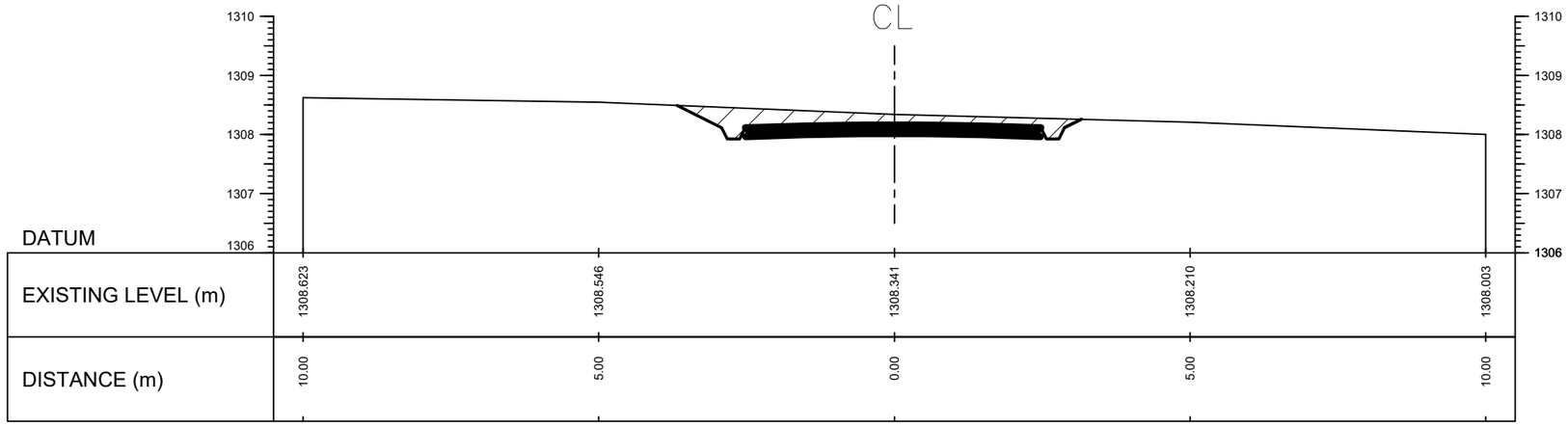

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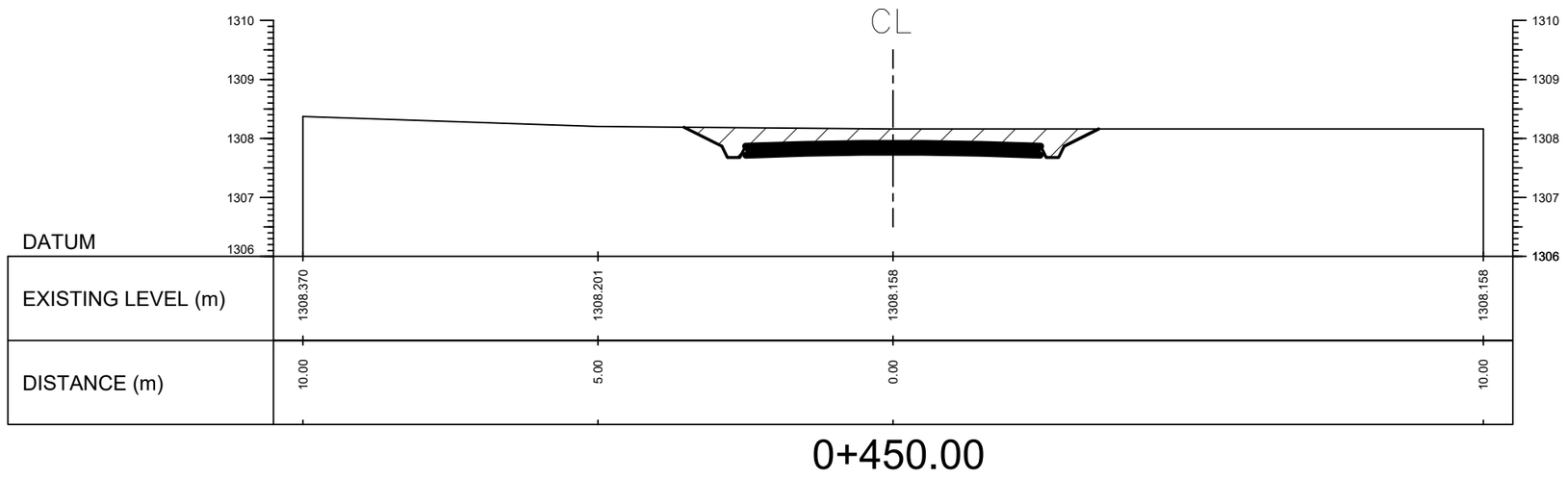
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 23



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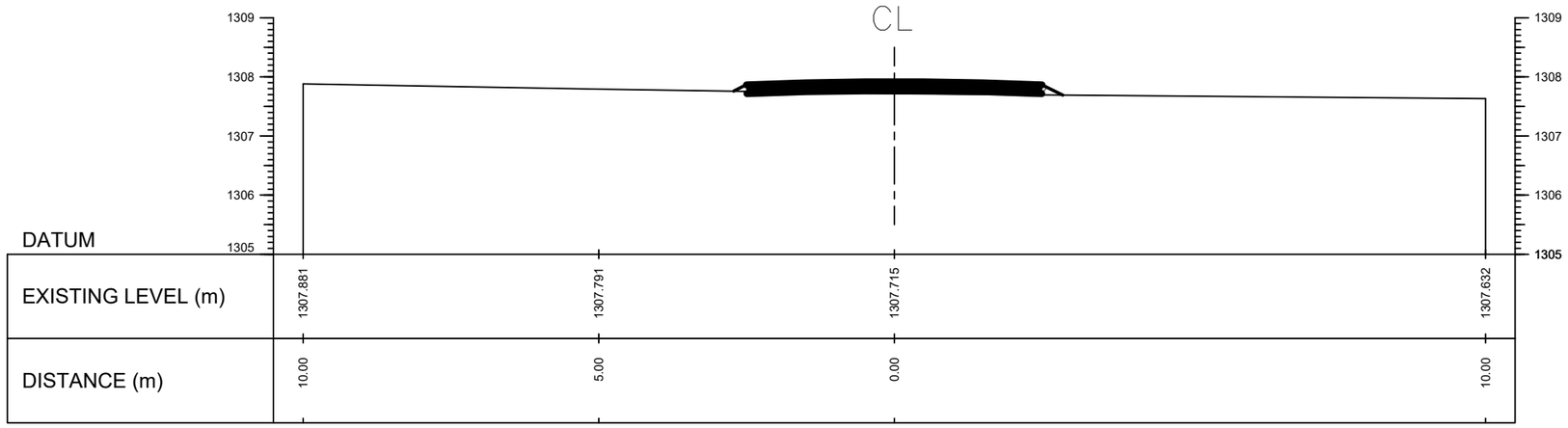

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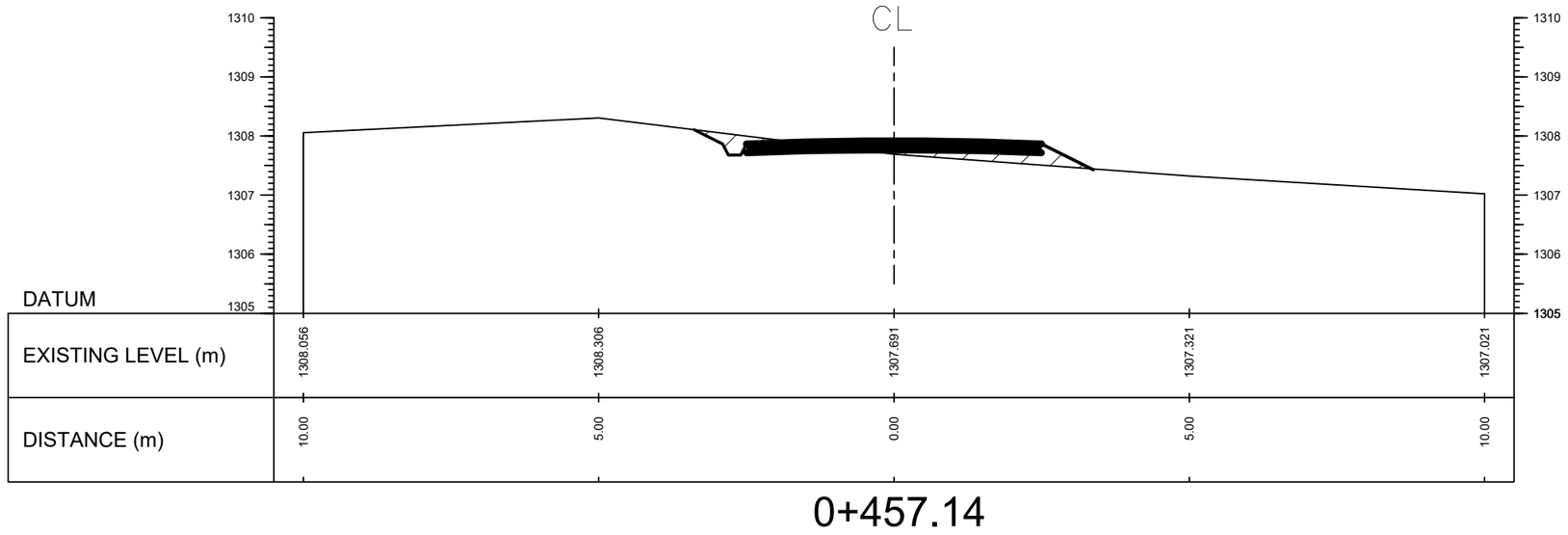
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 24



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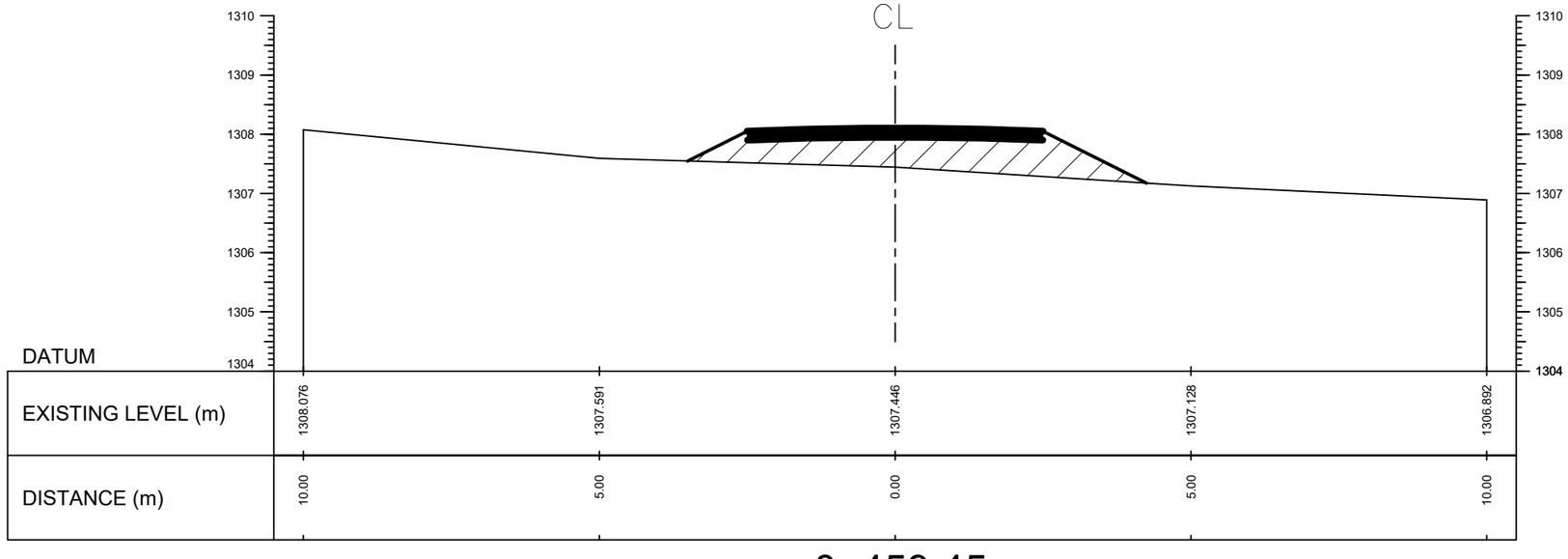

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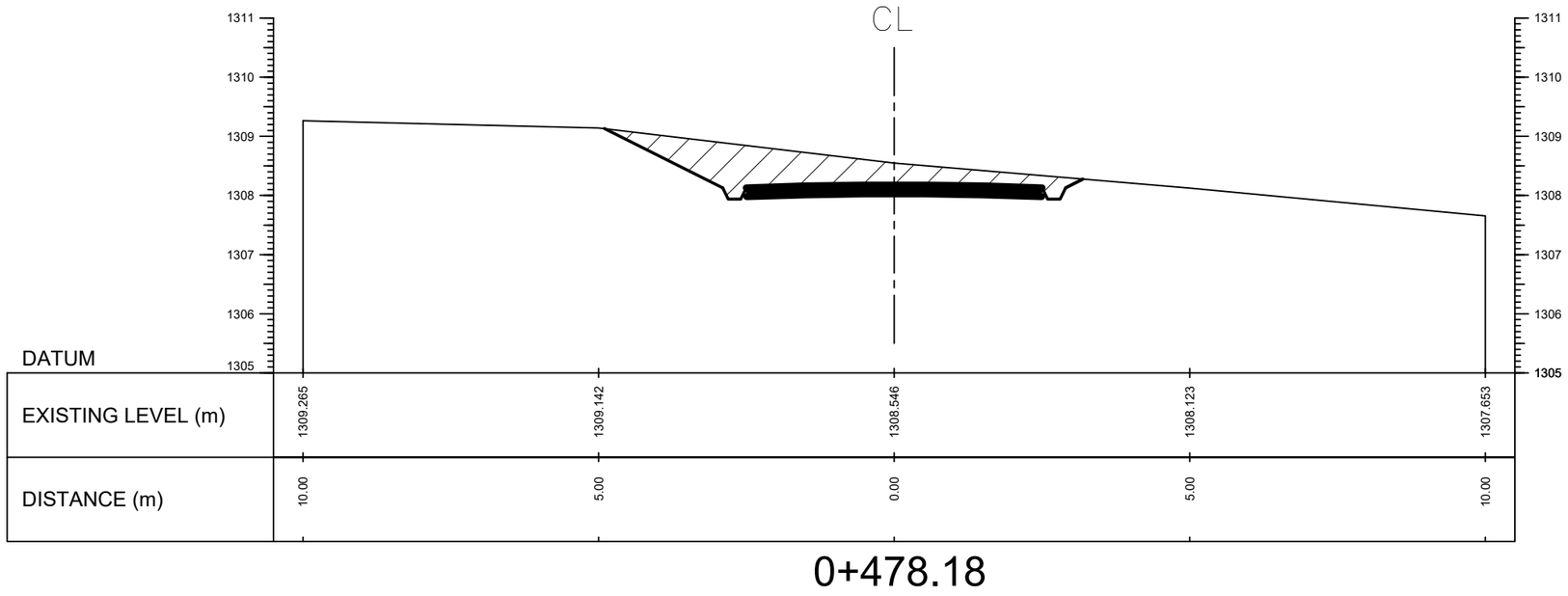
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 25



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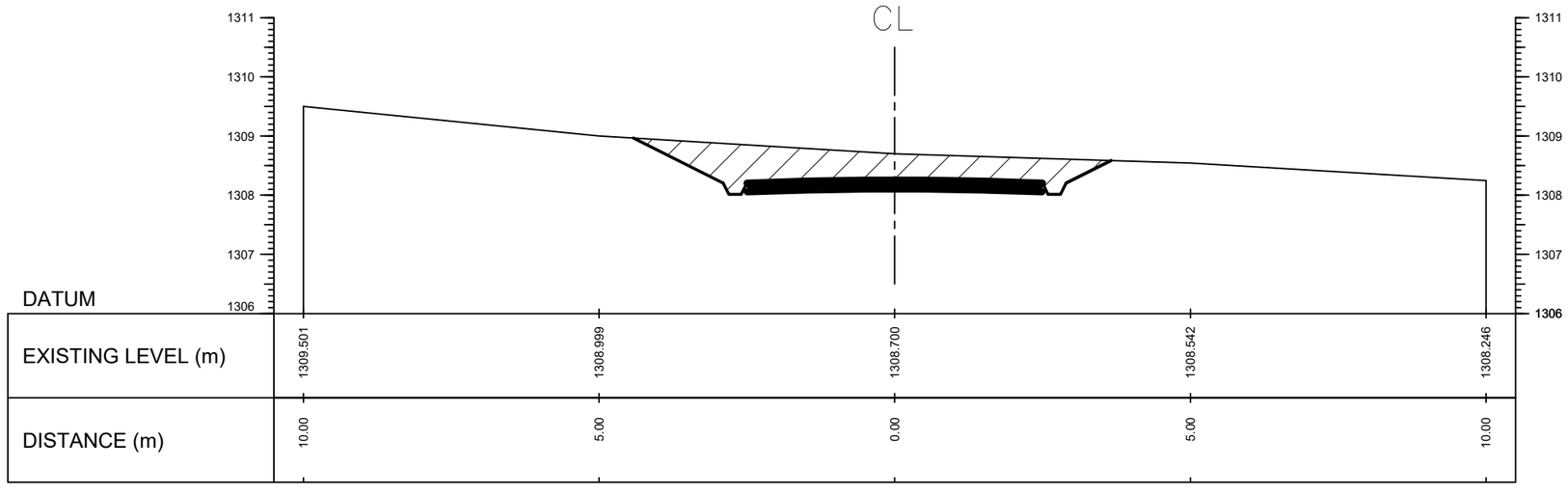

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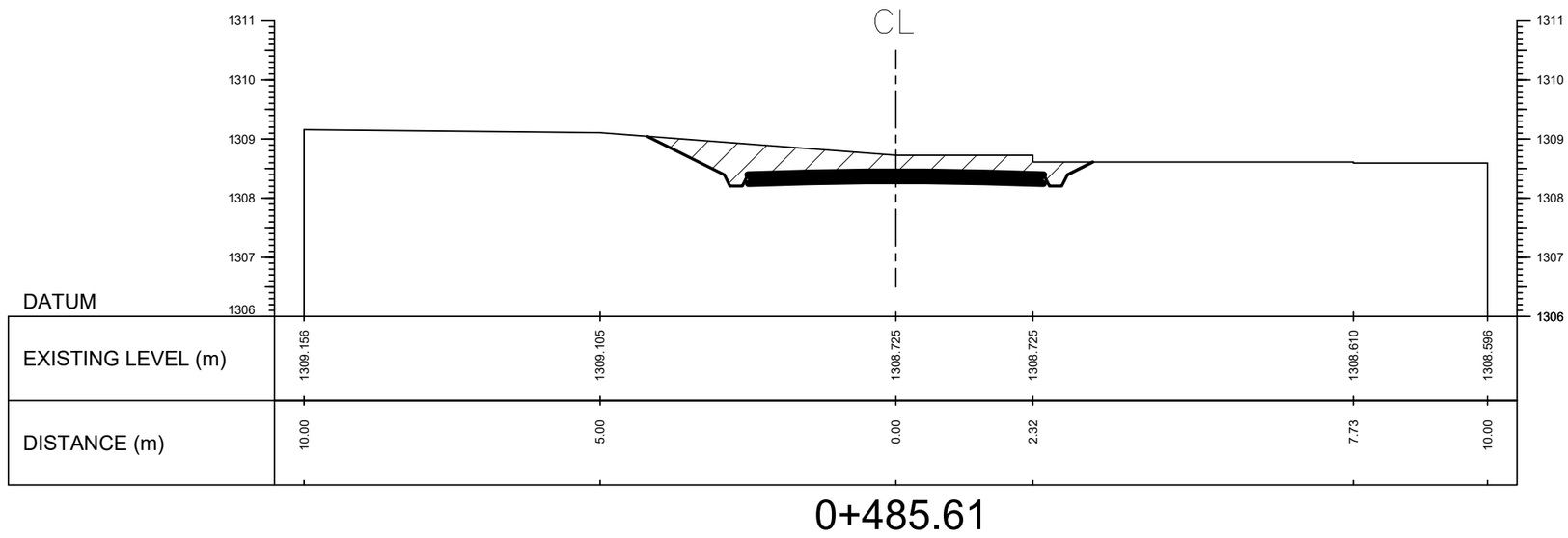
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 26



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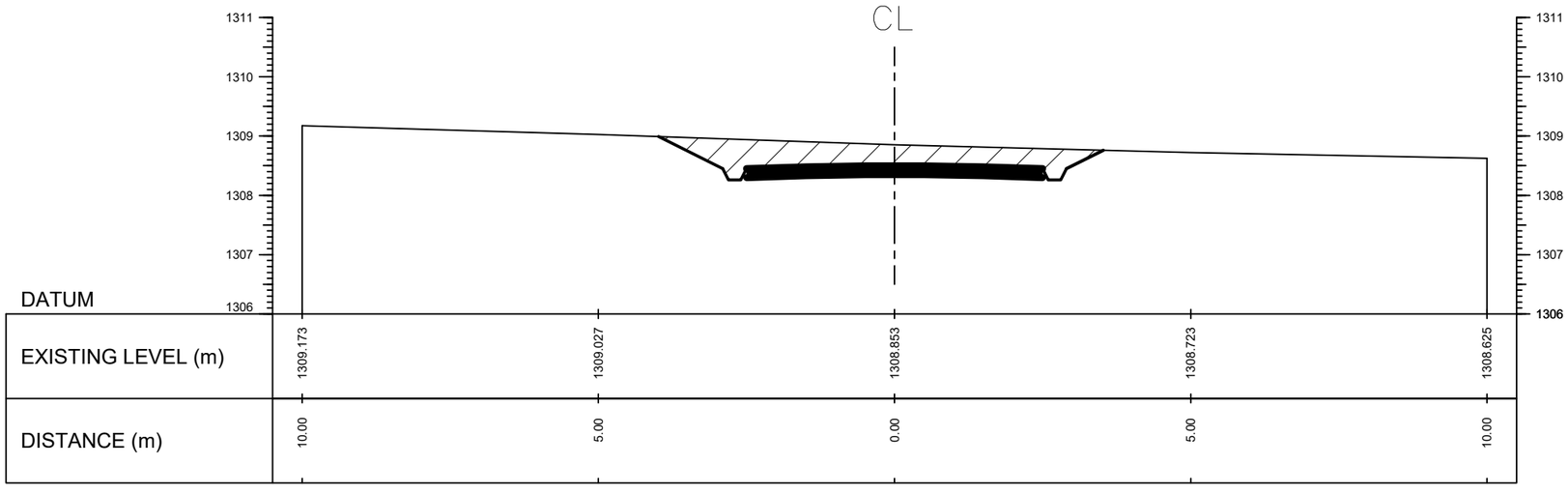

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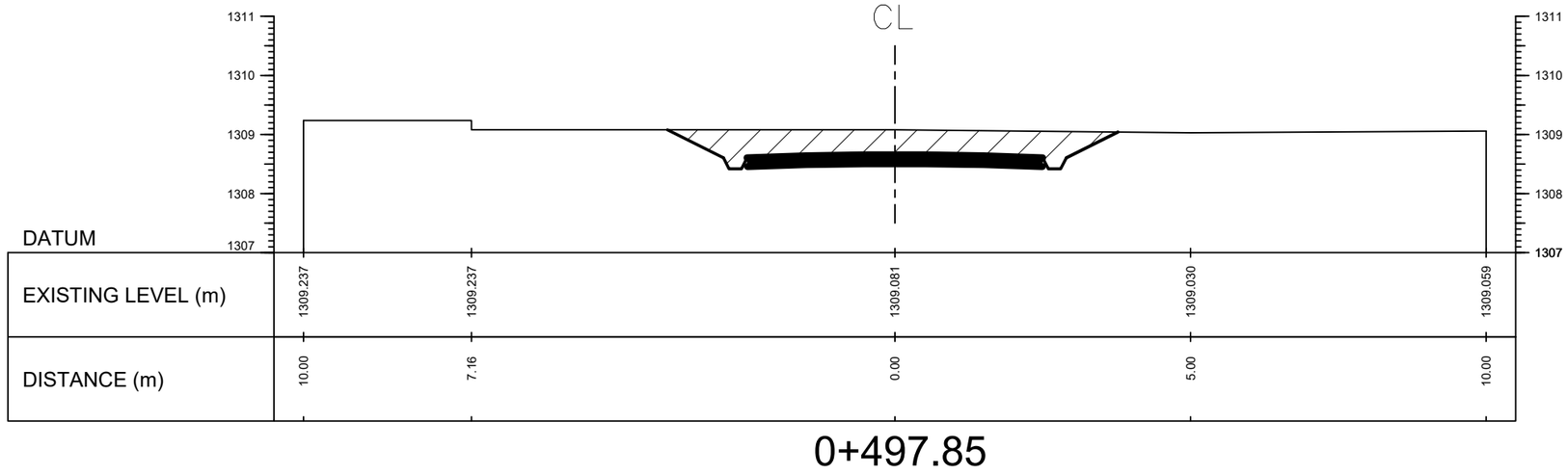
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 27



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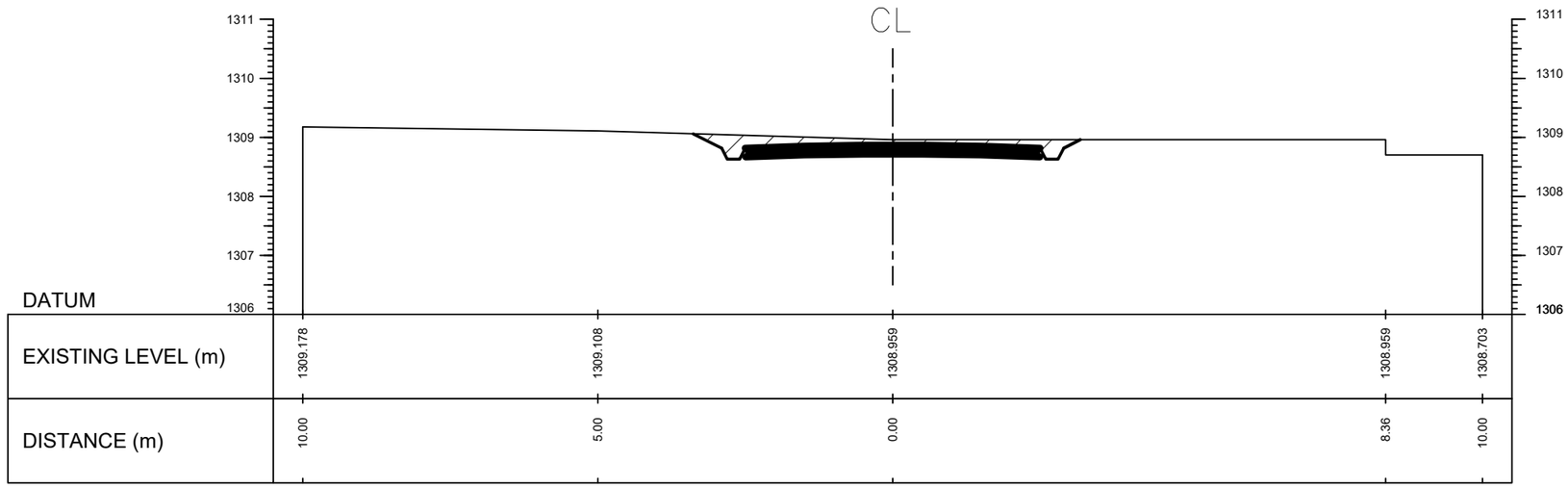

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DEPARTMENT OF CIVIL ENGINEERING
SURVEY INSTRUCTION COMITTEE

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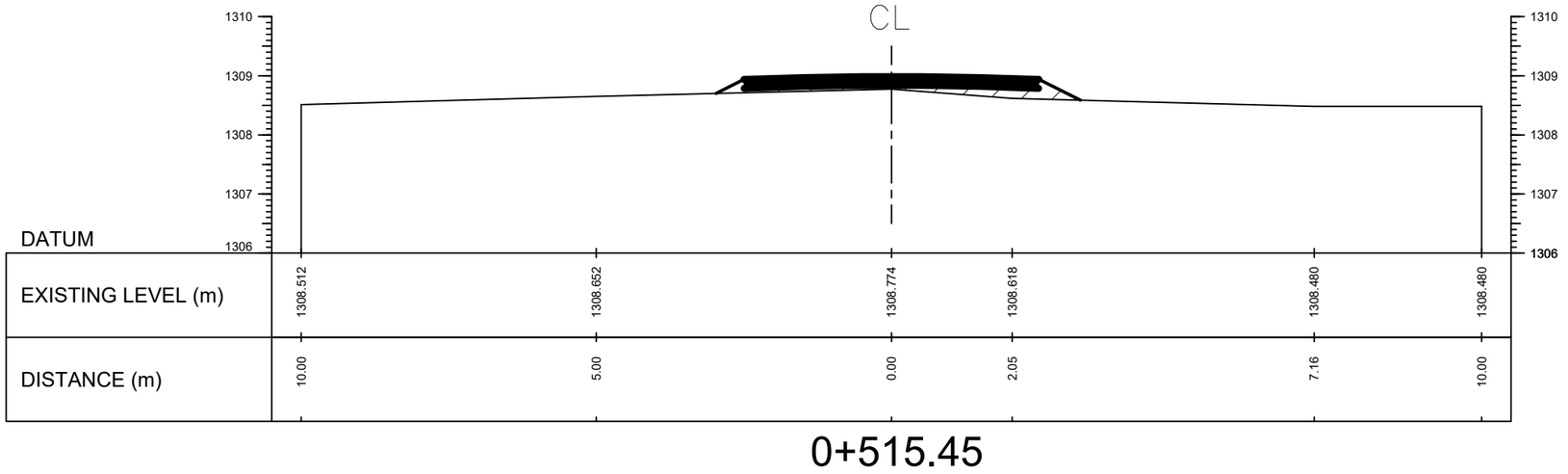
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 25



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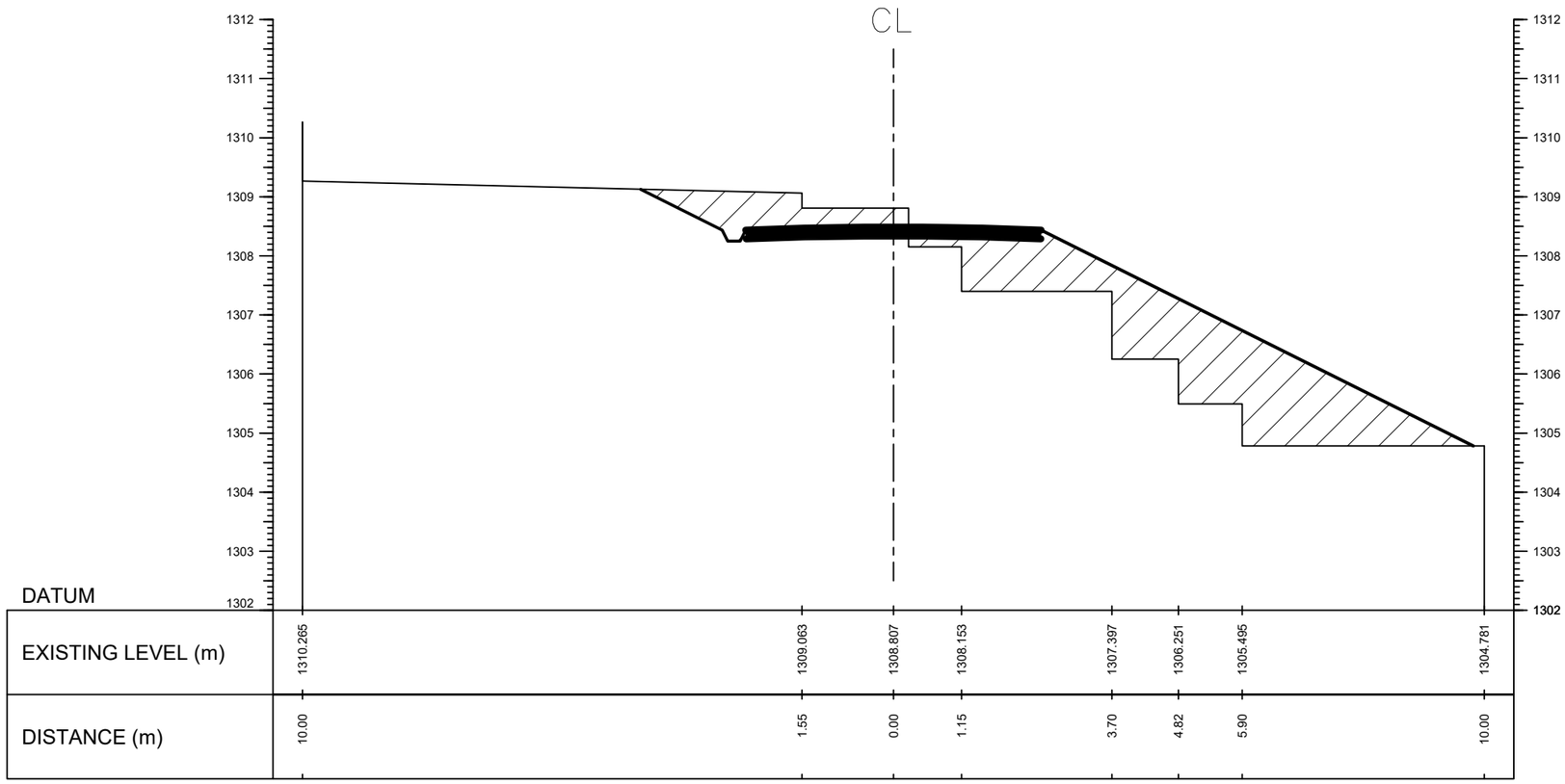

0+521.17

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SURVEY INSTRUCTION COMITTEE

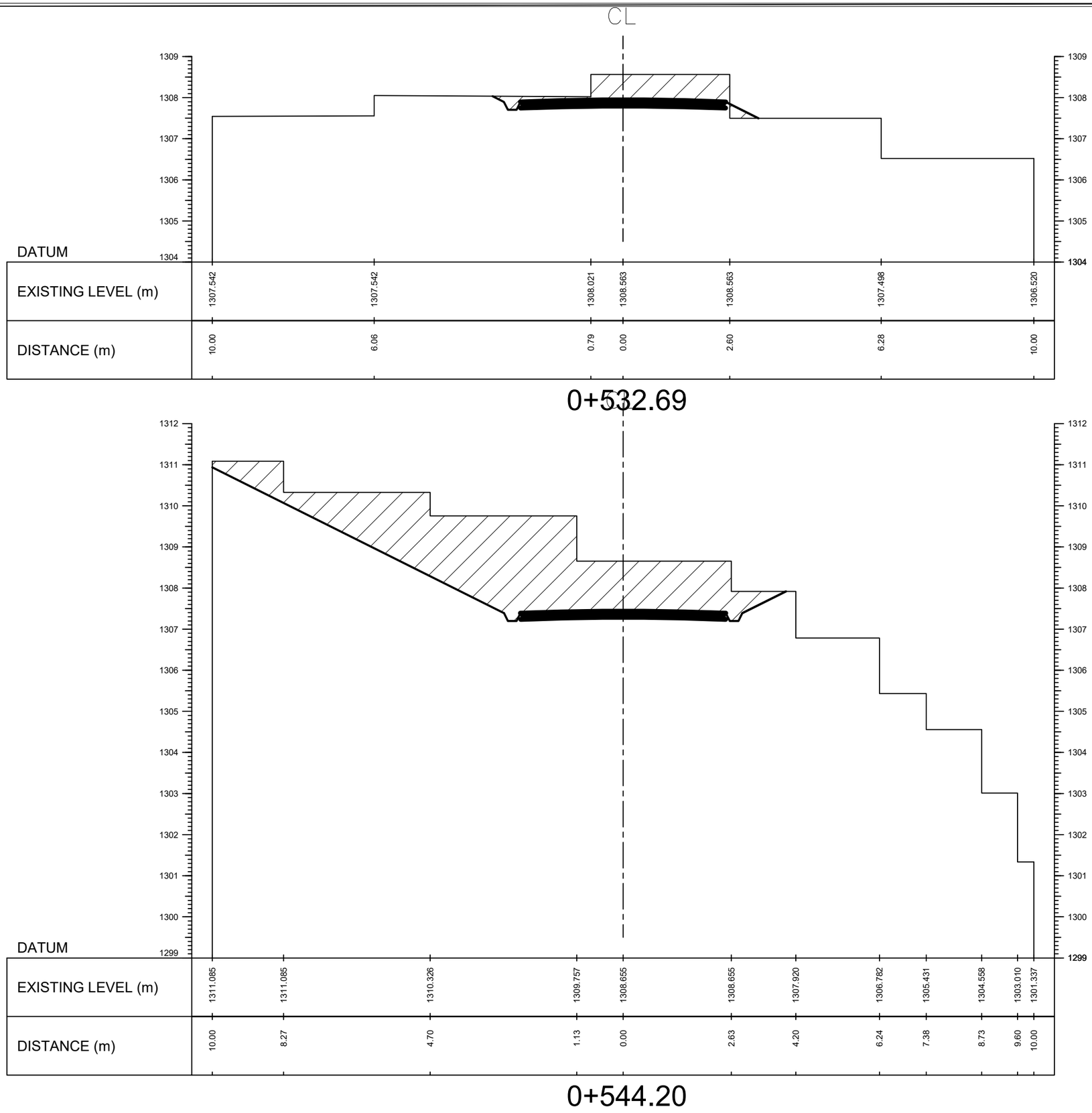
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 29



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SURVEY INSTRUCTION COMITTEE

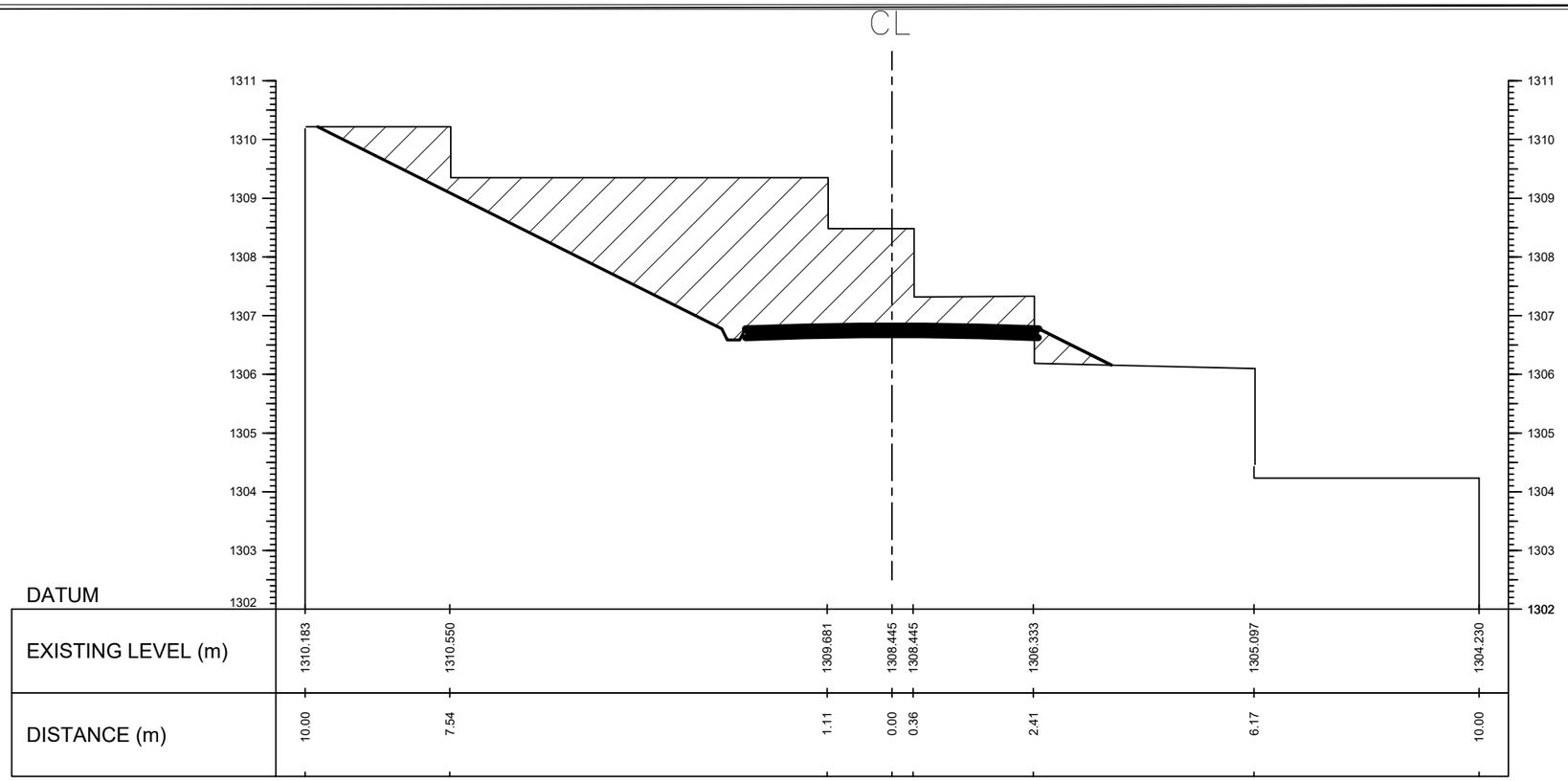
TITLE:ROAD ALIGNMENT CROSS SECTION

HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 30



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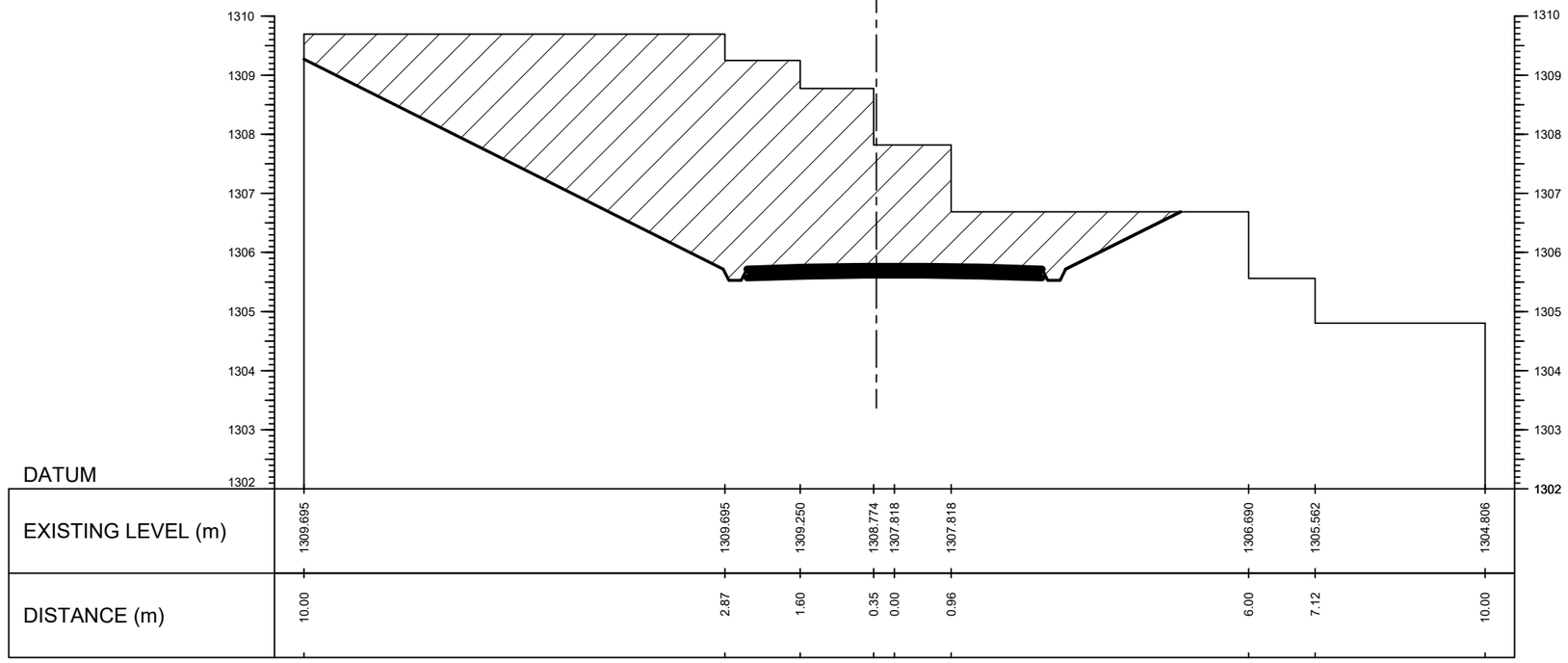

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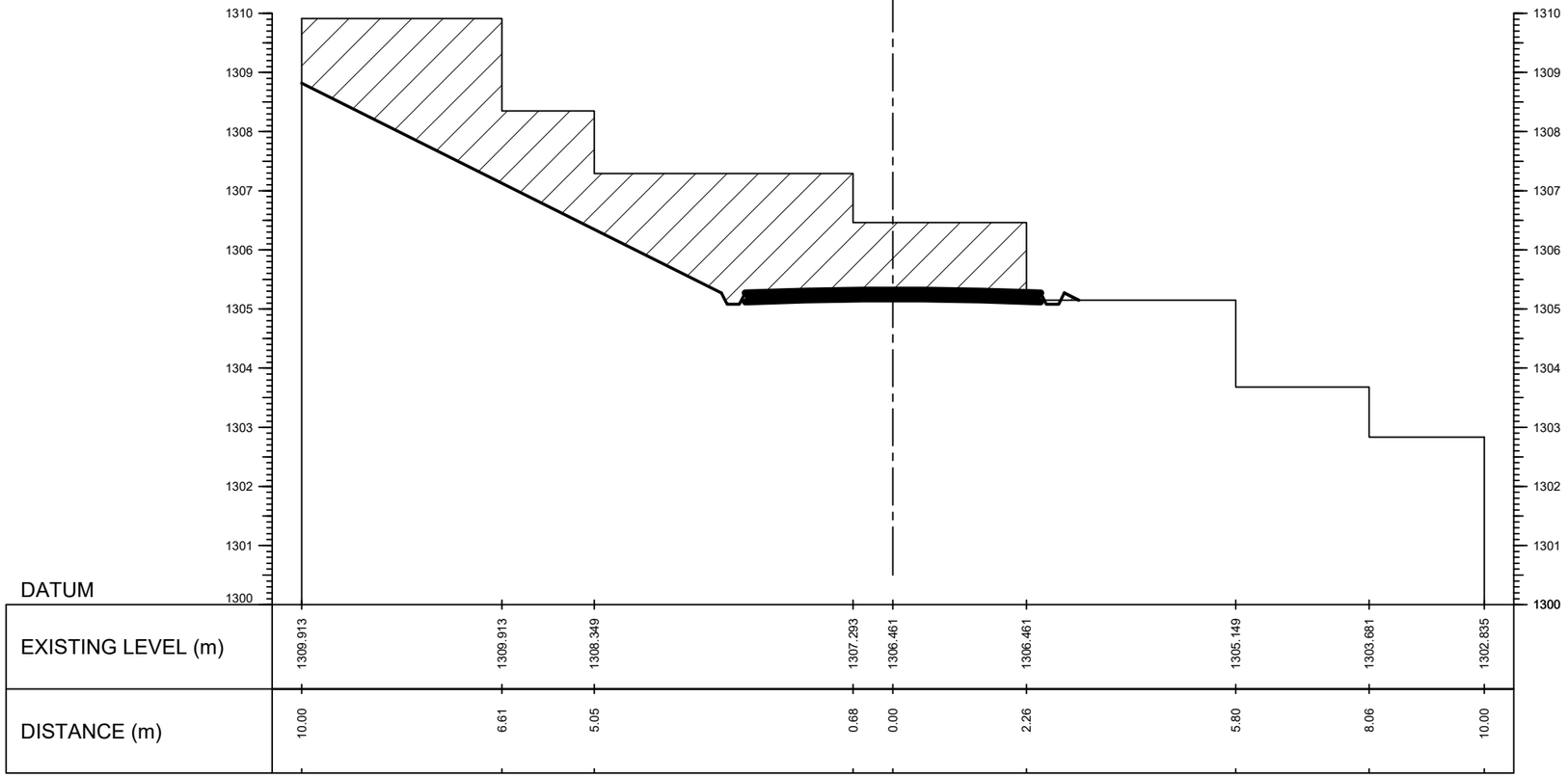
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 31



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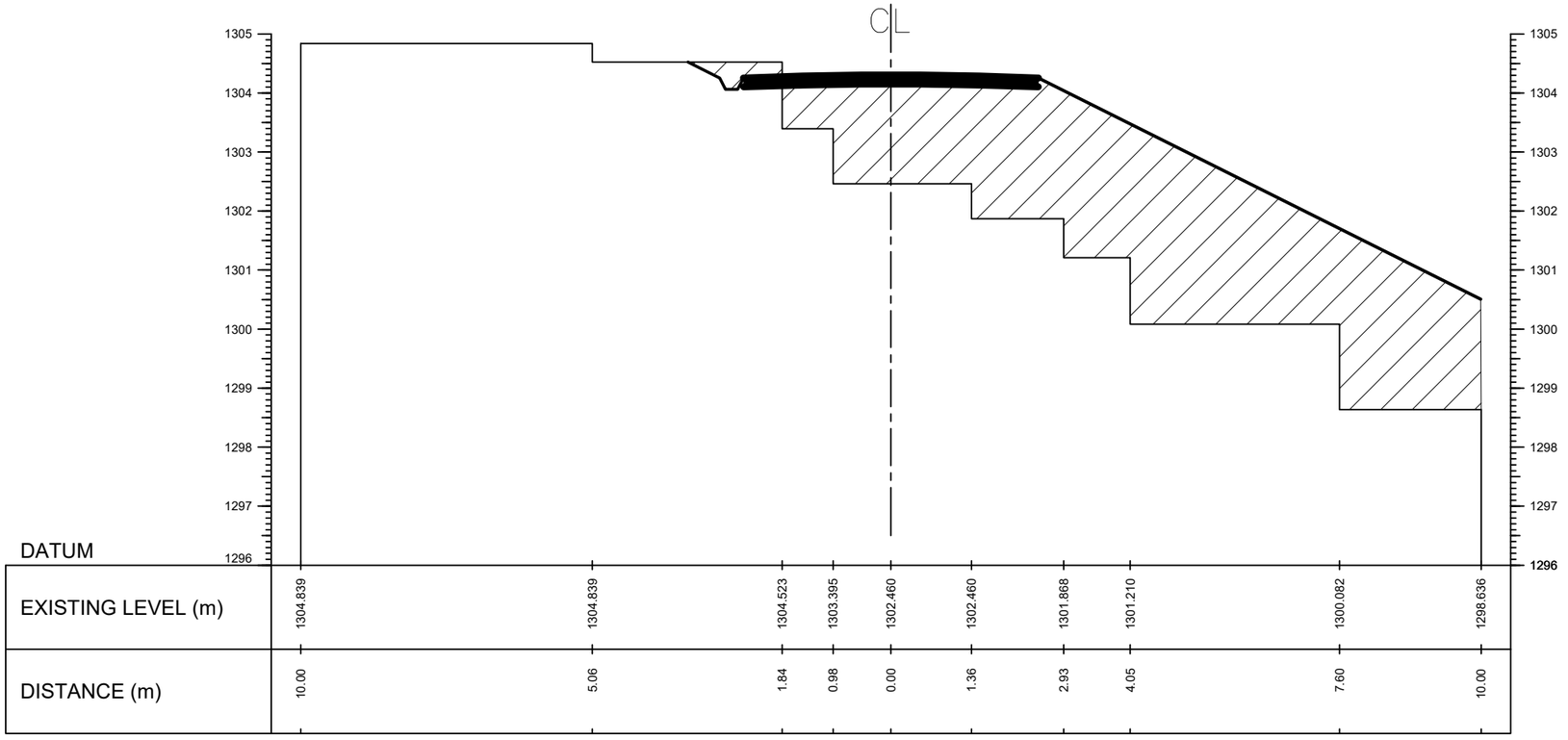

0+612.81

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SURVEY INSTRUCTION COMITTEE

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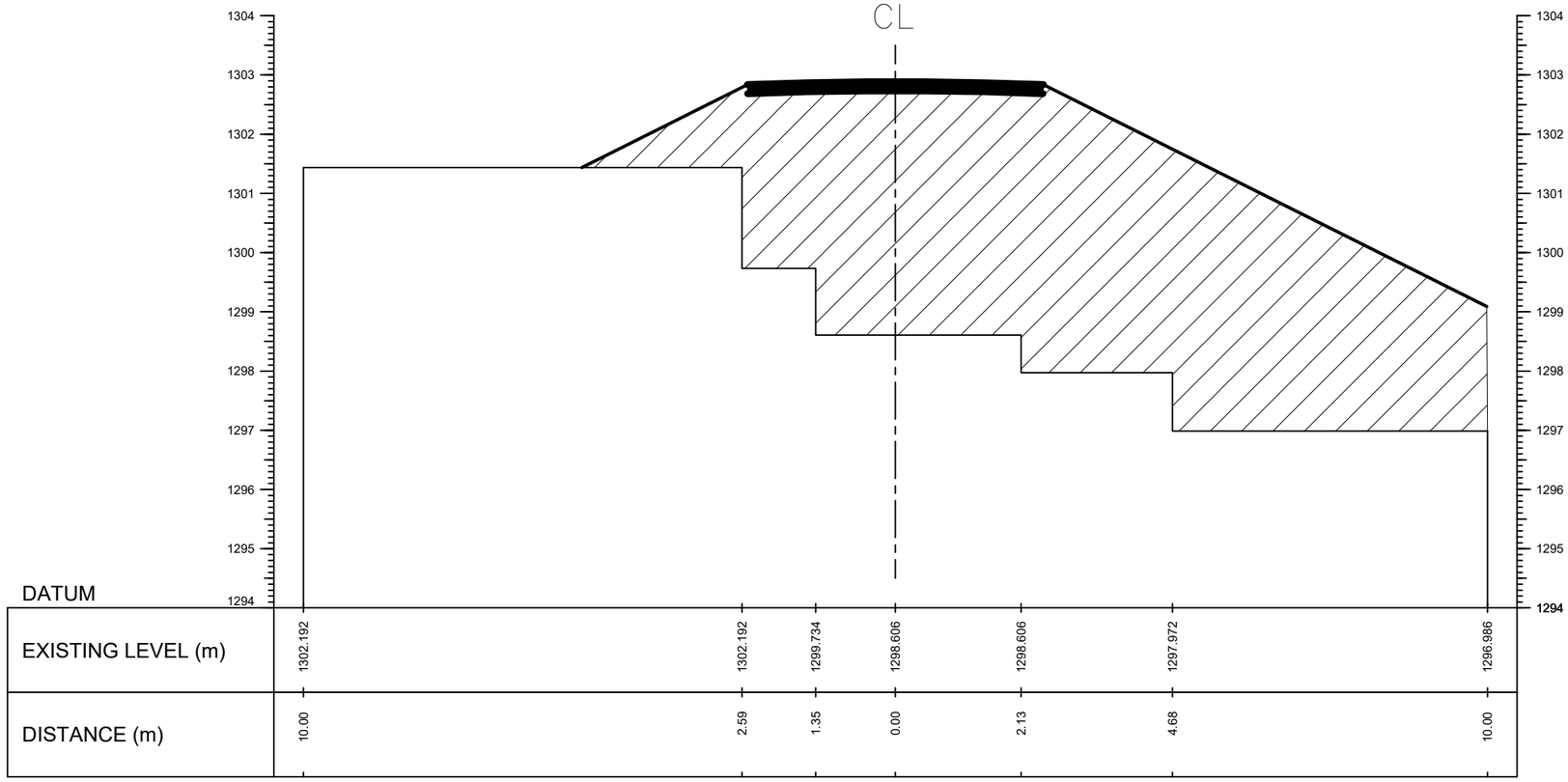
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 32



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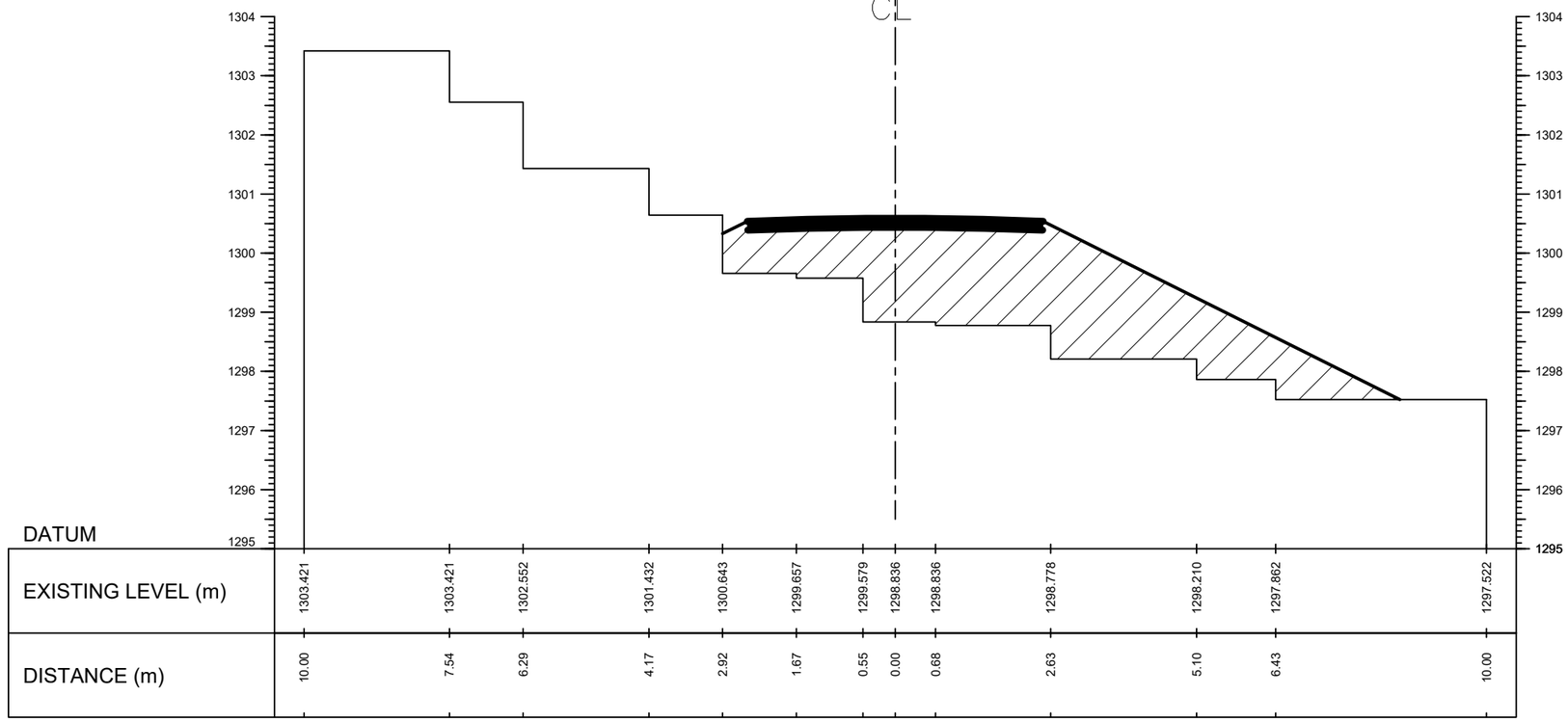

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SURVEY INSTRUCTION COMITTEE

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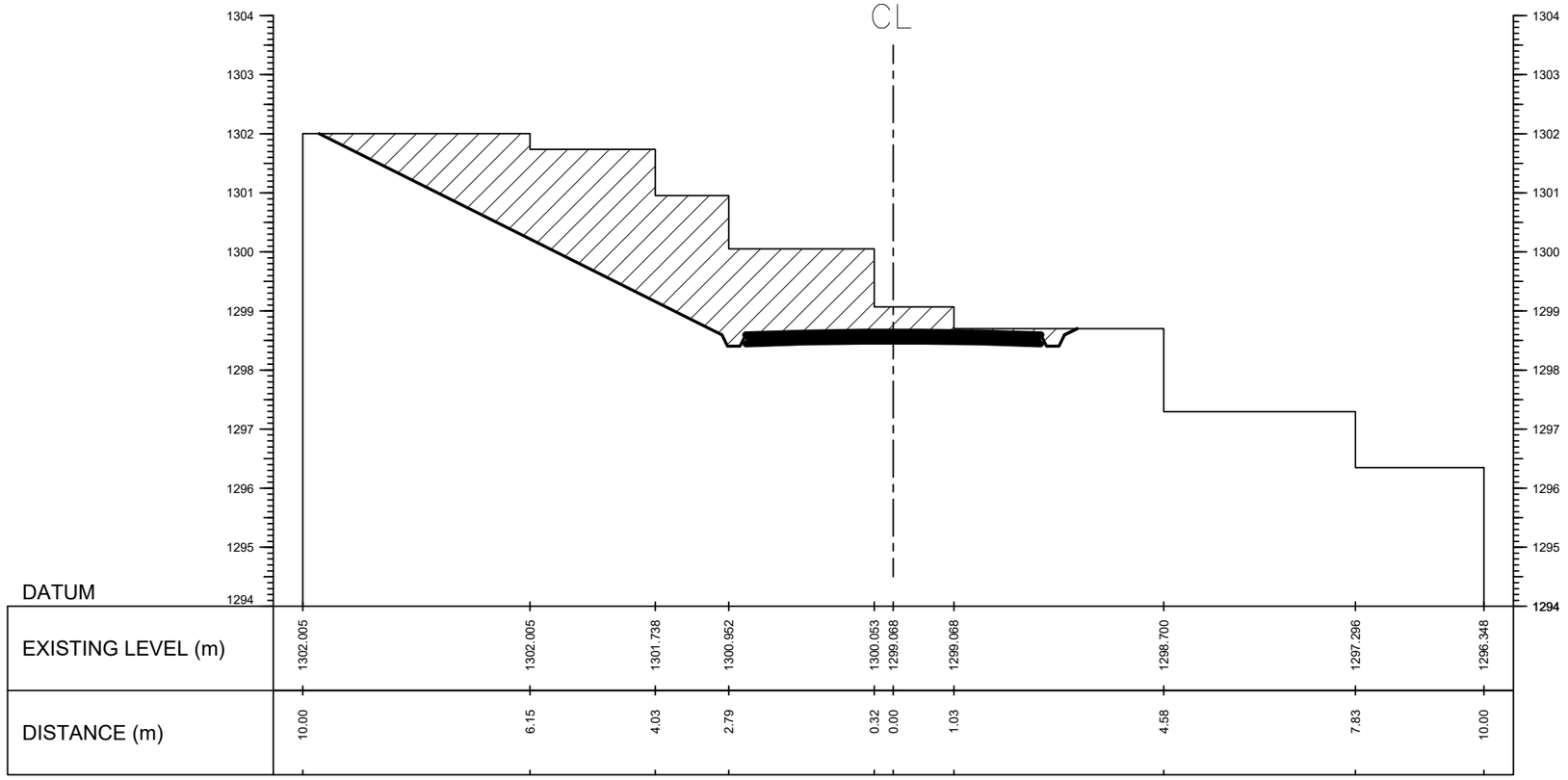
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 34



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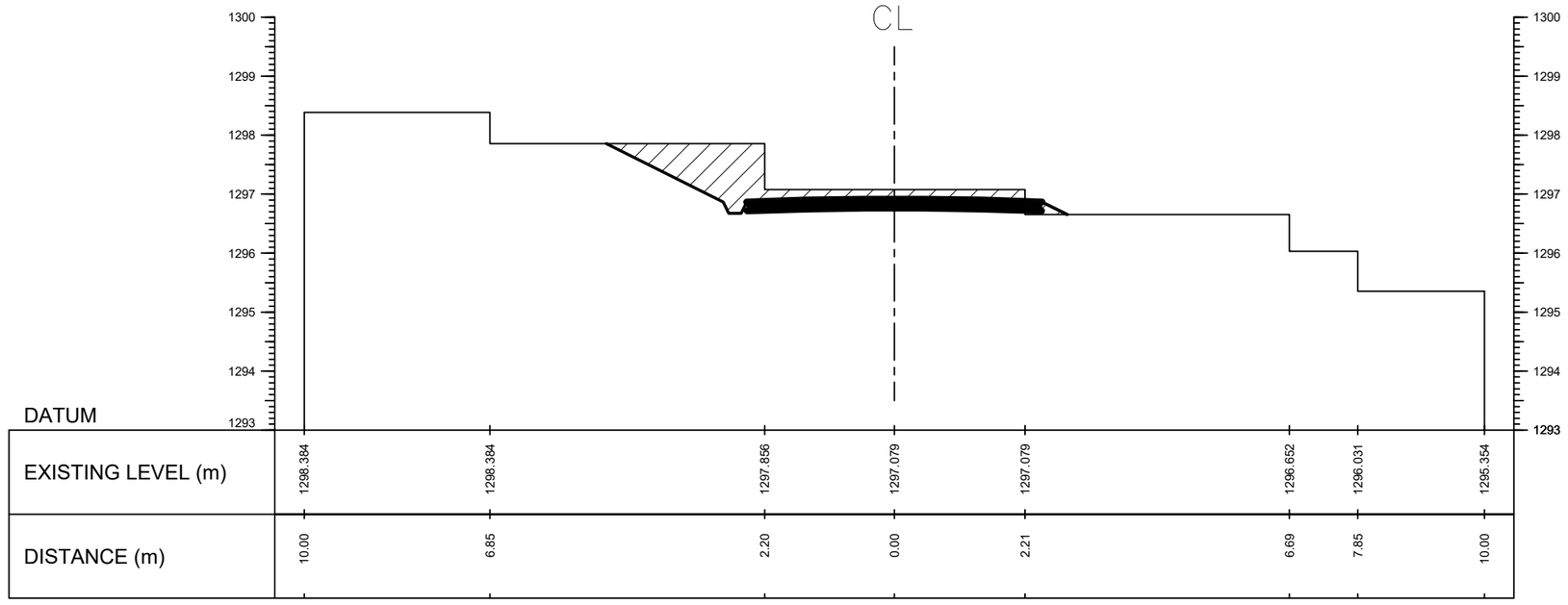

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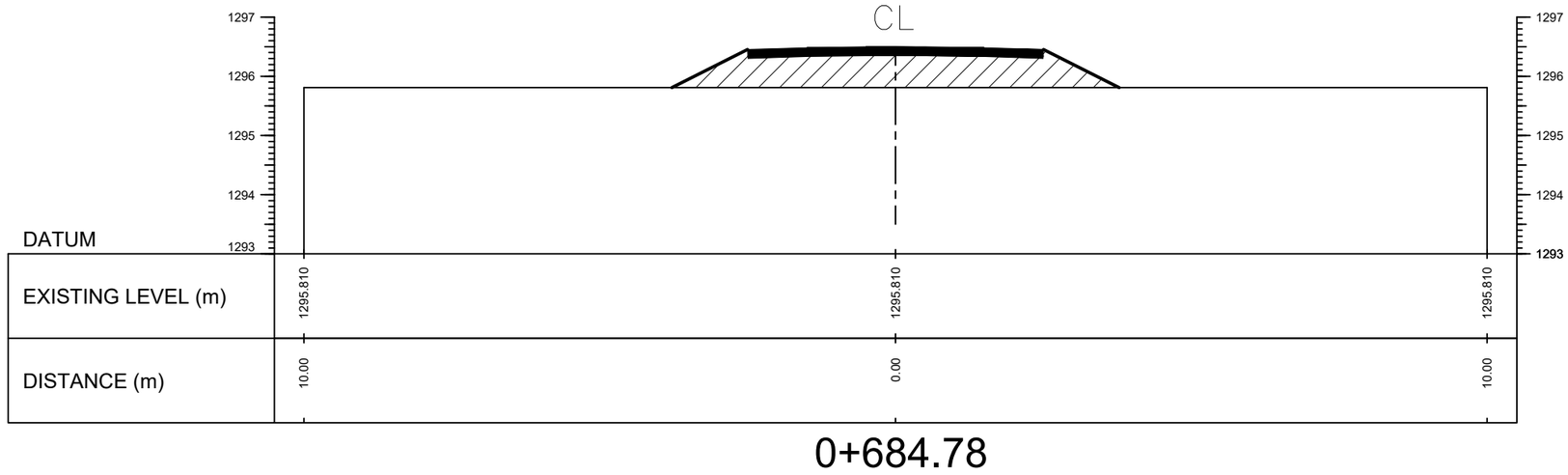
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 34



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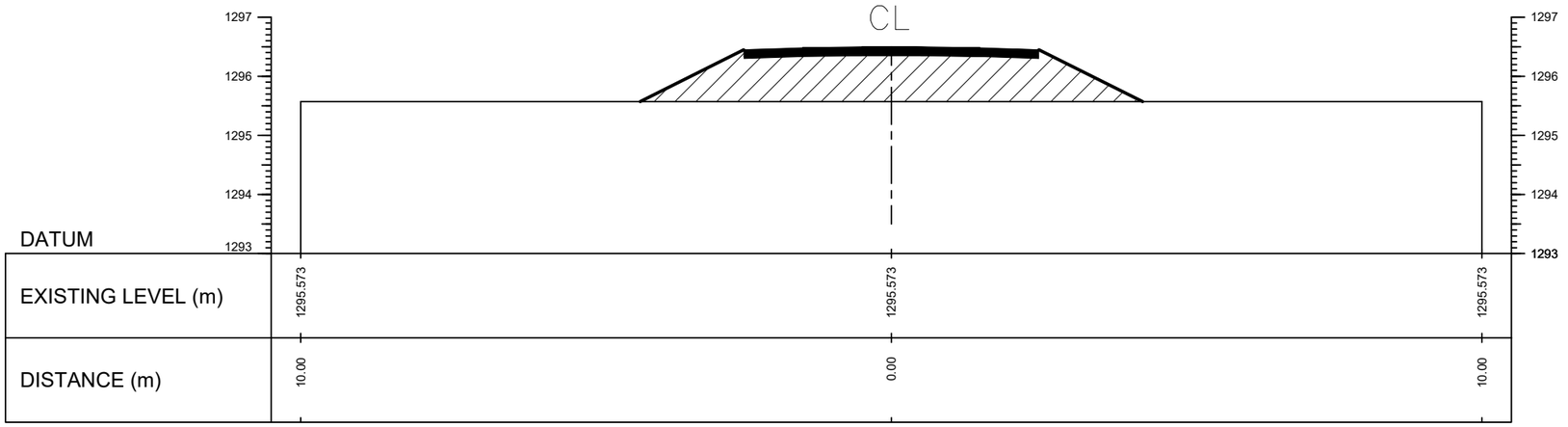

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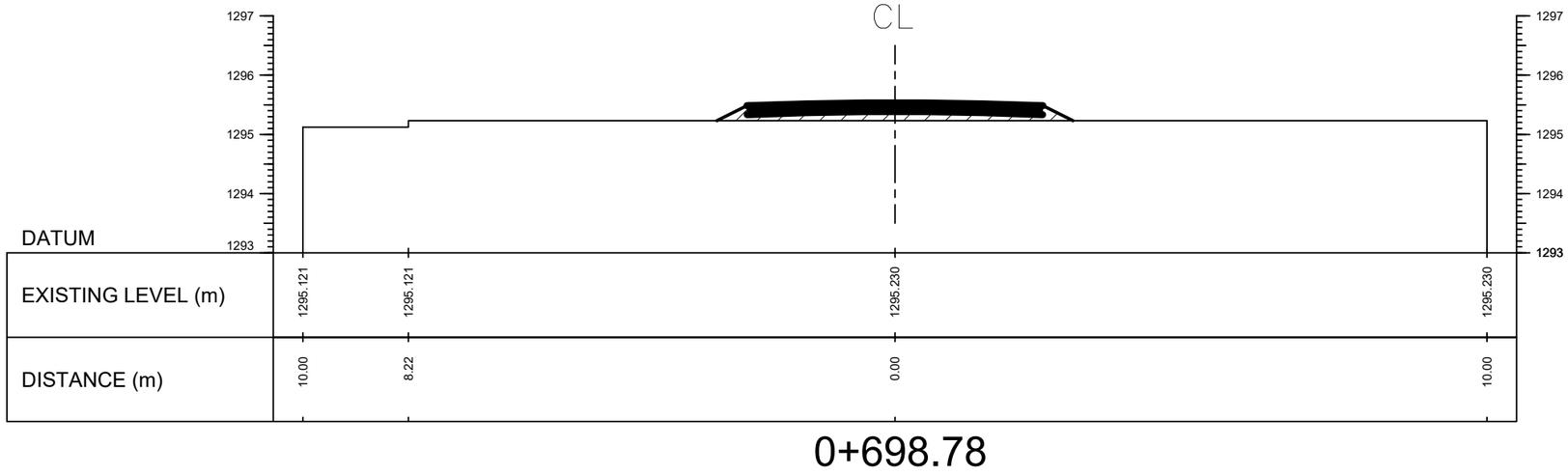
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 35



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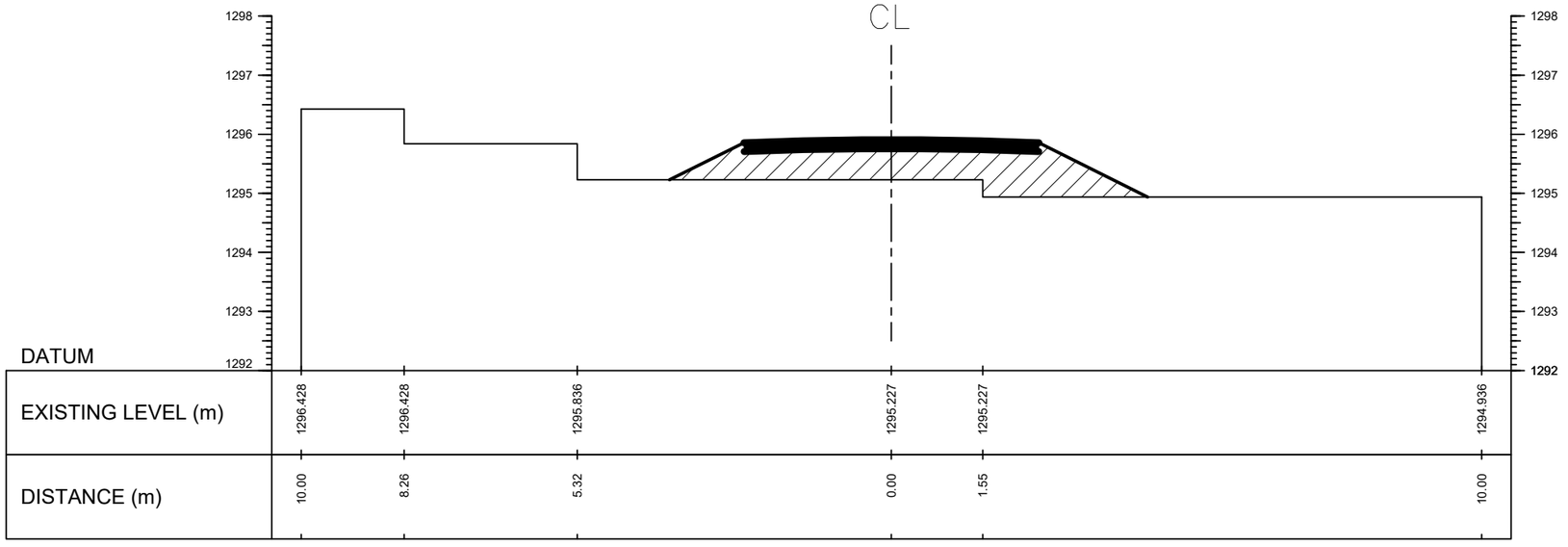

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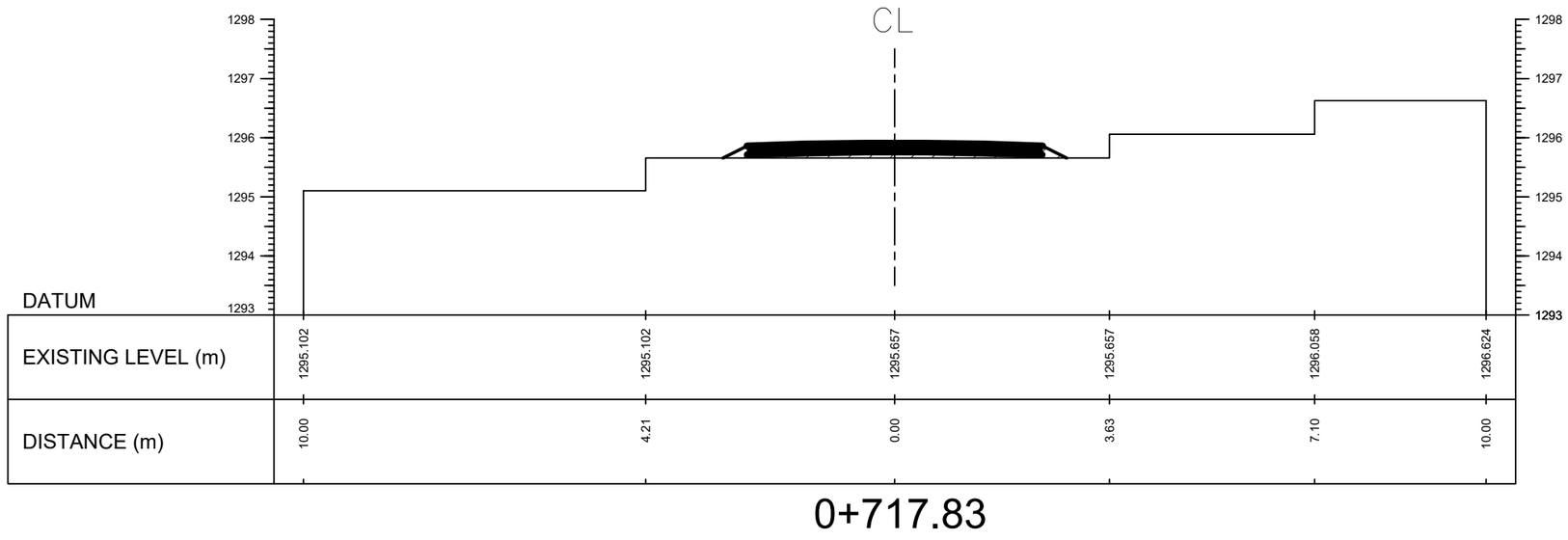
HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 36



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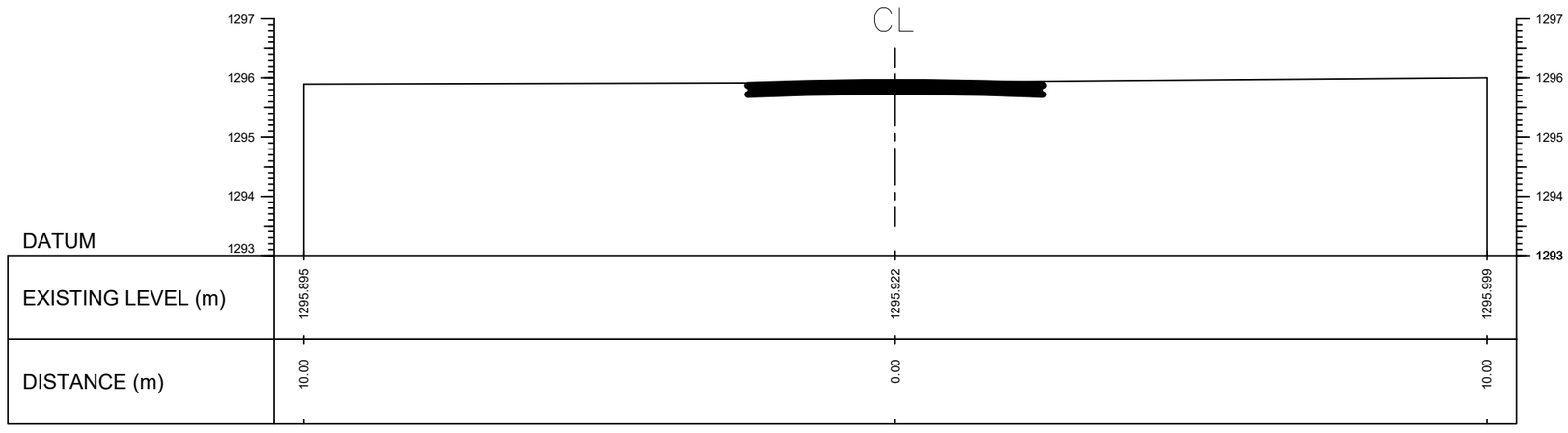

0+718.32

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HORIZONTAL SCALE 1:100
VERTICAL SCALE 1:100

GROUP 03

AMRIT PANDEY	078BCE023
CHANDAN KUMAR MAHATO	078BCE043
MANDEEP DANI	078BCE083
RAJIV MAHATO	078BCE122
SURENDRA SHARMA	078BCE178

SHEET NO 37