TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING, THAPATHALI CAMPUS

DEPARTMENT OF CIVIL ENGINEERING

Project No: THA076/BCE/20

DETAILED ENGINEERING SURVEY, DESIGN AND COST ESTIMATION FOR THE CONSTRUCTION, IMPROVEMENT AND RENOVATION OF THE ROAD SECTION FROM KALOPATI TO KASULA TOL CONNECTING SUNDARTHALI

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A DISSERTATION SUBMITTED IN FULFILLMENT OF THE REQUIREMENTS FOR THE BACHELOR DEGREE OF CIVIL ENGINEERING DEPARTMENT OF CIVIL ENGINEERING

Date: April, 2024

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DECLARATION OF AUTHORSHIP

Project entitled **"Detailed engineering survey, design and cost estimation for the construction, improvement and renovation of the road section from Kalopati to Kasula Tol connecting Sundarthali"**, which is being submitted to the Department of Civil Engineering, Thapathali Campus, IOE, TU; Nepal for the award of the degree of Bachelor in Civil Engineering is a Projectwork carried out by me under the supervision of Er. Gopal Gautam sir, Department of Civil Engineering, IOE, Thapathali Campus, TU, Nepal between April 2023 to April 2024. We declare that this is our work and has not been previously submitted by us at any university for any academic award.

Submitted by	*Roll No.*	*Signature*
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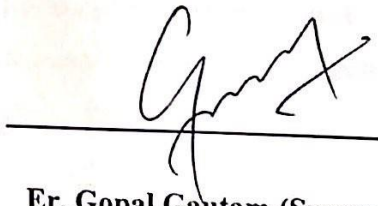
Date: April, 2024

RECOMMENDATION

The undersigned certify that they have read and recommended to the Department of Civil Engineering, Thapathali Campus, Institute of Engineering, Tribhuvan University for acceptance, a Project entitled **"Detailed engineering survey, design and cost estimation for the construction, improvement and renovation of the road section from Kalopati to Kasula Tol connecting Sundarthali"**, submitted by **THA076/BCE/20** in partial fulfillment of the requirement for the award of the degree of **Bachelor in Civil Engineering.**



Er. Gopal Gautam (Supervisor)

Department of Civil Engineering

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Date: April, 2024

TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

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Department of Civil Engineering

The undersigned certify that they have evaluated the Project entitled **"Detailed engineering survey, design and cost estimation for the construction, improvement and renovation of the road section from Kalopati to Kasula Tol connecting Sundarthali"** submitted by **THA076/BCE/20** and have external oral presentation for the partial fulfillment of the requirement for the degree of **Bachelor in Civil Engineering** and recommended to the IOE, Thapathali Campus for acceptance of this Project work.

Er. Gopal Gautam
IOE, Thapathali Campus
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TRIBHUVAN UNIVERSITY

INSTITUTE OF ENGINEERING

Thapathali Campus

Department of Civil Engineering

The project **"Detailed engineering survey, design and cost estimation for the construction, improvement and renovation of the road section from Kalopati to Kasula Tol connecting Sundarthali"** submitted by **THA076/BCE/20** for partial fulfillment of the requirement for the degree of Bachelor in Civil Engineering has been accepted by the IOE, Thapathali Campus, Departmental Project Committee (DPC) upon the recommendation of the supervisor with the approval by the following examiners.

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Er. Gopal Gautam
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Internal Examiner
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Finally, we are deeply grateful to everyone who has contributed to our final-year project. Their support and encouragement were critical in achieving our goals, and we will always cherish their contribution.

ABSTRACT

This project is concerned with the detailed design and cost estimation of a road section from Haku Falcha to Mandev Marg. The road has been serving as a major means of connecting the socio-economic activities of the people in that region with the main city area of Bhaktapur. Technically, the road falls under class IV with the design speed of 20km/hr. The road section has been designed as two lane road with shoulder width 0.75m on both the sides and minimum radius of 15m and pavement thickness 475mm. For site research and design work, AutoCAD, Google Earth, and the professional version of SWROAD V2 were utilized. Because the route is located in an urban area, slopes were included in a vertical profile while taking grade relaxation into account. Following a general hydrological assessment, longitudinal and cross drainage was installed, and the fill portion's required retaining walls were installed. 9528.082 m3

of earthwork were done in the cut portion and 940.6113 m3 in the fill portion overall. According to cost estimation, the project will cost a total of 205,285,330.72 and Rs. 79,276,049.71per kilometers.

ABBREVIATION

AASHTO	American Association of State Highway and Transportation Officials
DDC	District Development Committee
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DOR	Department of Road
GoN	Government of Nepal
GPS	Global Positioning System
IRC	Indian Road Congress
LRN	Local Roads Network
MoUD	Ministry of Urban Development
NURS	Nepal Urban Road Standard
PCU	Passenger Car Unit
SRN	Strategic Road Network
SSD	Stopping Sight Distance
TOR	Terms of Reference
VAT	Value Added Tax
VDC	Village Development Committee
VOC	Vehicle Operating Cost

SALIENT FEATURES OF THE PROJECT

1) Name of Project: Detailed Engineering Survey, Design and Cost Estimation for the construction, improvement and renovation of the road section from kalopati to kasula tol connecting sunderthali
2) Geographic Location: Changunarayan Municipality ward no. 2
3) Starting Point: Haku Falcha, Bhaktapur municipality, Bhaktapur
4) End point: Mandev marg, Changunarayan municipality, ward no. 3
5) Geographical Feature: Hilly Region
6) Terrain: Plain terrain (1.67°)
7) Climate: Moderate
8) Geology: Mostly Clayey
9) Hydrology: Kasan River
10) Meteorology precipitation: Uneven and precipitation mostly during Monsoon
11) Classification: Local Road as per NURS 2076, Class IV as per NRS
12) Surface: Unpaved
13) Longitudinal grade: 1.00% to 9.33%
14) Connection with Road Network: Sallaghari to Nagarkot
15) Alignment Details: Haku Falcha – Barkhepati -Kasula Tol -Mandev Marg

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1. INTRODUCTION

1.1 General Background

Transportation is the key factor in the development of all the other infrastructures of the development. It is one of the important infrastructures for overall development of the nation and its economy. Construction of new road and implementation of scientific transport network plays a vital role for it. Variation in the demographic trend, productivity and other socio-economic factors of different location prioritize the development of new road alignment, up gradation and well-organized transport network. Considering these facts, study of various new road alignments and up gradation are being done. Nepal is considered one of the least developed countries in the world. Nepal being a mountainous country thus other means of transportations such as railways, waterways, ropeway and airway are less viable and costlier. The economy is dominated by agriculture which represents about half of the gross national product (GNP) and employs the majority of the population. Apart from air transport, roads are the only means of transport. The road transportation in Nepal is best suited for the rural linkage and overall development of any area. For the fulfillment of the basic needs of people, to increase their living standard and sustainable development of the nation, road has become one of the major infrastructures of the development. To reach the light of the development in the corner of the rural areas, it is necessary that the facility of transportation should reach in these areas.

Nepal's road has been broadly categorized into two categories: the Strategic Road Network (SRN) and the Rural Roads (RR). The SRN is currently being updated to include approximately 5500 kilometers of completed and proposed national highways and feeder roads. It carries most of the road traffic and provides the national transportation links between main centers and to neighboring countries. Within the SRN is the loosely defined core road network (CRN). It comprises approximately 1,500 km of national highways with the highest traffic volumes (greater than 1,000 vehicles per day). The CRN carries the bulk of longer distance commercial traffic movements linking all major commercial Centre's, economic centres and main border crossings. The RR comprises approximately 4,600 km of district roads, plus trails, tracks and suspension bridges.

These facts contributed for the necessity of "DETAILED ENGINEERING SURVEY, DESIGN AND COST ESTIMATION FOR THE CONSTRUCTION, IMPROVEMENT AND RENOVATION OF THE ROAD SECTION FROM KALOPATI TO KASULA TOL CONNECTING SUNDARTHALI". This Road will ultimately help to improve the living standard of local people and therefore improve the economic development of the area and nation as a whole.

The History of Road development in Nepal is not very long. The Government of Nepal (GoN) has been giving high priority to the development of roads since the beginning of planned development programmed in 1956. With continued effort, the road length of the country which was only 376 Km in the 1950's is currently above 2,400 Km including District and Urban Roads. The length of road is also an indicator of development, industrialization and economic prosperity of a country. As expressed in the national transport policy 2058, Government of Nepal has put emphasis in the development of road and air transport for the social and economic development of the country. The present average road density in Nepal (as per SSRN 2009/10) equals 13.77 kms/100 sq kms. In terms of density-per population, this translates as an average across the country of 1.143 persons/km. These densities are very low in comparison with other countries. In the present situation by expanding the road transportation infrastructure to increase the road networking density of roads, reasonable upgrading of road networking and repairing and maintaining it, complete the under-construction road as well as to reach the road access to the headquarters of all 77 districts are seen as clear challenge of the moment.

1.2 The project backgrounds

There is already an existing two-lane Local Road with many locations to be improved in the project area. Thus, Construction of road with improved gradient, proper geometric design and design of pavement thickness has been a necessity of the project site because of the possibility of upliftment of the living standard of the people, promoting a planned urbanization and development of national economy. For the design purpose of our project, Nepal Urban Road Standard (NURS 2076) has been used.

1.3 Statement of Problem

The problems that caused the rise for necessity of this project are:

- Public discomfort and inconvenience
- Improper curve radius and curve designs
- Insufficient width of road in several places
- Lack of a proper surfacing of the road
- Lack of proper drainage structures
- Lack of Retaining structures for stability of road

1.4 Objective

The general objective of this project is to contribute in the national economy by uplifting the socio-economic status, quality of life and living standard of the people residing nearby or users of the road by providing a means of safe, reliable, economic and efficient mode of transportation.

- To conduct a detailed survey, design and estimate cost for the construction, improvement and renovation of the road section from kalopati to kasula tol connecting sundarthali.

1.5 Significance of Study

The proposed road alignment falls under the jurisdiction of Changunarayan Municipality which connects Haku Falcha (Bhaktapur Municipality) with Mandev marg (Changunarayan Municipality, Ward 3). This road affects the 9298 people living in Changunarayan Municipality ward no.2 as well as all the passersby. This road extends totally from south to east of this ward and lies at almost the centre of the ward due to which this road can serve for a huge population of this ward. With the improvements in the geometric design and transport facilities, this road can be the first choice with highest number of trip attraction.

The main objectives of the study are:

- To justify the need for the proposed road section by assessing the existing traffic patterns, population distribution, economic activities, and other relevant factors.
- To perform detailed engineering survey which includes the establishment of

base stations, horizontal control points and permanent reference points.

- To re-establish the horizontal and vertical alignment as well as the crosssection.
- To include the existing houses, electric poles and any other permanent structures in the contour map.
- To perform geometric design of the various road sections of the roadway using available design software.
- To conduct the pavement design using Department of Roads and Indian Road Congress recommendations, primarily by projecting the traffic over the lifetime of the roadway.
- To address the drainage requirements and storm water management for the road section by studying on surface drainage patterns, hydraulic calculations, culvert design, and erosion control measures.
- To identify potential impacts and propose mitigation measures to minimize adverse effects on the environment and local communities.
- To enhance road safety, reduce accidents, and create a user-friendly road environment.

1.6 Scope and limitation of the work

This project includes the road stretch of approximately 2.6 kilometers running from south to north across ward 2 of Changunarayan municipality. This study area was chosen for the improvement of the road network. The following are taken in the scope of work of the proposed road project:

1. Detailed survey and geometric design of road
2. Design of drainage structures for effective drain management
3. Design of retaining structures for road stability
4. Estimation of materials
5. Cost analysis

The limitations of the project are:

1. Unavailability of space for widening of road
2. Sharp curves with limited sight distance

2. STUDY AREA

2.1 Project Location

The proposed road alignment lies in Changunarayan municipality, Bhaktapur district of Bagmati province. The studied alignment begins from Haku falcha (Chainage Km: 0+000), Bhaktapur municipality and ends at Mandev Marg, Changunarayan municipality ward no. 3. The alignment passes through many settlement areas, cultivated areas, and crosses Kasan River. Proposed alignment does not include any other wards except ward no.2 of Changunarayan Municipality and falls under the category of Local Road as per NURS 2076.

2.2 Climate and Hydrology

Figure 1 Administrative Map of Changunarayan Municipality

The temperature of Changunarayan is moderate. The temperature ranges from 37 F to 67 F during January which is the coldest month of the year in Bhaktapur and for the warm season is 67F to 83 F in June. All in all, the climate isn't harsh or extreme and is very comfy and lively along with more warm periods in comparison to the cold seasons which supports the settlements and livelihoods.

2.3 Physical Infrastructure and Economy

A major portion of the economy comes from the agriculture in this area. Seasonal farming is a source for different crops and income thus generated supports the economy of more than half of the households. Also, there are brick factories, drinking water factory, textile industry and few other industries. However, it is not an industrial area and rather it is an agricultural area. The engineering geological study covers areas such as,

- Drainage flow and study
- Minor land slide areas
- Debris/mudflow sites
- Areas with high cuts and fill.

2.4 Factors Controlling Road Alignment

While designing road alignment, the distance between two terminals should be kept as straight and short as far as possible. Due to various practical difficulties such as physical condition and obstructions, it is not always possible. The shortest route might have very steep gradients. Similarly, there may be construction and maintenance problems along a route, which may otherwise be short and easy. Roads are often deviated from the shortest possible route in order to fulfill the demand of road as per the importance of obligatory points.

A road, which is economical in the initial construction cost, need not necessarily be the most economical in the maintenance or in cost of vehicular operation. The various factors which control the highway alignment in general may be listed as:

- Obligatory points
- Traffic
- Geometric Design
- Economics
- Other Considerations

a) Obligatory points

These are the control points that determine how the road is aligned. These are of two types:

1) Points through which a road has to pass such as
   - An industrial area or mine zone to which a highway is to serve additionally
   - Quarry
   - Hill Pass
   - Link with Intermediate towns
   - Bridge sites
   - Tourist spots
2) Points through which a road should not pass
   - Marshy place and water-logged areas
   - Historically and archaeologically important property
   - Restricted zone for defense, national security
   - Costly structural elements requiring heavy compensation

b) Traffic

The alignment must take traffic requirements into account. Desired lines should be created to depict the direction of traffic flow, and a thorough analysis of the locations of origin and destination must be done. When aligning the highway, it is important to take future trends, traffic flow patterns, and desirable lines into account.

c) Geometric design

The ultimate highway alignment would also be determined by factors including gradient, curve radius, and sight distance. As much as possible, the gradient should be flat and smaller than the design or governing gradient. It is necessary to make adjustments taking into account the horizontal alignment, design speed, maximum permitted super elevation, and lateral friction.

d) Economy

In working out the economics, the initial cost of the maintenance and vehicle operation should be taken into account. High embankments and deep cutting significantly increases the total cost per kilometers of the road. Therefore, there should be balance in cutting and filling with the decrement of high embankment and deep cutting.

e) Other Considerations

Factors like Political, hydrological, and drainage reasons, among others, may influence the alignment. The vertical alignment is determined by taking drainage into account. The elements to be considered include the high flood level, seepage flow, and subsurface water level. The vertical alignment is guided by drainage consideration. The subsurface water level, seepage flow and high flood level are the factors to be kept in view.

For Hill Road special consideration needs to be given to such concerns as:

- Drainage of surface as well as sub-surface water flowing from hill side.
- Stability of hill side slope.
- Special Geometric standards of hill roads.
- Composition of traffic.

3. LITERATURE REVIEW

3.1 Importance of Road in Development of Nepal

A country cannot progress unless it has a good road network. Transportation contributes to the economic, industrial, social and cultural development of any country. Inadequate transportation facilities retard the process of socio-economic and cultural development.

a) National Unity

   Better roads contribute to the reduction of regional differences and to the building of national unity through integration, resulting from enhanced transport services.

b) Economic Prosperity and Growth

   Better road connectivity stimulates economic growth by reducing transportation costs and providing access to markets, thus facilitating agricultural growth by ensuring reliable delivery of inputs and timely marketing of production at reasonable cost.

c) Assistance to Development strategies

   Better roads bolster Nepal's strategic geographical position as an essential transit corridor for its landlocked neighbors, facilitating their access to international markets.

d) Socio-economic upliftment of the people

   Roads provide access to administrative and social support services, employment opportunities, schools, health care facilities and other social services.

3.2 Road Classification

Roads in Nepal are classified as follows:

A. Administrative Classification:

Administrative classification of roads is intended for assigning national importance and level of government responsible for overall management and methods of financing. According to this classification roads are classified into:

- National Highways
- Feeder Road

- District roads and
- Urban roads

a) National Highway: National Highways are main roads connecting East to West and North to South of the Nation. These serve directly the greater portion of the longer distance travel, provide consistently higher level of service in terms of travel speeds, and bear the inter-community mobility. These roads shall be the main arterial routes passing through the length and breadth of the country as a whole. They are designated by letter 'H' followed by a two-digit number.
b) Feeder Roads: Feeder roads are important roads of localized nature. These serve the community's wide interest and connect District Headquarters, Major economic centers, Tourism centers to National Highways or other feeder roads. They are designated by letter 'F' followed by 3-digit number.
c) District Roads: District Roads are important roads within a district serving areas of production and markets, and connecting with each other or with the main highways.
d) Urban Roads: Urban Roads are the roads serving within the urban municipalities.

In Nepal the overall management of National Highways and Feeder Roads comes within the responsibility of the Department of Roads (DOR). These roads are collectively called Strategic Roads Network (SRN) roads. District Roads and Urban Roads are managed by Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR). These roads are collectively called Local Roads Network (LRN) roads.

B. Technical/Functional Classification

For assigning various geometric and technical parameters for design, roads are categorized into classes as follows:

- Class-I: Class I roads are the highest standard roads with divided carriageway and access control (Expressways) with ADT of 20,000 PCU or more in 20 yrs perspective period. Design speed adopted for design of this class of roads in plain terrain is120 km/h.

- Class-II: Class II roads are those with ADT of 5000-20000 PCU in 20 yrs perspective period. Design speed adopted for design of this class of roads in plain terrain is I00 km/h.
- Class III: Class III roads are those with ADT of 2000-5000 PCU in 20 yrs perspective period. Design speed adopted for design of this class of roads in plain terrain is 80 km/h.
- Class IV: Class IV roads are those with ADT of less than 2000 PCU in 20 yrs perspective period. Design speed adopted for design of this class of roads in plain terrain is 60 km/h.

For the design of roads, the class of the road is taken as the basic deciding factor, which is ascertained based on the traffic volume on the road. But an approximate correlation can be established between the administrative and functional classifications of the roads as follows: (Roads, Nepal Road Standards, 2070)

Table No. 1 Correlation between administrative and functional classification

	Plain and rolling terrain	Mountainous and steep terrain
National Highway	I, II	II, III
Feeder Roads	II, III	III, IV

3.3 Terrain classification

Table No. 2 Terrain classification

S.No	Terrain Type	Percentage Cross Slope	Degree
1	Plain	0-10	0°-5.7°
2	Rolling	>10-25	>5.7°-14°
3	Mountanious	>25-60	>14°-31°
4	Steep	>60	>31°

Elevation difference = 1378-1312 = 66 m, Distance = 2610-357 = 2253 m, Terrain classification: Plain terrain (tan ___ = 1.67°)

3.4 Design speed

Recommended Design Speeds for Different Classes of Urban Roads: (Roads, Nepal

Urban Road Standards, 2076)

Table No. 3 Design speeds for different classes of urban roads

Type of Road	Design speed (km/hr)
Arterial Roads	40-50
Sub Arterial Roads	30-40
Collector Roads	20-30
Local Streets	10-20

Since the road section is the local street, design speed is taken as 20 km/hr.

3.5 Development of Road in Nepal

Wide trails intended for horse driven carts consisting of hard broken brick over which flat stone slabs were laid over a base of lime concrete were constructed during Malla Period. Tribhuan Rajpath is the first highway connecting Kathmandu to Birgunj constructed in 1956.In 1963 Kodari highway joining Kathmandu to Kodari was constructed. Development of modern road progressed by mid-1970's with the completion of eastern section of East West Highway.

The state of existing connectivity through road network by the development regions in the country is provided in Table 2.

Table No. 4 Road Connectivity in Nepal by the Development Regions

Province	Number of Roads	Constructed Length (Km)	Road Length (Km)				Population Influenced (Km/1000 persons)
			Black topped	Gravel Road	Earthen Road	Road density (Km/sq. Km)	
Eastern	1009	9435.737	172.507	3015.185	6248.046	33.16	1.62
Central	3072	18751.270	679.463	4976.740	13095.067	68.41	1.93
Western	1705	14282.066	646.394	2377.426	11258.246	48.58	2.89
Midwestern	643	5593.780	77.070	2378.030	3138.680	13.20	1.56
Farwestern	254	2880.794	0.000	1854.540	1026.254	14.74	1.13
Total	6683	5943.647	1575.434	14601.921	34766.293	34.61	1.91

Nepal's total road network and density are very low as compared to other South Asian Nations. Over the last two decades, therefore, increasing emphasis has been accorded to the development of roads in the country.

3.6 Design consideration of road

The design consideration of roads is based on many factors including design speed, functional classification, vehicular volume, types of vehicles, existing terrain and natural features, community impacts, environmental effects, cost considerations and the right of way needed for road development. Road design is accomplished with the consideration of following design criteria and guidelines:

a) Design hourly volume and capacity:

The traffic volume keeps on fluctuating from a low value during certain off-peak hours to the higher flow during the peak hours. It will be uneconomical to design the roadway facilities for the peak traffic flow or the highest hourly traffic volume. Therefore, a reasonable value of traffic volume is decided for the design and this is called the design hourly volume.

b) Design Speed:

When the design speed is higher, the design standards should be of higher order which ensures the road safety, capacity, and comfort and decreases the user's operational expenditure but the choice of design speed is influenced by the class of road, traffic volume, available budget and the terrain.

c) Terrain:

The terrain through which the road transport linkage passes directly influences the selection of geometric standards such as formation width carriageway width, right of way, free board, radius of horizontal curves: gradient etc.

d) Environment:

The factors such as aesthetics, landscaping, air pollution, noise pollution and other local conditions should be given due consideration in the design on road geometrics.

3.7 Environmental and Social consideration in Urban Roads

a) Environmental Considerations

The basic intention of environmental consideration is to develop the best possible road in the given environmental settings by the use of environmentally sound and appropriate approaches, methods, standards and techniques maintaining environmental quality. Main environmental factors that need to be considered are forest and protected areas, landslides and erosion prone areas, flood and drainage problems, sites of historic, cultural, religious or archaeological significance, population centers and valued environmental features like wet land, lakes, drinking water source need to be protected while planning and developing the road network.

b) Social Considerations

The social consideration in road development is associated with promoting broader social development benefits and to discourage any social harms and dis-benefits from the road. Emphasized care should be given for not harming the poor, landless and vulnerable groups. Compensation should be provided for the loss of livelihood assets and employment opportunities.

3.8 Road Alignment

Road alignment may be defined as the position or layout of the center line of the road on the ground surface. The horizontal alignment includes straight path and the horizontal deviations called curves. Changes in gradient and vertical curves are covered under vertical alignments of road. To determine the precise position of the layout of the road centerline from the design drawing on ground during construction it is essential to determine three coordinates (X, Y and Z) of all points from the center line. Thus, Road alignment is located on the ground with the help of its two components. A new road should he aligned very carefully as improper alignment will result in one or more of the following disadvantages:

- Increase in construction cost
- Increase in vehicle operation cost
- Increase in maintenance cost
- Increase in accident rates

It is highly uneconomical to change the road alignment once it is aligned and constructed due to the increase in construction costs of required structures and costs

of adjoining land. Thus, careful consideration must be taken while finalizing the alignment.

3.9 Process of Identifying Best Route Location

The basic requirements an ideal alignment between two terminal stations is that it should be:

i. Short: The alignment between two terminal stations needs to be short in distance. Road alignment deviates from its shortest path due to obligatory points, such as gradient, mountain pass, structures, ditches and intermediate population center.

ii. Easy: The Road alignment should be such that it is easy to construct and maintain with minimum problems. In addition, the alignment should be easy for the operation of vehicles with easy gradients and curves.

iii. Safe: The alignment should he safe enough for construction and maintenance from the viewpoint of stability of natural hill slopes, embankment and cut slopes and foundation of embankments. In addition, it should be safe for the traffic operation with safe geometric features.

iv. Economical: The road alignment can be considered economical only if the total cost including initial cost, maintenance cost and vehicle operation cost is lowest but also maintaining SESE. All these factors should be given due consideration before working out the economics of each alignment. Besides these points, the alignment best serving the population as well as providing maximum utility should be considered while selecting the alignment.

3.10 Engineering Survey and Its Stages

The engineering surveys are to be carried out before a Road alignment is finalized in Road project. The Surveys are completed in four stages, first three stages consider all possible alternate alignments keeping in view of the various requirement of road alignment. The fourth stage is meant for the detailed survey of the selected alignment. The four stages of the engineering surveys are:

a) Map Study

By analyzing the topographical map of the area, we first extract several alternative routes of the road, so that further details of these may be studied later at the site.

Usually, the topographical map of scale of l: 25000 provided by Department of Survey, Government of Nepal (GoN) is preferred in highway planning but for small stretch, such large-scale maps are not preferable.

b) Reconnaissance:

It is the second stage of surveying deciding the road location. The field survey parties inclusive of an advisor inspect a broad stretch of land along the proposed alternative routes of map in the field. All relevant details not available in the map were collected and noted down. Some of the details collected during reconnaissance are listed below:

- Ponds, marshy land, ridge, hills, permanent structures and other obstruction along the route, which are not available in the map study.
- Number and types of cross drainage structures, maximum flood level and natural ground water level along the probable routes.
- Soil type along the routes from field identification tests and observation of geological features.
- Sources of construction materials, water and location of stone quarries.

c) Preliminary Survey:

During Preliminary survey following tasks are performed:

- The Survey of the various alternate alignments proposed after the reconnaissance and to collect all necessary details of topography, drainage and soil.
- Comparison of different proposals in view of the requirements of a good alignment
- Selected the best alignment from all considerations.

d) Final Location and Detailed Survey:

The alignment finalized after the preliminary surveys is first located on the field by establishing the centerline. Next detailed survey is carried out collecting the data necessary for the preparation of plans and construction details for the road Project.
The key terms used in the course of detailed survey are as stated here under:

i. Plan:

It is top view of project in a map. It consists of:

- Northing
- Location of IPs and BMs with Reference
- The road centerline, formation width, side drain and right of way

ii. Benchmark:

It is a permanent point of reference whose elevations w.r.t. some assumed datum is known.

iii. Levelling:

The objective of leveling is to find the elevations of given points w.r.t. a given elevations or at a different elevation w.r.t. a given or assumed datum. Leveling deals with measurements in a vertical plane. For the purpose of road construction, the profile leveling is carried out to determine the R.L. of the centerline located with driven pegs. The leveling determines the alignment of the road. The leveling is taken at suitable intervals according to the site.

iv. Composition of Traffic:

The alignment of road passing from the shortest route is deviated due to the volume and composition of traffic. For road with intensive heavy vehicles and high volume of traffic alignment yielding minimum length of steep ascend/descend is much desirable than the shortest route distance. Similarly, a road leading to a recreation spot, or tourist spot that might have predominant by light passenger car and few buses, alignment may be chosen with higher slope. In addition, the origin and destination study should be carried out in the area and the desire lines be drawn showing the trend of traffic flow. The alignment should be chosen based on origin and destination study, traffic desire lines, flow pattern, future trends etc.

v. Geometric Features:

Geometric design factors such as permissible limit of descending or ascending slopes, sight distance requirements, degree of curvature and bends, slope of camber, super elevation, and width of the road, extra widening and many other dimensional features of the road may also govern the final alignment of the road.

vi. Economy:

The appropriate alignment should also be economical. The economic analysis is done taking into account all the possible costs which includes construction cost,

maintenance cost, vehicle operation cost, accident cost, travel time cost etc. The analysis should also include cost of environmental and social mitigation measures, land acquisition for construction and development of road. For road alignment to be economical, the sum of all road components should be as less as possible. The initial construction cost seems to be more initially but in reality, the vehicle operation cost and road user travel time cost is more. However, due to budget constraint sometimes - initial construction cost might be the governing factor and alignment selected accordingly even if the road yields highest maintenance cost and vehicle operation cost. The Initial cost of construction can be decreased if high embankments and deep cuttings are avoided and the alignment is chosen in a manner to balance the cutting and filling.

3.11 Geometric Design of Road

Geometric design of road deals with the dimensions and layout of visible features of road such as alignment, cross slope or camber, gradient, sight distance considerations, horizontal and vertical alignment details, intersection elements, width, turning radius, carriage way, kerb and road margins. The geometry of the road should be designed to provide optimum efficiency in traffic operations with maximum safety at reasonable cost and also should be consistent with its economy. Therefore, it is important to plan and design the geometric features of the road during the initial alignment itself taking into consideration the future growth of the traffic flow as well as the possibility of the road being upgraded to a higher category or to a higher design speed standard at a later stage.

3.11. 1 Elements of Geometric design

Geometric design of Road deals with following elements:

- Cross section elements
- Sight distance considerations
- Horizontal alignment details
- Vertical alignments details
- Intersection elements

3.11. 2 Highway Cross Section elements

Cross-sections are run along transverse direction to the longitudinal profile and on other side for the purpose of lateral outline of the ground surface. They provide the data for estimating quantities of earthwork and for other purposes. The scale selected for plotting is equal on both the axes. Cross-sections are plotted for each element of curves. The cross-section consists of the following:

a) Carriageway

The standard width of carriageway shall be as shown on the following table. Total width of pavement shall be determined based on the volume of the traffic and capacity of each lane.

Table No. 5 Width of Carriageways, meter

Single lane road	Intermediate lane	Multilane pavements width per lane
3.75 (up to 3.0m in difficult terrain)	5.5 m	3.5 m

In case of single lane roads, it is recommended to have two treated shoulders on either side to make a total width of 5.5m of treated surface.

b) Shoulder

- The width of shoulders on either side of the carriageway shall be at least 0.75m. Recommended width of shoulder for various classes of roads is given below in Table.
- For protection of pavement from water percolating under it from shoulder it is recommended to treat at least a 0.50-0.75m wide strip of shoulder near the edge of the pavement with impervious to water surfacing.
- If a small gap(<1m) of untreated shoulder is formed between the edge of the pavement and edge of the side drain in hill roads it is recommended to treat this gap with appropriate surface treatment.

Table No. 6 Width of Shoulders, metres

Road class	Class I	Class II	Class III	Class IV
Minimum Shoulder width, m	3.75	2.5	2.0	1.5

- For mountainous and steep terrains, the above values can be reduced to a minimum value for a lower class of the road but not less than 0.75m.
- It is desirable that the color and texture of shoulders be different from those of the carriageway.
- This contrast serves to clearly define the carriage way at all times, particularly at night and during inclement weather, while discouraging the use of shoulders as additional through lanes.
- Very wide shoulders (more than 3.75m wide) are also not desirable due to tendency of vehicles misusing it as a carriageway.

c) Medians

- For roads with 4 or more lanes, it is recommended to provide medians or traffic separators. Medians should be as wide as possible.
- A minimum median width of Sm is recommended. But a width of 3m can be adopted in areas where land is restricted.
- In mountainous and steep terrains maximum possible width of median dictated by the topography should be provided. In such situations simple barriers may be provided to function as a median or individual carriageways could be designed at different levels.
- On long bridges and viaducts, the width of the median may be reduced to 1.5m, but in no case this should be less than 1.2m.
- The median should be of uniform width in a particular section of the highway. However, where changes are unavoidable, a transition of 1 in 20 must be provided.

d) Formation or Roadway Width

Formation width shall be a total of widths of carriageways, medians and shoulders as discussed in previous paragraphs.

e) Camber

- All straight sections of roads shall have a camber or cross fall as given on the Table.

- On roads with undivided carriageways the camber shall be on both directions from the center line of the road. On roads with divided carriageways unidirectional camber can be provided.
- However, on some sections of hill roads with undivided carriageway a unidirectional camber can be adopted. In this case the adverse effect of negative camber on movement of vehicles on curves should be properly checked.

Table No. 7 Camber, percentage (%)

Pavement type	Cement Concrete	Bituminous	Gravel	Earthen
Camber, %	1.5 to 2.0	2.5	4.5	5.0

- On straight sections of roads, shoulders should have a higher cross fall than that of the carriageway by 0.5%.

f) Superelevation

- Superelevation is provided on horizontal curves. Value of superelevation is calculated using following formula: $e = \_\_\_ - f$
- Minimum value of superelevation should be equal to the rate of camber of the pavement.
- The rate of introduction of superelevation (i.e. longitudinal grade developed at the pavement edge compared to through grade along the center line) should be such as not to cause discomfort to travelers or to make the road unsightly.
- Rate of change of the outer edge of the pavement should not be steeper than 1 in 150 in plain and rolling terrain and l in 60 in mountainous and steep terrain in comparison with the grade of the center line.

g) Side slopes

- Side slopes of embankment and cuttings depend on the type of fill/cut materials and height/depth of filling/cutting.
- Recommended side slopes for embankments are given below. But wherever possible flatter slopes are recommended for aesthetic reason and traffic safety.

Table No. 8 Embankment side slopes

Height, m	Side slope (vertical: Horizontal)

<1.5	1:4
1.5-3.0	1:3
3.0-4.5	1:2.5
4.5-12.0	1:2
>12.0	Design Specially

- If natural cross slope of the ground is more than 1:5 then the ground should be cut with more than 2m wide horizontal steps.
- Recommended values of side slopes in cutting are given in Table:

Table No. 9 Cutting Side slopes

Table No. 1 Soil Type	Side Slope (vertical: Horizontal)
Ordinary Soil	1:2 to 1:1
Disintegrated rock or conglomerate	1: 1 to 1: 1
Soft rock, shale	1: 1 to 1: 1
Medium Rock	1: 1__ to 1: 1__
Hard Rock	Almost vertical

h) Typical Cross Sections

i) Arterial Road section

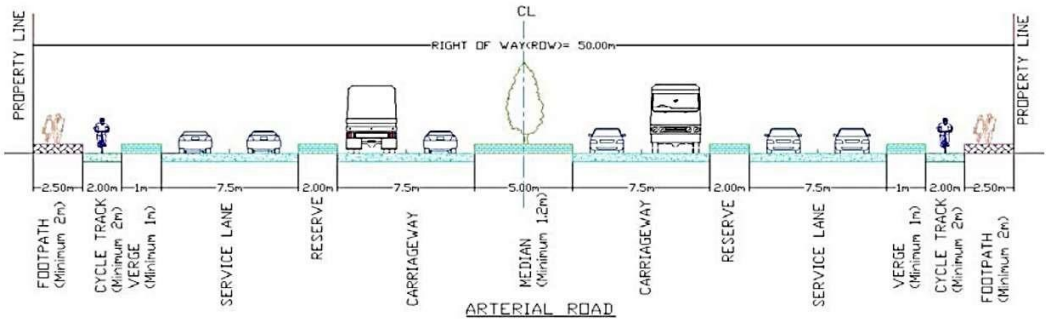


Figure 2 : Arterial Road section option 1

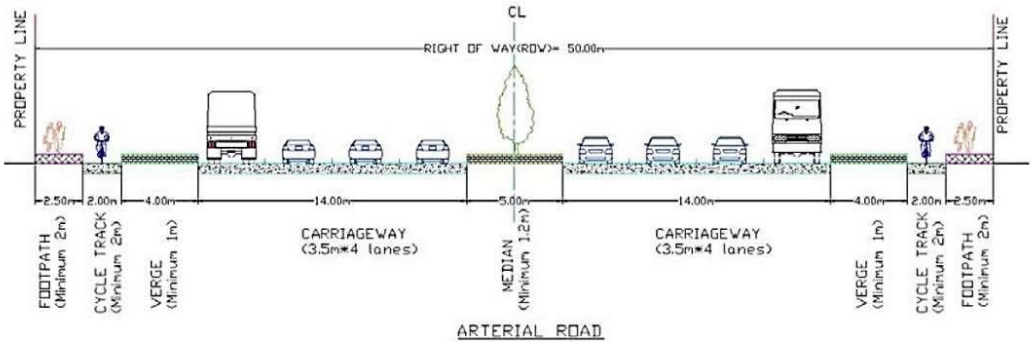


Figure 3: Arterial Road section option 2

ii) Sub Arterial Road Sections

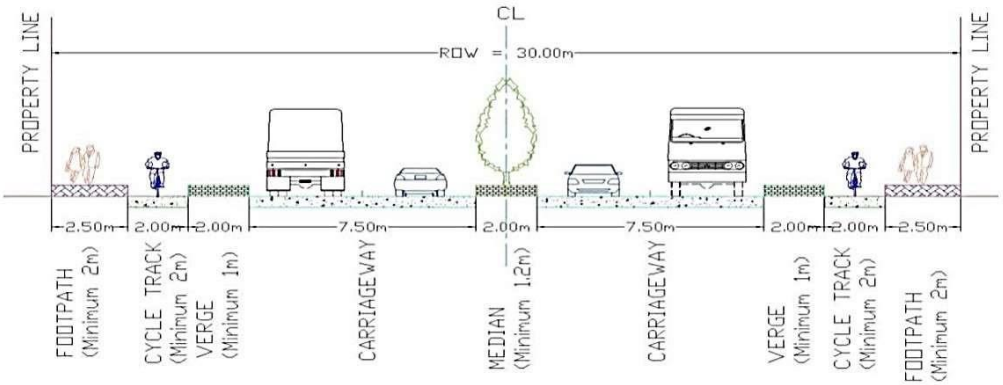


Figure 4: Sub-Arterial Road Option 1

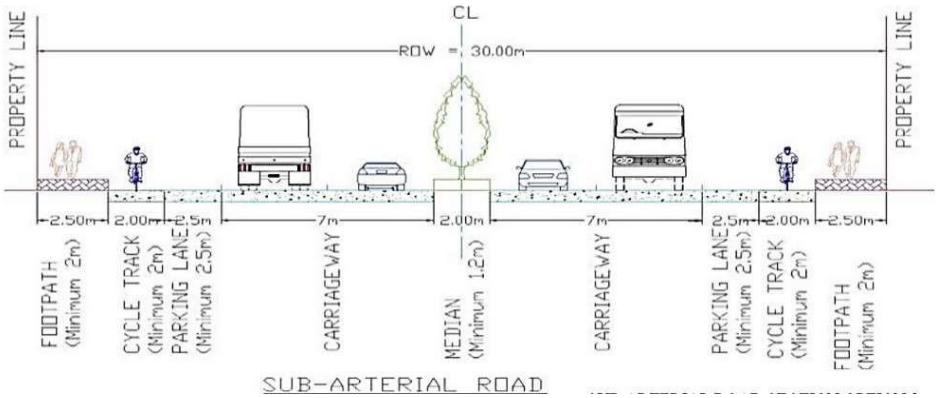


Figure 5: Typical Sub-Arterial Road Option 2

iii) Collector Road Section

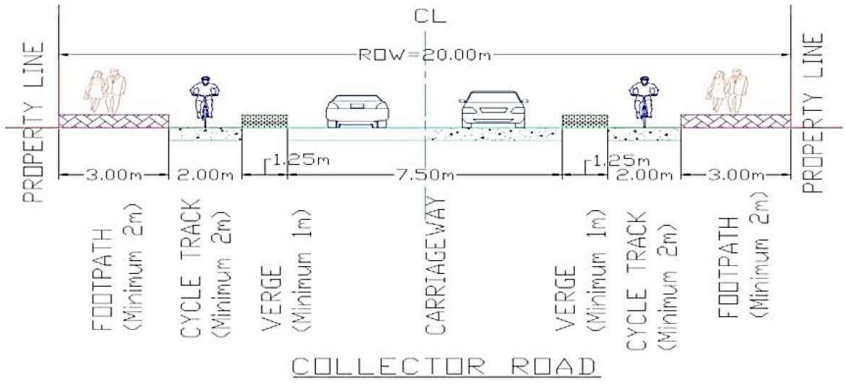


Figure 6: Typical Collector Road Section

iv) Local Road Section

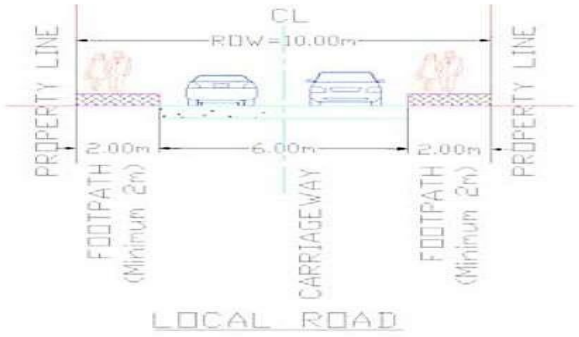


Figure 7: Typical Local Road Section

i) Right of way and Clearances

I. Right Of Way

Right of way for different types of roads shall be as follows:

Table No. 10 Right of way, meters

Road Type	Total Right of way, m
Highways	50
Feeder Roads	30
District Roads	20

II. Lateral Clearances

- For a single carriageway road that goes through an underpass, whole width of the roadway (carriageway plus shoulder widths) should be cleared in lateral direction.

- If footpaths are provided minimum lateral clearance should be width of footpath plus 1.0 m.
- On roads with divided carriageway, left hand side lateral clearance should be as given on (a.) and (b.) above.
- Right hand side clearance should be 2.0 m (desirable) with 1.5m minimum.

III. Vertical Clearances

- A vertical clearance of 5.0m measured from the crown of the road surface shall be provided for whole roadway width on all roads. No obstructions shall be made on this space.
- Vertical clearance for high voltage electric cables from the road surface shall be as shown in Table

Table No. 11 Vertical Clearances for Electric wires and cables

Table No. 2 Voltage, kV	Minimum vertical clearance, m
1	6
110	7
132	7.5
220	8
330	8.5
550	9
720	16

3.11. 3 Sight Distance

The clear distance visible ahead of a driver at horizontal and vertical curves and at intersections governs the safe movements of vehicles.

Three sight distance situations are considered in the design:

i. Stopping sight distance
ii. Safe overtaking or passing sight distance
iii. Safe sight distance for entering into controlled intersection

The standards for sight distance should satisfy the following three conditions:

i. Driver travelling at the design speed has sufficient sight distance or length of road visible ahead to stop the vehicle, in case of any obstruction on the road ahead, without causing collision.

ii. Driver travelling at the design speed should be able to safely overtake the slower vehicles without causing obstruction or hazard to traffic from opposite direction at a certain interval.

iii. Driver entering an uncontrolled intersection has sufficient visibility to enable him/her to take control of his/her vehicle and to avoid collision with another vehicle.

a) Stopping Sight Distance (SSD)

The minimum sight distance available on a highway at any spot should be of sufficient length to stop a vehicle travelling at design speed safely without collision with any other obstruction. The sight distance available on a road to a driver at any instance depends on

- Features of the road ahead
- Height of the driver's eye above the road surface
- Height of the object above the road surface. Stopping distance = Lag distance + Braking distance

  Stopping sight distance = Lag Distance = Braking Distance

$$s = \frac{Vt}{3.6} + \frac{V}{254\emptyset}$$

Table No. 12 Coefficient of longitudinal friction

Table No. 3 Speed(km/h)	Ø
20	0.40
30	0.39
40	0.39
60	0.38
80	0.36
100	0.35
120	0.34

b) Overtaking Sight Distance (OSD)

The minimum distance open to the vision of the driver of a vehicle intending to overtake slow vehicle ahead with safety against opposite direction vehicles is known as the overtaking sight distance or the safe passing sight distance available.

Some of the important factors on which the minimum overtaking sight distance required for the safe overtaking maneuver depends are:

- Speed of a) Overtaking vehicle
  b) Overtaken vehicles
  c) The vehicle coming from opposite direction, if any.
- Distance between the overtaking and overtaken vehicles. The minimum spacing required depends on the speed.
- Skill and reaction time of the driver.
- Rate of acceleration of overtaking vehicle.
- Gradient of the road.

Time components for various maneuvers and corresponding overtaking distances are given below in Table:

Table No. 13 Overtaking Distance Calculation

Speed, km/h	Time Components			Overtaking Distance, m
	For overtaking maneuvers	For opposing vehicles	Total	
40	9	6	15	165
60	10.8	7.2	18	300
80	12.5	8.5	21	470
100	14	9	23	640
120	16	10	26	880

3.11. 4 Vertical Alignment Details

While aligning a highway it must follow the general topography of the land. But the natural ground may be level only at some places and otherwise the ground may have slopes of varying magnitudes. Hence, the vertical profile of a road would have level stretches as well slopes or grades. In order to have smooth vehicle movements on the roads, the change in the grade should be smoothened by the vertical curves.

Followings are important to be considered in vertical alignment:

a) Design of Vertical Curve:

It is necessary to introduce vertical curve at the intersection of different grades to smoothen out the vertical profile because of changes in grade in the vertical alignment of highway and thus ease off the changes in gradients for the fast-moving vehicles. If not so, the drastic change in the rate of grade may subject a vehicle passing over it to an impact, which would be dangerous leading to the loss of property and lives. Hence, the vertical curve contributes to the safety, comfort and appearance.

b) Types of Vertical Curve

- Summit curve
- Valley curve

The length (L) and K-value of vertical summit curve should be selected based on:

- The required visibility of at least stopping distance as given on Table. For this purpose, the driver's eye is assumed to be located at 1.2 m above the road surface and any object lying on the roads surface to be 0.15m high.
- The required visibility of at least overtaking distance as given on Table or twice the stopping distance. For this purpose, the driver's eye is assumed to be located at 1.2 m above the road surface.
- Minimum length of summit curve from the consideration of stopping distance is to be found as follows:

  When stopping sight distance (S) is less than L

  $$L = \frac{\quad}{(\quad)}$$

  When stopping sight distance (S) is more than L

  $$L = 2S - \frac{(\sqrt{\quad}\ \sqrt{\quad})}{\quad}$$

  Where,

  L = Length of summit curve, m

  A = Algebraic difference in approach grades, %

  S = stopping distance, m

  h_1= height of driver’s eye above the pavement surface, m (taken as 1.0m)

  h_2 = height of object above the pavement surface, m (taken as 0. lm)

- Minimum length of summit curve from the consideration of overtaking distance and twice the stopping distance is to be found as follows:

  When overtaking distance or twice the stopping distance (whichever is higher(S) is less than L

  L = $\frac{\quad}{\sqrt{\quad}\ \sqrt{\quad}}$ i.e L = $\frac{\quad}{(\quad)}$

  When stopping sight distance (S) is more than L

  L = 2S - $\frac{(\sqrt{\quad}\ \sqrt{\quad})}{\quad}$ i.e L= 2S -

3.11. 5 Horizontal Curve

a. Radius of horizontal curve is selected based on the following criteria:
   - The centrifugal force developed on the vehicle negotiating a horizontal curve should not be more than the balancing force of friction and superelevation.
   - The vehicle should be stable against overturning.
   - The road should be visible to a sufficient distance that is illuminated in a horizontal plane by the headlight of the vehicle during night driving time.
   - The visibility of the road ahead should not be obstructed by objects on the inner side of the horizontal curve.
   - The wear and tear of vehicle tires should be minimum.
   - Passengers and drivers of the vehicle should not feel excessive lateral force from the view point of comfort of travel.
b. Among all above criteria the first one usually governs in the road design.
c. Radius of horizontal curves is decided in such a way that the centrifugal force acting on the vehicle is balanced by superelevation and side friction.
d. Basic equation for finding the radius of horizontal curve from the condition of equilibrium of centrifugal force, superelevation and friction is given below:

   R = $\frac{\quad}{(\quad)}$

   Where,

R = radius of horizontal curve, metres

V = design speed in km/h e = Superelevation provided

f = coefficient of lateral friction, depends on the speed

Table No. 14 Coefficient of lateral friction

Table No. 4 Speed (km/h)	f
120	0.09
100	0.12
80	0.14
60	0.17
40	0.23
30	0.28
20	0.33

e. Radius of curve calculated from the above consideration usually gives a very sharp curve. As a consequence, passengers travelling on such curves experience discomfort with high lateral force acting on their body.

f. So, where site conditions permit it is recommended that radius of horizontal curve be decided based on the lateral force acting on the passenger caused by the centrifugal force thereby limiting the ratio of lateral to vertical forces to 0.15.

g. From the consideration of passenger's comfort

R = ___

R= Radius of Horizontal Curve, m

V = Design speed in km/h

Elements of horizontal curves are as follows:

- Tangent Length (T): The length between the beginning of the curve or end of the curve and the point of intersection is called the tangent length. It depends on the deflection angle and radius of the curve given by the relation T=R tan (Δ/2).

- Length of Curve (L): The length of curve from the point of commencement to the point of tangency is called length of the curve. If the curve is designated by its degree of curvature, the length of the curve will depend upon the criteria used for the definition of the degree of curve given by relation L= πRΔ/180.
- Length of Chord (l): It is the chord joining the point of curve with the point of tangent or point of curve itself.
- Deflection Angle (Δ): The angle between which a survey line makes with the prolongation of the proceeding line is called deflection angle. It is measured to the clockwise or anticlockwise from the prolongation of the previous line. Its value ranges from 0°-180°.
- Radius of Curve(R): For the certain speed of vehicle, the centrifugal force is dependent on the radius of the horizontal curve. To keep the centrifugal ratio within low limit the radius of the curve should be kept correspondingly high. According to the NRRS2055, the minimum radius to be adopted is 15m.

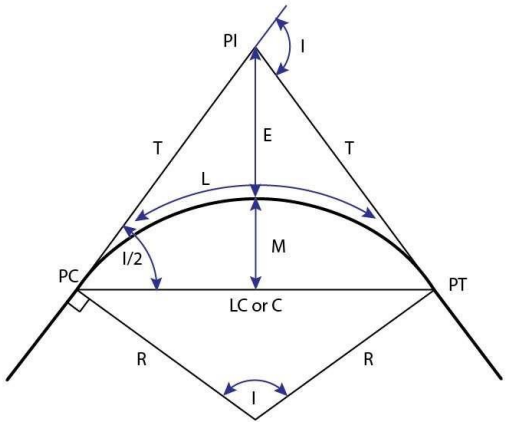


Figure 8: Horizontal curve

- Apex Distance (E): It is the distance between the points of intersection to the middle of curve length. It also depends in the deflection angle and radius of the curve.
- Bearing of Line: The bearing of line is the angle made by that line with respect to the magnetic north direction. It is also known as whole circle bearing (WCB).

Radius of Horizontal Curve

For the certain speed of vehicle, the centrifugal force is dependent on the radius of the horizontal curves. To keep the centrifugal ratio within a low limit the radius of the curve should be kept correspondingly high. The centrifugal force which is counteracted by the super elevation and lateral friction is given by the relation,

e + f = __

0.07 + 0.15 = __ (Where e = 0.07 maximum allowable superelevation rate)

0.22 = __ (f = 0.15, design coefficient of lateral friction)

If the design speed is decided for a highway, the minimum radius to be adopted can be found from the above relationship. Thus, the ruling minimum radius of the curve for ruling design speed v m/sec or V, Kmph is given by:

$$R \quad \frac{V}{(e+f)g}$$

Also,

$$R \quad \frac{V}{127(e+f)g}$$

Where, v and V = ruling design speeds in m/sec and Kmph respectively

e = rate of super-elevation

f = design value of transverse skid resistance or coefficient of friction taken as 0.15

g = acceleration due to gravity = 9.8 m/s^2

- Widening of Pavement on Horizontal Curve

  Especially on horizontally curves, when they are not of very large radii, it is common to widen the pavement slightly more than the normal width. The widening is introduced gradually, sta1ting from the beginning of the transition curve or the tangent point progressively increased at the uniform rate, till the full value of designed widening is reached. Total widening 'We' is reached at the end of transition curve where full value of super elevation is provided.

Mechanical widening (W_m) = ___

Psychological widening (W_{ps}) = $\frac{V}{9.5\sqrt{R}}$

Total widening (W_e) = Mechanical widening (W_m) + Psychological widening (W_{ps})

$= W_m + W_{ps}$

Where, n = number of traffic lanes.

l = Length of wheelbase of longest vehicle, m. The value of l is normally taken as 6.1m or 6.0 m for commercial vehicle.

V = design speed, Kmph.

R = radius of horizontal curve.

Transition Curve

A non- circular curve introduced between a straight and a circular curve, is known as transition curve. The curvature of such curves varies from zero as its beginning to a definite value at its junction with the circular curve.

The function of transition curves in the horizontal alignment of the highway may be summed up into the following points:

- To introduce gradually the centrifugal force between the tangent point and the beginning of the circular curve, avoiding a sudden jerk on the vehicle.
- To enable the driver tum the steering gradually for his own comfort and security.
- To enable gradual introduction of the designed super-elevation and extra widening of pavement at the start of the circular curve.
- To improve the aesthetic appearance of the road.

Calculation of the length of transition curve

The length of transition curve is designed to fulfill following three conditions:

- Rate of the change of centrifugal acceleration to be developed gradually.
- Rate of the introduction of the designed super-elevation to be at reasonable rate.
- Minimum length by IRC empirical formula.

Rate of the change of centrifugal acceleration (C)

$C = \frac{\quad}{\quad}$ (m/sec^3)

The length of transition curve L_s

$L_s = \frac{\quad}{\quad}$

Where,

L_s = Length of transition curve, m

R = radius of the circular curve, m

C = allowable rate of change of centrifugal acceleration m/sec^3

$C = \frac{\quad}{\quad}$ m/sec^3 [$0.5 < C < 0.08$]

Rate of introduction of superelevation

$L_s = \frac{\quad}{\quad} = \frac{\quad}{\quad}(W + W_e)$; If the outer edge is rotated about the centre line.

$L_s = EN = eN(W+W_e)$; If pavement is rotated about the inner

edge. Where, L_s = Length of transition curve, m e = rate of

superelevation in %

$E = e\ (W+We)$

W_e = extra widening provided at the circular curve

N = 150 in plain rolling terrain and 60 in hilly terrain

By empirical formula

a) For plain and rolling terrain

$L_s =$ V= Velocity in Kmph

b) For hilly and steep terrains

$L_s =$ V= Velocity in Kmph

Grade Compensation on Horizontal Curves

When a sharp horizontal curve is to be introduced in a certain section of the road, which has already maximum permissible gradient, then the longitudinal gradient should be corrected and reduced to compensate the loss of tractive effort due to various reasons. Some of them are:

a) Increased rolling resistance

b) Increased grade resistance

c) Increased air resistance

Due to the turning angle of vehicles, the curves resistance is developed at the horizontal curves. When there are horizontal curves in addition to the gradient, there will be increased resistance to traction due to both gradient and curves; it is necessary that in such cases, the total resistance due to grade and curve should not exceed the resistance due to the maximum value of gradient specified. For design purpose, this maximum value may be taken as the ruling gradient and in some special cases as limiting gradient for the terrain. When the sharp horizontal curve is to be introduced on a road, which has already the maximum permissible gradient, the gradient should be decreased to compensate for the loss of tractive effort due to the curves.

This reduction in gradient at the horizontal curve is called grade compensation. This is calculated from the relation:

Grade compensation, % = ____ , subject to a maximum value of __

Where,

R = Radius of circular curve, m

The grade compensation is not required for the curves flatter than 4% gradients.

3.11. 6 Intersection Elements

Design of road intersection with facilities for safe and efficient traffic movement needs adequate knowledge of traffic engineering.

3.12 Highway Drainage

3.12. 1 Introduction

Highway drainage is the process of removing and controlling excess surface and sub-soil water within the right of way. This includes interception and diversion of water from the road surface and sub-grade. Highway drainage is achieved by two methods as given below.

a) Surface drainage.

The surface water is to be collected and disposed of. The water is first collected in longitudinal drains, generally side drains and then the water is disposed of at the nearest stream, valley or water course. Cross drainage structures like culverts and

small bridges may be necessary for the disposal of surface water from the road side drains.

b) Sub-surface drainage.

Sub-surface drainage involves removal of excess water from the sub soil. The sub surface drainage implies:

- Lowering of water table.
- Control of seepage flow. Control of capillary rise.
- Drainage of infiltration water.

3.12. 2 Importance of Highway Drainage

Followings are the importance of highway drainage:

a. It maintains the bearing capacity of soil.
b. It removes water from flowing or standing on the carriageway.
c. It prevents from failure of pavement.
d. It reduces necessity of maintenance cost.
e. It provides safety travel in place of freezing temperature.
f. It prevents mud pumping pavement failure

3.12. 3 Side Drains

Side drains are meant for the drainage of the surface water these are provided on the both side of the road to drain off the surface water from the carriageway. The longitudinal slope of drain is made parallel to the longitudinal slope of the alignment.

3.12. 4 Design of Surface Drainage System

Design of surface drainage system involves:

a. Hydrologic analysis
b. Hydraulic analysis

a) Hydrologic analysis

The peak runoff is calculated by rational formula:

$Q = CIA$

Where, Q = Runoff in m^3/s.

C = Runoff Coefficient.

I = Rainfall intensity, mm/hr. A

= Catchment area in hectares.

b) Hydraulic analysis

Once the design discharge is determined the hydraulic analysis is done. The side drains are designed based on principle of open channel flow. Longitudinal slope of channels, which is parallel to road profile is selected. The type of lining from which value of 'n' and permissible 'V' is obtained is selected.

Then,

Q = A x V

$Q = \_ AR^{/} S^{/}$ …… (1)

For the rectangular section, select economical section as,

R = D/2, B= 2D

Solve equation (1) to get B and D

Calculate V by

$V = (R^{2/3} x S^{1/2})/n$ for the design section which should be within the permissible limit otherwise change lining material and redesign the section

Where,

V= velocity of flow, m/sec

N= Manning's roughness coefficient

A= Area, m^2

R= Hydraulic Radius = A/P, m

P= wetted perimeter, m

S= Longitudinal bed slope of channel

3.12. 5 Cross Drainage Structure

There are number of cross drainage structure is to be constructed in order to drain off the water from the side drain. One of the important cross drainage structures in the road aliment is culvert.

a. Culvert

A culvert is a closed conduit placed under the embankment to carry water across the roadway. Culvert is preferred than a minor bridge because it is hydraulically more

efficient. According to Nepal Road Standard 2027; bridge structures of span less than 6 m are termed as culverts.

Following are important type of culverts:

- Slab Culvert: A slab is placed over abutments made of masonry, sometimes called box culverts if the span is below two meters.
- Pipe Culvert: Pipe of minimum diameter 60 cm and made of steel or pre-cast RCC is used when the discharge is low. But, pipe culverts of diameter 75 cm, 90 cm, 120 cm are available in the market.

b. Causeway:

These are structures provided with hill road which allows draining off water flowing over the road surface to the lower level safely. Generally, for stability and durability consideration RCC cause ways are used rather than dry stone cause ways.

3.13 Retaining Structure

3.13. 1 Introduction

Retaining wall is that type of wall, which is used to retain the vertical mass of soil. The primary function of retaining wall is to resist the lateral thrust of a mass of earth on one side and sometime the pressure of subsoil, water and in many cases the wall may also be required to support vertical loads form a structure above call surcharge.

Functional Requirements of Retaining Structures:

Retaining structures must specially satisfy the important requirements as below:

- Strength and stability
- Durability

The retaining structures must not

- Slide
- Overturn
- Overstress the materials of which the structures are constructed
- Overstress the soils in which the wall rest

3.13. 2 Types of Retaining walls

a) Cantilever retaining walls
b) Gravity Retaining walls (Mass retaining walls)

Considerations of following elements are important in the design of retaining wall:

a) Active Earth Pressure:

Lateral pressure, which tends to move or overturn the wall at all, times and this is result of the earth wedge being retained together with any hydrostatic pressure caused by the pressure of ground water.

b) Passive Earth Pressure:

Reactionary pressure that builds up to resist any forward movement will comprise the soil in front and relation to counteract this movement.

c) Angle of Repose:

It is the natural slope taken by any soil and it is given in terms of the angle to the horizontal base line. Angle of repose varies from 45 degree to O degree for wet clay but for most of soil angle of repose is nearly about 30 degrees.

d) Wedge of Soil:

It is the mass of soil resting on the upper plane of the angle of repose.

e) Surcharge Load:

The part of the material or load supported by a retaining wall at a level above the top level of the wall may be by virtue of its nature of position.

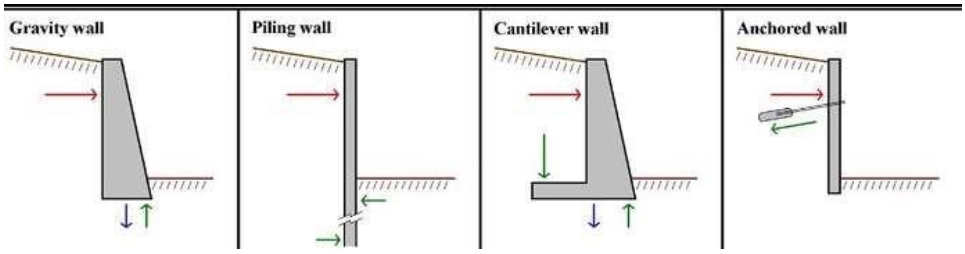


Figure 9: Different types of retaining wall

Survey Information and Design Consideration for Retaining Walls

Retaining walls help to support mountainside slopes, or support the road or slope segments from the valley side. They are designed to stop an active earth pressure. Toe walls are normally considered to be a type of retaining wall found are the base of a slope or segment of slope which have the outer slope 1 in 10 and bed slope is 1 in 4.

Practical features:

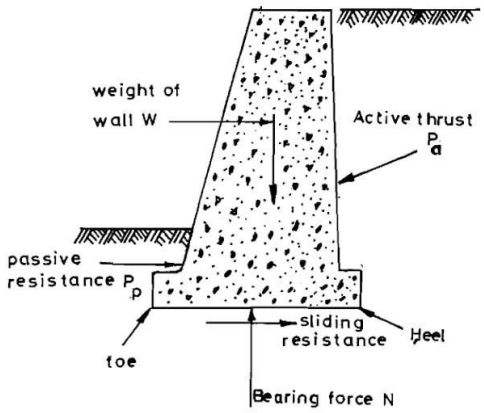


Figure 10: Different forces on retaining wall

- Use dry masonry in every case where it is applicable (see special features of dry masonry walls below). Only use other types of walls when you are certain you need greater strength and can justify the additional cost.
- The top width of the retaining wall should not be less that 60cm for stone masonry
- The back should be left rough or built in steps to increase friction between the wall and the backing.
- The backfill should be deposited in 10 cm to 15 cm layers with moderate compaction sloping downward from the wall to reduce lateral pressure after the wall has attained sufficient strength. '
- The foundation should be taken deep enough to safeguard against weather and should be at least h/10 +30 cm below the ground level.
- The projection of any footing course should not exceed half the depth of course
- Careful design and supervision of foundations are of paramount importance
- While excavating foundations, remove debris to a safe location. Do not allow to be thrown down the slope.
- In most locations, solving the drainage problem is a major difficulty. Therefore, consideration should always be given to using the best drained of structures. Once the construction is complete ensure that the slopes around the structure are tidied up and treated using appropriate bioengineering measure. All surplus debris must be removed, or it will encourage the development of erosion.

3.14 Miscellaneous Works

3.14. 1 Bio-engineering

Bioengineering systems work by fulfilling the engineering functions required for the protection and stabilization of slopes. It is not a substitute for civil engineering even though it offers a set of tools to complement those already available in solving a range of shallow slope problems.

Bioengineering plays one or more roles of catching debris, armoring the surface, reinforcing the soil, anchoring the surface layer, supporting the slope or draining the material. Bioengineering serves two distinct roles providing additional techniques for stabilizing shallow failures and controlling erosion and enhancing civil engineering structures by protecting them and maximizing their effectiveness.

In the context of Nepal, Bioengineering plays an important role because of the conditions like the active geomorphology, steep slopes in mountains, intense rainfall, restricted economy, etc. So, Bio-engineering should be used more widely in Nepal on account of the extreme terrain conditions and the need for extensive low-cost techniques for protecting slopes and stabilizing shallow-seated failures.

3.14. 2 Traffic control device

The devices used to control, guide or direct the traffic is known as traffic control devices. Types of traffic control device:

- Traffic sign
- Traffic signal
- Road markings
- Island

a) Traffic sign

There are 3 types of traffic sign:

- Regulatory sign
- Warning sign
- Informatory sign

  Traffic signs are installed at appropriate distance and appropriate number according to the chapter 7 of the Vehicle Road Transportation Management Act 2049

b) Traffic Signals

Traffic signals are the power operated control device or sign which direct and guide the user. Types of traffic signals are as follows:

- Fixed time signals
- Manually operated signals
- Automatic signals

  Traffic signals are not yet necessary fo this road section as there is less traffic and busy intersections.

c) Road Markings

Road markings or traffic markings consists of lines, symbols, patterns, letters, reflectors to guide and direct the road users. It also acts as a psychological barrier.

Types of road markings:

- Pavement Marking
- Kerb Marking
- Object Marking
- Reflector Unit Marking

3.14. 3 Maintenance

Measures adopted to keep the pavement surface in serviceable condition as long as possible and as best as practicable is known as maintenance.

Classification of maintenance:

- Routine Maintenance
- Recurrent Maintenance
- Periodic Maintenance
- Emergency Maintenance

During inspection, various defects are found and they must be maintained. The maintenance of all defects may be affected due to limited fund. So the maintenance activities must be prioritize.

 Strengthening of Pavement

Strengthening of pavement is done by providing additional thickness whenever required. In partially damaged road, patch repair work should be done before the

overlay. For our road section, flexible over flexible overlay can be done considering the damaged condition for strengthening of pavement in the future.

4. METHODOLOGY

4.1 General

After selecting the proposed project area, detailed survey was carried out using total station level machine, OPS. Socio-economic status, geological and demographic data of the area was collected. The temperature, rainfall, vegetation, climate, of the area were studied which arc important for analysis of hydrological data. After the complete analysis of data obtained from survey decision of alignment was made, engineering survey was done along the proposed alignment considering several geometrical parameters according to NRS 2070. Collection of several primary data such as type of the soil at different chainage, buildings, type of crop production and co-ordinates (x,y,z) was done during engineering survey. Cost estimate of the proposed road alignment was made considering various types of works to be carried out during road construction with the help of Road Design Software, Autodesk Civil 3D, Autodesk and Excel program.

4.2 Tools and Equipment's used in Survey

Following tools and equipment's were used in conducting the survey:

- Compass
- Measuring tape
- GPS
- Level machine
- Total station
- Reflector
- Hammer
- Concrete blocks
- Paint and Brush

4.3 Feasibility

The proposed road section is an existing road with traffic movement in current date and quite important for the improvement of lifestyle of the people of the ward. Municipality is seeking to develop this area after looking at its huge potential of growth and has offered us the preliminary job. Hence the project is feasible.

4.4 Engineering Design

The geometric parameters were adopted following the NRS (2070) guidelines and chosen on the basis of comfort, safety and minimal construction and maintenance cost after finalizing the road classification. The vertical alignment was designed to obtain an optimum balance of cut and fill (earth work) while minimizing the optimum embankment filling in the plain and rolling terrain insuring its stability. The locations of key points of vertical alignment such as beginning of curve, middle of curve, and end of curve, highest and lowest points was fully defined with respect to the designed points of vertical intersection. Cross-sectional parameters such as extra widening, superelevation, and camber was provided according to NR (2070). Adequate provisions for retaining wall, gabion wall, cross and side drams was made to ensure safety of road.

Road Design Software (SW Road V2) was used for the computation of field data which also facilitate in the preparation of various drawings and design such as:

- Plan of Survey alignment showing the key structures within road corridor.
- Horizontal and Vertical alignments showing all design parameters with the conformity of road design standards.
- Cross-sections at given interval including retaining structures, drainage type as recommended.
- Computation of cut-fill quantity to access the estimation of earth work.

4.5 Engineering Drawings

The drawings were prepared using Road Design Software (AUTODESK CIVIL 3D). For the implementation of detailed design works of the project following drawings are produced:

- Plan in I: 5000 scale containing alignment, curve data and indicating surrounding features in the Road corridor.
- Profile at 1:5000 scale indicating existing ground situations, proposed designs and indicating length and type of drains.
- Cross-sections incorporating structures at 1:1000 scale at all centerline pegs with existing ground situations, proposed designs and data such as existing ground level, area of cut, area of fill, soil type and drain type etc.

4.6 Software used

SW Road V2 is used. One of the greatest tools for drawing the plan and profile of the suggested road alignment, as well as the cross-section at the necessary intervals, is SW Road V2. Using this app is quite simple. This software is often used for designing roadways. An excel sheet contains the survey data that was collected using a total station. The longitudinal profile of the current ground is then produced by this software, and using this profile, alignment may be adjusted in relation to the average maximum gradient while taking the volume balance of the cut and fill into account.

After entering co-ordinates, type of drain, side slope of drain, right of way, shoulder width, carriageway width, type of soil, cross-section interval, scale of drawing, the output can be achieved in required format of cross section, plan and profile in SW Road V2. This software gives the quantities required for various structures like gabion retaining wall, gabion breast wall. It also gives the data for horizontal curve and vertical curve in excel sheets. Cross section, plan and profile of road alignment from SW Road V2 can be plotted easily.

5. ENGINEERING STUDY AND INVENTORY SURVEY

5.1 General

Following field surveys and investigations have been carried out for the project roads to determine the appropriate outputs for design and project preparation.

1. Road Inventory Survey
2. Geological and Geo-technical Survey
3. Traffic Count Survey
4. Hydrological and Meteorological Survey
5. CBR test of Soil sample

5.2 Road Inventory Survey

Field surveys have been carried out to record road inventory details of the project roads. Following surveys have been carried out:

- Existing structure survey
- Cross drainage requirement survey
- Retaining work requirement survey

Table No. 15 Initial and Termination point

Table No. 5 Initial point	Termination point
Haku Falcha, Bhaktapur municipality, Bhaktapur	Mandev marg, Duwakot, Changunarayan municipality, Bhaktapur
0+000	2+590

5.2. 1 Land Use Pattern

Table No. 16 Land Use Pattern

Legend: FA- Forest Area, MA- Market Area, SA- Settlement Area, AL- Agricultural land, IA- Industry present Area				
SN	Chainage	Length	Land Use pattern	Remarks

	From	To	(m)	Side	FA, MA, SA, AL, IA	
1	0+000	0+040	40	Left	SA	
2	0+040	0+120	80	Left	AL	
3	0+120	0+200	80	Left	SA	
4	0+200	0+340	140	Left	AL	
5	0+340	0+540	200	Left	IA	A factory located adjacent to the road
6	0+540	0+730	190	Left	AL	
7	0+730	0+840	110	Left	IA	Brick factory adjacent to road
8	0+840	0+960	120	Left	AL	
9	0+960	1+120	160	Left	SA	
10	1+120	1+470	350	Left	AL	
11	1+470	2+220	750	Left	SA	
12	2+220	2+560	340	Left	AL	
13	0+000	0+040	40	Right	SA	
14	0+040	0+130	90	Right	IA	A factory located adjacent to the road
15	0+130	0+200	70	Right	SA	
16	0+200	0+460	260	Right	AL	
17	0+460	0+880	420	Right	SA	
18	0+880	1+030	150	Right	AL	
19	1+030	1+760	730	Right	SA	
20	1+760	2+400	640	Right	AL	
21	2+400	2+589	189	Right	SA	End point of road site

5.2. 2 Existing Condition of Road Structures:

Table No. 17 Existing Road Site Conditions

S.No.	Chainage	Length(m)	Condition	Remarks

1	0+100	100	Unpaved	Earthern Road
2	0+200	100	Unpaved	Earthern Road
3	0+300	100	Unpaved	Earthern Road
4	0+400	100	Unpaved	Earthern Road
5	0+500	100	Unpaved	Earthern Road
6	0+600	100	Unpaved	Earthern Road
7	0+700	100	Unpaved	Earthern Road
8	0+800	100	Unpaved	Earthern Road
9	0+900	100	Unpaved	Earthern Road
10	1+000	100	Unpaved	Earthern Road
11	1+100	100	Unpaved	Earthern Road
12	1+200	100	Unpaved	Earthern Road
13	1+300	100	Unpaved	Earthern Road
14	1+400	100	Unpaved	Earthern Road
15	1+500	100	Unpaved	Earthern Road
16	1+600	100	Unpaved	Earthern Road
17	1+700	100	Unpaved	Earthern Road
18	1+800	100	Unpaved	Earthern Road
19	1+900	100	Unpaved	Earthern Road
20	2+000	100	Unpaved	Earthern Road
21	2+100	100	Unpaved	Earthern Road
22	2+200	100	Unpaved	Earthern Road
23	2+300	100	Unpaved	Earthern Road
24	2+400	100	Unpaved	Earthern Road
25	2+500	100	Paved	Black Topped
26	2+600	100	Paved	Black Topped

5.3 Pavement Design

The stable and non-yielding layer constructed over natural soil is the soil pavement. The objective of laying a pavement is to support the wheel load and transfer load

stresses over a wide area on the soil subgrade such that the magnitude of stresses transferred are considerably lower. The pavement is designed such that vehicles can travel at design speed without discomfort. The pavement structure typically consists of the following layers: prepared soil subgrade, granular sub-base course, base course and surface course.

Based on structural behavior, road pavements are generally classified as:

1. Flexible pavement
2. Rigid pavement

- Flexible pavement

The pavements which have low or negligible flexural strength and are rather flexible in their structural action under the loads are called flexible pavements. The lower layer of flexible pavements reflects the deformation up to the surface of the layer. The typical flexible pavement structure consists of a wearing surface at the top, the base course followed by sub-base course and the lowermost layer of compacted soil.

- Rigid Pavement

The pavement which possesses noteworthy flexural strength or flexural rigidity is rigid pavement. The rigid pavements are made up of plain reinforced or prestressed concrete. The rigid pavement has the 'slab action' which transmits the wheel load through a much wider area. Rigid pavement structure consists of a cement concrete slab, below which granular sub-base or base course over the subgrade soil.

5.3.1 CBR Test

The California Bearing Ratio or CBR test is performed in construction materials laboratories to evaluate the strength of soil subgrades and base course materials. Those who design and engineer highways, airport runways and taxiways, parking lots, and other pavements rely on CBR test values when selecting pavement and base thicknesses.

Standard Proctor test for determination of optimum moisture content

Sample -1 at chainage 0+0500m

S.No.	Observations and Calculations	1	2	3	4	5
1	Mass of empty mould+ base plate(gm)	4140	4140	4050	4140	4050
2	Mass of mould+ base plate+ compacted soil (gm)	6008	6142	6046	6072	6006
3	Mass of compacted soil (gm)	1868	2002	1996	1932	1956
4	Bulk density (gm/ml)	1.868	2.002	1.996	1.932	1.956
5	Water content (%)	14.815	17.949	20	23.423	26.364
6	Dry density (gm/ml)	1.627	1.6973	1.6633	1.5653	1.5479
	Water content					
7	Mass of empty container	20	20	20	20	20
8	Mass of container+ soil	182	176	140	242	240
9	Mass of soil	162	156	120	222	220
10	Mass of container+ dry soil	158	148	116	190	182
11	Mass of dry soil	138	128	96	170	162
12	Water content (%)	14.815	17.949	20	23.423	26.364

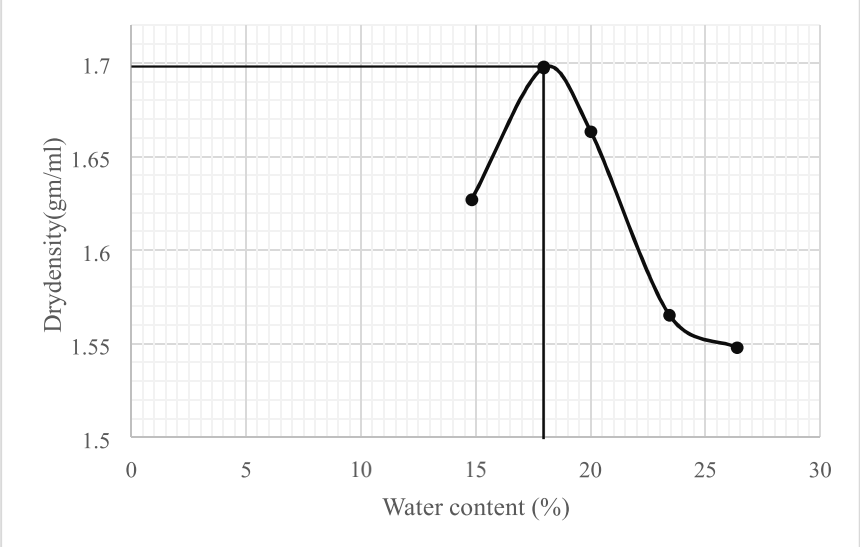


Figure 11: OMC vs MDD curve for sample 1

From figure, OMC =17.95% MDD = 1.698 gm/ml Sample-2 at change 1+250m

S.N.	Observations and Calculations	1	2	3	4	5
1	Mass of empty mould+ base plate(gm)	4050	4050	4050	4050	4050

2	Mass of mould+ base plate+ compacted soil (gm)	5968	6010	5960	5950	5960
3	Mass of compacted soil (gm)	1918	1960	1910	1900	1910
4	Bulk density (gm/ml)	1.918	1.96	1.91	1.9	1.91
5	Water content (%)	17.204	18.018	20.089	22.26	23.81
6	Dry density (gm/ml)	1.6365	1.6608	1.5905	1.5541	1.5427
	Water content					
7	Mass of empty container	20	20	20	30	20
8	Mass of container+ soil	206	242	244	322	272
9	Mass of soil	186	222	224	292	252
10	Mass of container+ dry soil	174	202	199	257	212
11	Mass of dry soil	154	182	179	227	192
12	Water content (%)	17.204	18.018	20.089	22.26	23.81

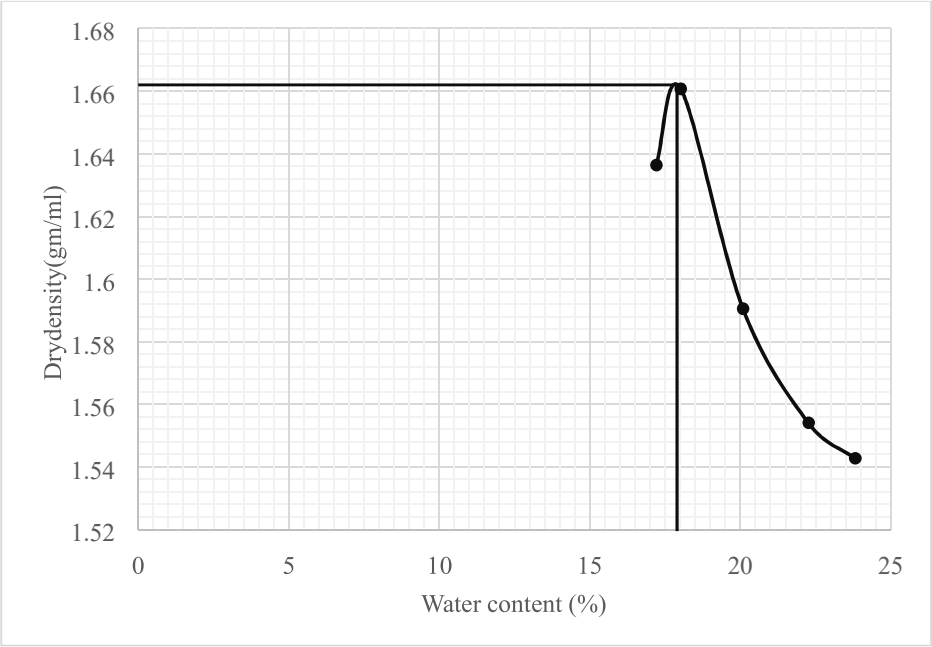


Figure 12: OMC vs MDD curve for sample 2

From figure, OMC =17.90% MDD = 1.662 gm/ml

Sample-3 at chainage 2+000m

S.No.	Observations and Calculations	1	2	3	4	5	6
1	Mass of empty mould+ base plate(gm)	4050	4050	4050	4050	4050	4050

2	Mass of mould+ base plate+ compacted soil (gm)	5833	5904	5910	5912	5916	5900
3	Mass of compacted soil (gm)	1783	1854	1860	1862	1866	1850
4	Bulk density (gm/ml)	1.783	1.854	1.86	1.862	1.866	1.85
5	Water content (%)	15.789	18.75	20.472	22.36	23.913	25.694
6	Dry density (gm/ml)	1.5399	1.5613	1.5439	1.5217	1.5059	1.4718
	Water content						
7	Mass of empty container	30	30	20	20	20	22
8	Mass of container+ soil	220	222	274	342	204	310
9	Mass of soil	190	192	254	322	184	288
10	Mass of container+ dry soil	190	186	222	270	160	236
11	Mass of dry soil	140	156	202	250	140	214
12	Water content (%)	15.789	18.75	20.472	22.36	23.913	25.694

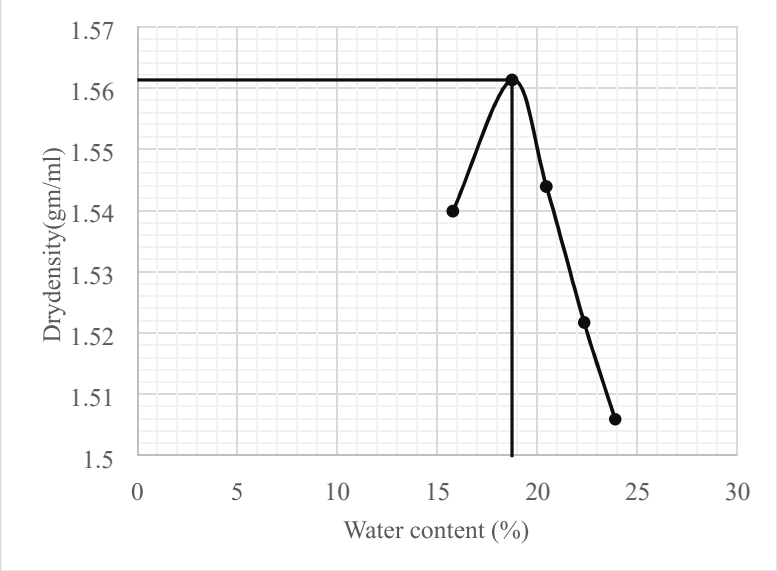


Figure 13: OMC vs MDD curve for sample 3

From figure, OMC =18.75% MDD = 1.561 gm/ml

CBR test

Sample-1

S.N	Penetration (mm)	Load dial gauge	
		Dial gauge reading	Load (kg)
1	0	0	0
2	0.5	1	12.5
3	1	2	25
4	1.5	3.2	40
5	2	4.6	57.5
6	2.5	5.6	70
7	3	7	87.5
8	4	9	112.5
9	5	11	137.5
10	7.5	14.4	180
11	10	16.6	207.5
12	12.5	18.4	230

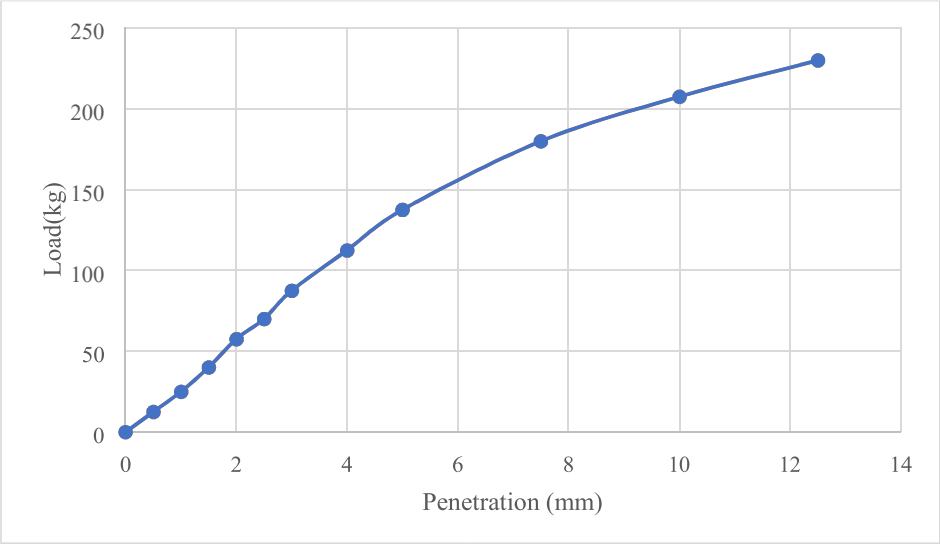


Figure 14: Load vs penetration curve for sample 1

From figure,

CBR at 2.5mm $\frac{}{1370}$ penetration = $\quad * 100 = 5.109\%$

CBR at 5 mm penetration $\frac{137.5}{}$ $= * 100 = 6.69\%$

Since CBR value at 5mm is more than CBR value at 2.5 mm, so the process was repeated.

Sample-1 (repeated)

S.N	Penetration (mm)	Load dial gauge	
		Dial gauge reading	Load (kg)
1	0	0	0
2	0.5	1	12.5
3	1	1.8	22.5
4	1.5	3.2	40
5	2	4.2	52.5
6	2.5	5.4	67.5
7	3	7.2	90
8	4	9.2	115
9	5	11.2	140
10	7.5	14.6	182.5
11	10	16.4	205
12	12.5	18	225

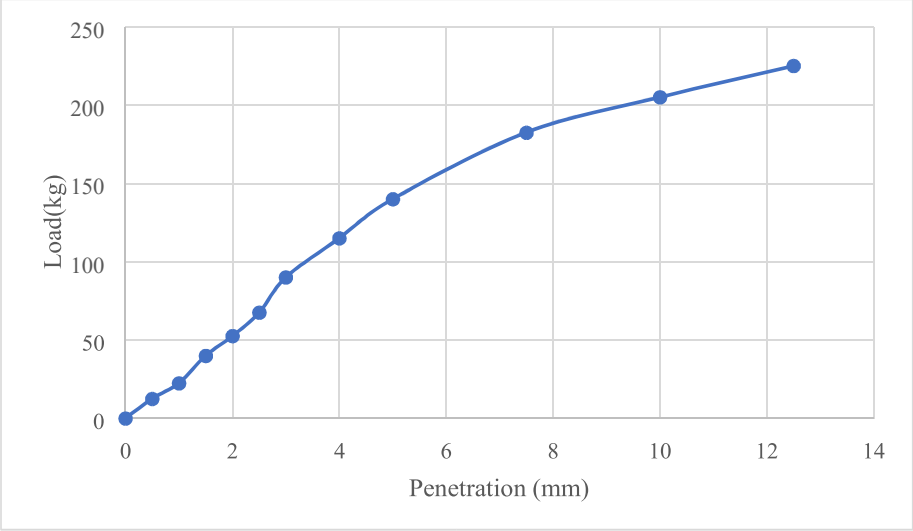


Figure 15: Load vs penetration curve for sample 1 (repeated)

From figure,

CBR at 2.5mm penetration = 4.92%

CBR at 5 mm penetration = 6.81%

Sample -2 (Repeated)

S.N	Penetration (mm)	Load dial gauge	
		Dial gauge reading	Load (kg)
1	0	0	0
2	0.5	1.8	22.5
3	1	2.8	35
4	1.5	3.6	45
5	2	4.6	57.5
6	2.5	5.4	67.5
7	3	6.2	77.5
8	4	7.6	95
9	5	8.4	105
10	7.5	10	125
11	10	11.2	140
12	12.5	12.4	155

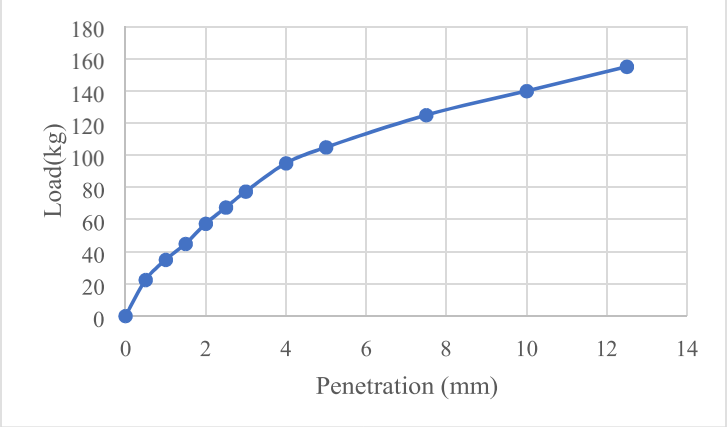


Figure 16: Load vs penetration curve for sample 2

From figure,

CBR at 2.5mm penetration = 4.927%

CBR at 5 mm penetration = 5.109%

Sample-3 (Repeated)

S.N	Penetration (mm)	Load dial gauge	
		Dial gauge reading	Load (kg)

1	0	0	0
2	0.5	1.6	20
3	1	2.8	35
4	1.5	3.4	42.5
5	2	4.4	55
6	2.5	5.4	67.5
7	3	6.4	80
8	4	8	100
9	5	10	125
10	7.5	13	162.5
11	10	14.8	185
12	12.5	16.2	202.5

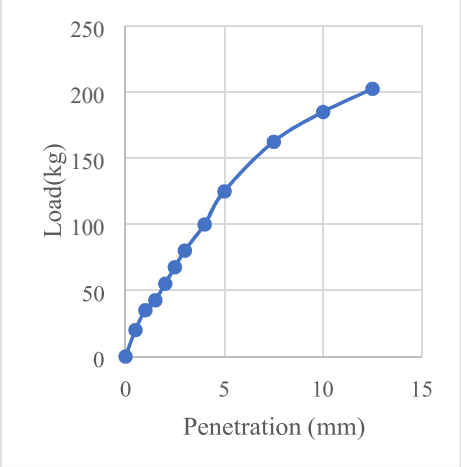


Figure 17: Load vs penetration curve for sample 3

From figure,

CBR at 2.5mm penetration = 4.927%

CBR at 5 mm penetration = 6.082% CBR value at 87th percentile:

S.N.	CBR in descending order	% equal to or greater than
1	6.6909	33.333
2	5.839	66.667

3	5.2311	100

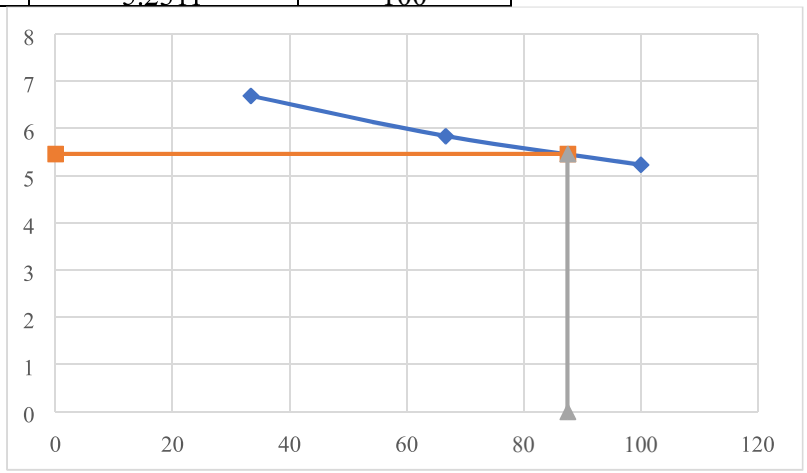


Figure 18: Final CBR value

Thus the CBR value is adopted as 5.459%

5.3.2 Traffic Count:

For highways in Nepal, traffic count surveys are a crucial part of Detailed Project Reports (DPRs). They offer essential information for efficiently organizing, creating, and overseeing transportation infrastructure. To ensure the best possible development and upkeep of road networks, precise traffic count surveys are essential in Nepal due to the country's varied geography and traffic patterns.

The data are as follows:

Table No. 18 Three Day Traffic Count Data

Table No. 6 Type of vehicle	Day 1			Day 2			Day 3			Average
	Toward	Outward	Total	Toward	Outward	Total	Toward	Outward	Total	
Two-wheeler	277	250	527	256	225	481	209	243	452	486.7
Car/Jeep/Van/Taxi	47	54	101	56	53	109	50	53	103	104.3
Bus full	6	6	12	6	6	12	6	6	12	12
Bus mini	2	2	4	2	2	4	2	2	4	4
Truck(2-Axle)	37	40	77	42	37	79	39	35	74	76.67
Water tanker	15	8	23	9	13	22	10	14	24	23
Cycle	10	14	24	15	13	28	14	11	25	25.67
Cycle rickshaw	6	5	11	5	4	7	8	4	12	10
Dozer	3	2	5	4	2	6	1	2	3	4.667
Tractor	14	10	24	11	16	27	14	10	24	25

Total	417	391	808	406	371	775	353	380	733	772

PCU calculation of base year:

Table No. 19 PCU values

S. N	Vehicle Type	Equivalency	Traffic	PCU
1	Motorcycle, Bicycle, Porter	0.5	522.34	261.17
2	Car, Auto Rickshaw, SUV, Light van, Pick	1	104.34	104.34
3	Light (Mini) Truck, Tractor, Rickshaw	1.5	25	37.5
4	Truck, Bus, Minibus, Tractor with trailer	3	115.67	347.01
	Total			751

PCU calculation in the design year

Traffic growth rates shall be established for each category of commercial vehicles. In the absence of data for estimation of the annual growth rate of commercial vehicles a minimum annual growth rate of 5 percent shall be used for commercial vehicles for estimating the design traffic. (Guidelines for the Design of Flexible Pavements-2014 (Second Edition 2021), 2021)

Table No. 20 PCU in Next 20 years

S. N	Vehicle Type	PCU	Growth rate	PCU in next 20 years
1	Motorcycle, Bicycle, Porter	261.17	0.05	692.97
2	Car, Auto Rickshaw, SUV, Light van, Pick	104.34	0.05	276.85
3	Light (Mini) Truck, Tractor, Rickshaw	37.5	0.05	99.5
4	Truck, Bus, Minibus, Tractor with trailer	347.01	0.05	920.73
	Total	751		1990.05

After projecting the traffic for next 20 years, PCU was found to be 1990.05 which is less than 2000 PCU so the road lies in class IV.

5.3.3 Pavement Design methods:

For pavement was designed using Road Note 31, DOR guidelines and IRC-37. Since our road has low volume of traffic, according to DOR, Guidelines for the Design of Flexible Pavements-2014 (Second Edition 2021),

Design period = 10 years

Lane distribution factor for two-lane two-way roads = 50%

In the absence of detail traffic study, annual growth rate (r)= 5%

The axle load survey is not necessary for small projects due to the similar types of commercial vehicles plying on the existing roads. Therefore, after the analysis of recently conducted axle load survey VDF values can be used for the purpose of converting volume of commercial traffic into the number of standard axles for each category of vehicle types. (Guidelines for the Design of Flexible Pavements-2014 (Second Edition 2021), 2021)

Road Note 31

This method is based on structural catalogues. The cells of the catalogues are defined by the ranges of traffic and sub-grade strength.

Key for catalogue:

Traffic classes (MSA)	Subgrade strength classes (CBR %)
T1 ≤ 0.3	S1 = 2
T2 = 0.3 - 0.7	S2 = 3-4
T3 = 0.7-1.5	S3 = 5-7
T4 = 1.5-3.0	S4 = 8-14
T5 = 3.0-6.0	S5 = 15-29
T6 = 6.0-10.0	S6 ≥ 3
T7 = 10-17	
T8 = 17-30	

Calculation of equivalent standard axle load:

Traffic Type	Total no(a)	ESAL factor (b)	a*b	Remarks
Two axle truck	104	4.75	494	Truck, water tanker, dozer
Mini truck	25	1	25	Tractor
Bus	12	0.5	6	Bus full
Mini bus	4	0.05	0.2	Bus mini
Sum			525.2	

Cumulative no. of standard axle (P) = 525.2ESAL/day

Design period (n) = 10 years

Construction period(x) = 2

Annual growth rate (r) = 5%

Lane Distribution Factor= 50%

Cumulative no. of standard axle at base period (A) = $P(1+r)^x$ =579.033

Cumulative number of standard axles at the end of design period (N) = 1329150.21

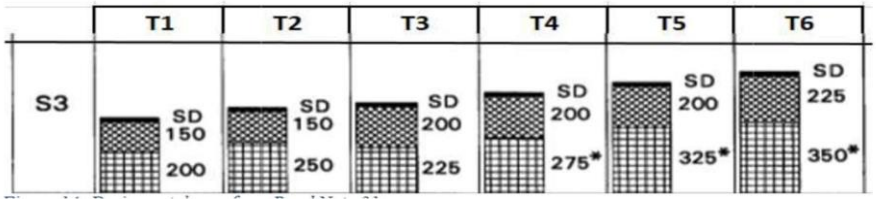
Cumulative number of standard axles at the end of design period ($*10^6$) =1.329msa

From key to structural catalogue,

Traffic Classes=T3

Subgrade strength classes = S3

CHART 1: GRANULAR ROADBASE/ SURFACE DRESSING



Total thickness (mm)	Wearing Course (mm)	Granular base (mm)	Granular Sub-base (mm)
475	50	200	225

IRC: 37-2018

Traffic Type	Total nos
Two axle truck	104
Mini truck	25
Bus	12
Mini bus	4
Sum	145

Indicative VDF values

Initial traffic volume in terms of number of commercial vehicles per day	Terrain	
	Rolling/Plain	Hilly
0-150	1.7	0.6
150-1500	3.9	1.7
More than 1500	5	2.8

No. of commercial vehicles as per last count (P) = 145

Design period (n) =10

Construction period(x) =2

Annual growth rate (r) =5%

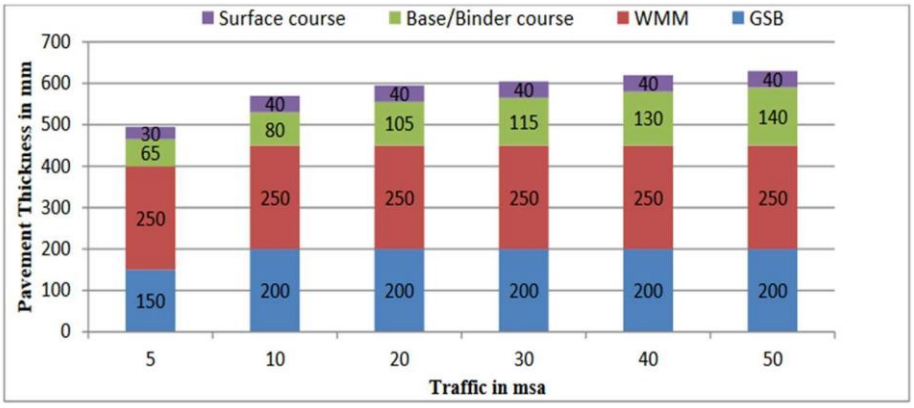
Lane Distribution Factor=50%

Vehicle Damage Factor=1.7

Cumulative no. of standard axle at base period (A) = $P(1+r)^x$ =159.863

Cumulative number of standard axles at the end of design period (N) = 550438

Cumulative number of standard axles at the end of design period ($*10^6$), msa =0.55msa



Total thickness (mm)	Surface Course (mm)	Base/Binder Course (mm)	WMM (mm)	GSB (mm)
495	30	65	250	150

DOR GUIDELINES FOR THE DESIGN OF FLEXIBLE PAVEMENTS-2014

(Second Edition 2021)

Calculation of standard axle load:

Vehicle type	Total no(a)	VDF (b)	a*b
Heavy two axle	104	4.75	494
Mini truck/ tractor	25	1	25
Large bus	12	0.5	6
Bus	4	0.35	1.4
Sum	145		526.4

Cumulative no. of standard axle (P) =526.4

Design period (n) = 10 years

Construction period(x) = 2 years

Annual growth rate (r) = 5%

Lane Distribution Factor= 50%

Cumulative no. of standard axle at base period (A) = P(1+r)^x = 580.356

Cumulative number of standard axles at the end of design period (N) = 1332187.1

Cumulative number of standard axles at the end of design period (*10^6) =1.332msa

Pavement Design Catalogue
Plate I - Recommended Design for Traffic Range 1 - 10 msa

CBR 5%					
Cumulative Traffic, msa	Total Pavement Thickness, mm	Pavement Composition			
		Bituminous Surfacing		Granular Base, mm	Granular Sub-base, mm
		Wearing Course, mm	Binder Course, mm		
1	430	20 PC		150	280
2	480	20 PC	50 DBM	150	280
3	510	20 PC	50 DBM	150	310
5	580	50 AC	50 DBM	150	330
10	660	50 AC	50 DBM	200	360

Total Thickness	Wearing Course (mm)	Binder Course (mm)	Granular Base(mm)	Granular Subbase(mm)
480	20	50	150	280

Final Adopted Pavement Design:

After calculating the pavement thickness from all above methods, considering the economy the pavement design having the least thickness is chosen which is obtained from road note 31.

Total thickness=475mm

Wearing Course=50mm

Granular Base=200mm

Granular Sub-base=225mm

5.4 Hydrological and Meteorological Study

5.4.1 Rainfall Data

Maximum rainfall data of 10 years:

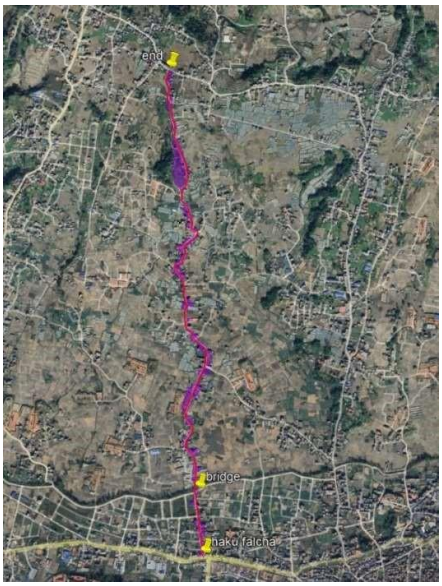


Figure 19: Catchment area

Table No. 21 Maximum Rainfall data

Year	Max rainfall (mm)
2013	87.5
2014	54.5
2015	115.7
2016	76.5
2017	71.2
2018	80.5
2019	76.4
2020	82.2
2021	97.6
2022	86.5

For the drainage design, we have taken the return period as 5 years which is feasible for the road project.

Time of concentration (t_c)

Kirpich's equation: t_c =

$0.01947\ L^{0.77}\ S^{-0.385}$

Where, t_c = time of concentration (minutes)

L= maximum length of travel of water (m) = 805m

ΔH = Difference in elevation between the farthest point and outlet (m)

=1380-1341 = 39m

S = Slope of catchment = ΔH/L = 39/805 =0.0484

$t_c = 0.01947*(805)^{0.77} *(0.0484)^{-0.385}$ = 10.921 minutes

Take t_c = 15 minutes

5.4.2 Calculation of rainfall intensity (i):

1. Gumbel's Method:

The Gumbel method is a statistical technique used in hydrology to estimate the probability of extreme events such as floods, droughts, and rainfall. According to this method, the value of rainfall X with a recurrence interval T is given by

$X_T = \bar{x} + K\sigma_{n-1}$

Where, $\bar{x}$ = mean σ_{n-1} = standard deviation of

the sample T = return period = 1/p

K = frequency factor = $\frac{\bar{y}}{\quad}$

Y_T = reduced variate = $-ln.\ ln\left[\frac{\quad}{\quad}\right]$ $\bar{y}_n$ = reduced mean in

Gumbel's extreme value distribution

S_n = reduced standard deviation in Gumbel's extreme value distribution

Calculation of T for observed data:

Table No. 22 T value for observed data

Order number (m)	Rainfall in Descending Order	Return Period T=N/(m+1)	Probability of Exceedance (p=1/T)
1	115.7	5	0.2
2	97.6	3.333	0.3
3	87.5	2.5	0.4
4	86.5	2	0.5
5	82.2	1.667	0.6
6	80.5	1.428	0.7
7	76.5	1.25	0.8
8	76.4	1.111	0.9
9	71.2	1	1

10	54.5	0.909	1.1

N = 10 $\bar{x}$ = 82.86 mm/hr, σ_{n-1} = 16.189 mm/hr, $\bar{y}_n$ = 0.4952mm/hr and S_n = 0.9496mm/hr

Table 7.3 *Reduced mean $\bar{y}_n$ in Gumbel's Extreme Value Distribution*

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.4952	0.4996	0.5035	0.5070	0.5100	0.5128	0.5157	0.5181	0.5202	0.5220
20	0.5236	0.5252	0.5268	0.5283	0.5296	0.5309	0.5320	0.5332	0.5343	0.5353
30	0.5362	0.5371	0.5380	0.5388	0.5396	0.5402	0.5410	0.5418	0.5424	0.5430

Table 7.4 *Reduced Standard Deviation S_n in Gumbel's Extreme Value Distribution*

N = sample size

N	0	1	2	3	4	5	6	7	8	9
10	0.9496	0.9676	0.9833	0.9971	1.0095	1.0206	1.0316	1.0411	1.0493	1.0565
20	1.0628	1.0696	1.0754	1.0811	1.0864	1.0915	1.0961	1.1004	1.1047	1.1086
30	1.1124	1.1159	1.1193	1.1226	1.1255	1.1285	1.1313	1.1339	1.1363	1.1388

Calculation of X_T for different T years are as follows:

Table No. 23 Discharge for different years

T	$Y = -ln.\ ln\left[\frac{T}{T-1}\right]$	$K = \frac{Y-\bar{y}}{S}$	$X = \bar{x} + K\sigma$
1			
2	0.366513	-0.13552	80.66602
5	1.49994	1.058067	99.98973
10	2.250367	1.848323	112.7837
20	2.970195	2.606356	125.056

2. Log-Pearson Type III Distribution

The Log-Pearson Type III distribution is another statistical distribution commonly used in hydrology for analyzing extreme events. In this method if X is the rainfall value then, the variate Z for any recurrence interval T is given by,

$z_T = \bar{z} + K_Z \sigma_Z$ Where, z = log x $\bar{z}$ = mean of z values

K_Z = frequency factor, a function of coefficient of skew (C_s) and return period (T)

σ_z = standard deviation of the sample of z values

= Coefficient of skew = $\frac{\sum(\quad)^{3} C_s}{(\quad)(\quad)(\quad)}$

After calculating z_T the corresponding value of x_T is calculated by,

X_T = antilog (z_T)

Calculating z=log x for all the rainfall values:

Table No. 24 Z value for rainfall data

Table Year	Max rainfall (x)	z = log(x)	z - $\bar{z}$	(z - $\bar{z}$)^3
2013	87.5	1.9420	0.0312	0.0000304
2014	54.5	1.7364	-0.1744	-0.0053057
2015	115.7	2.0633	0.1525	0.0035482
2016	76.5	1.8837	-0.0271	-0.00002
2017	71.2	1.8525	-0.0583	-0.000198
2018	80.5	1.9058	-0.0050	-0.0000001
2019	76.4	1.8831	-0.0277	-0.0000213
2020	82.2	1.9149	0.0041	0.00000007
2021	97.6	1.9894	0.0786	0.0004863
2022	86.5	1.9370	0.0262	0.0000180
Sum				-0.0014627

Mean ($\bar{z}$) = 1.9108, SD = 0.0859

Coefficient of skew (C_S) = -0.320

TABLE 12.3.1 *(cont.)*
K_T values for Pearson Type III distribution (negative skew)

Skew coefficient C_s or C_w	Return period in years: 2	5	10	25	50	100	200
	Exceedence probability: 0.50	0.20	0.10	0.04	0.02	0.01	0.005
-0.1	0.017	0.846	1.270	1.716	2.000	2.252	2.482
-0.2	0.033	0.850	1.258	1.680	1.945	2.178	2.388
-0.3	0.050	0.853	1.245	1.643	1.890	2.104	2.294
-0.4	0.066	0.855	1.231	1.606	1.834	2.029	2.201
-0.5	0.083	0.856	1.216	1.567	1.777	1.955	2.108
-0.6	0.099	0.857	1.200	1.528	1.720	1.880	2.016
-0.7	0.116	0.857	1.183	1.488	1.663	1.806	1.926
-0.8	0.132	0.856	1.166	1.448	1.606	1.733	1.837
-0.9	0.148	0.854	1.147	1.407	1.549	1.660	1.749
-1.0	0.164	0.852	1.128	1.366	1.492	1.588	1.664
-1.1	0.180	0.848	1.107	1.324	1.435	1.518	1.581
-1.2	0.195	0.844	1.086	1.282	1.379	1.449	1.501
-1.3	0.210	0.838	1.064	1.240	1.324	1.383	1.424
-1.4	0.225	0.832	1.041	1.198	1.270	1.318	1.351
-1.5	0.240	0.825	1.018	1.157	1.217	1.256	1.282
-1.6	0.254	0.817	0.994	1.116	1.166	1.197	1.216
-1.7	0.268	0.808	0.970	1.075	1.116	1.140	1.155
-1.8	0.282	0.799	0.945	1.035	1.069	1.087	1.097
-1.9	0.294	0.788	0.920	0.996	1.023	1.037	1.044
-2.0	0.307	0.777	0.895	0.959	0.980	0.990	0.995
-2.1	0.319	0.765	0.869	0.923	0.939	0.946	0.949
-2.2	0.330	0.752	0.844	0.888	0.900	0.905	0.907
-2.3	0.341	0.739	0.819	0.855	0.864	0.867	0.869
-2.4	0.351	0.725	0.795	0.823	0.830	0.832	0.833
-2.5	0.360	0.711	0.771	0.793	0.798	0.799	0.800
-2.6	0.368	0.696	0.747	0.764	0.768	0.769	0.769
-2.7	0.376	0.681	0.724	0.738	0.740	0.740	0.741
-2.8	0.384	0.666	0.702	0.712	0.714	0.714	0.714
-2.9	0.390	0.651	0.681	0.683	0.689	0.690	0.690
-3.0	0.396	0.636	0.666	0.666	0.666	0.667	0.667

Source: U. S. Water Resources Council (1981).

Calculating the frequency factor (K):

Table No. 25 Frequency factor (K) table

Coefficient of skew, C_S	Recurrence interval T in years		
	2	5	10
-0.3	0.05	0.853	1.245
-0.32	0.0532	0.8534	1.2422

-0.4	0.066	0.855	1.231

The values of rainfall for a given T is calculated as below:

T	K_z	$z_T = \bar{z} + K_z\sigma_z$	X_T = antilog (Z_T)
2	0.0532	1.9154	82.297
5	0.8534	1.9842	96.417
10	1.2422	2.0176	104.129

Here the data from Gumbel method is found to be closer. So using Gumbel's method, rainfall value for various return period are calculated.

Table No. 26 Rainfall value for different return periods

Rainfall Duration, hr	Return Period, Years			
	2	5	10	20
0.25	70.47	87.35	98.53	109.25
0.5	44.39	55.03	62.07	68.82
1	27.97	34.66	39.10	43.35
3	13.44	16.66	18.80	20.84
6	8.47	10.50	11.84	13.13
12	5.34	6.61	7.46	8.27
18	4.07	5.05	5.69	6.31
24	3.36	4.17	4.70	5.21

For t_c= 15 min, i = 87.35 mm/hr

Maximum rainfall intensity (mm/hr) for different time of concentration using Mongbe equation, for different years

From 10 years maximum rainfall data estimation of rainfall value at different duration was calculated by using empirical formula:

Rainfall at t-hour duration = $\frac{daily\ Rainfall}{24} * \left(\frac{24}{t}\right)^{\frac{2}{3}}$

Year	0.25 H	0.5 H	1 H	3 H	6 H	12 H	18 H	24 H	Max rainfall
2013	76.44	48.15	30.33	14.58	9.19	5.79	4.42	3.65	87.5
2014	47.61	29.99	18.89	9.08	5.72	3.60	2.75	2.27	54.5
2015	101.07	63.67	40.11	19.28	12.15	7.65	5.84	4.82	115.7
2016	66.83	42.10	26.52	12.75	8.03	5.06	3.86	3.19	76.5
2017	62.20	39.18	24.68	11.87	7.48	4.71	3.59	2.97	71.2
2018	70.32	44.30	27.91	13.42	8.45	5.32	4.06	3.35	80.5
2019	66.74	42.04	26.49	12.73	8.02	5.05	3.86	3.18	76.4

2020	71.81	45.24	28.50	13.70	8.63	5.44	4.15	3.43	82.2
2021	85.26	53.71	33.84	16.27	10.25	6.46	4.93	4.07	97.6
2022	75.56	47.60	29.99	14.42	9.08	5.72	4.37	3.60	86.5

Arranging the rainfall data in descending order and calculating probability of exceedance and return period:

Rank (m)	0.25 H	0.5 H	1 H	3 H	6 H	12 H	18 H	24 H	P =	T=
1	101.07	63.67	40.11	19.28	12.15	7.65	5.84	4.82	0.09	11.00
2	85.26	53.71	33.84	16.27	10.25	6.46	4.93	4.07	0.18	5.50
3	76.44	48.15	30.33	14.58	9.19	5.79	4.42	3.65	0.27	3.67
4	75.56	47.60	29.99	14.42	9.08	5.72	4.37	3.60	0.36	2.75
5	71.81	45.24	28.50	13.70	8.63	5.44	4.15	3.43	0.45	2.20
6	70.32	44.30	27.91	13.42	8.45	5.32	4.06	3.35	0.55	1.83
7	66.83	42.10	26.52	12.75	8.03	5.06	3.86	3.19	0.64	1.57
8	66.74	42.04	26.49	12.73	8.02	5.05	3.86	3.18	0.73	1.38
9	62.20	39.18	24.68	11.87	7.48	4.71	3.59	2.97	0.82	1.22
10	47.61	29.99	18.89	9.08	5.72	3.60	2.75	2.27	0.91	1.10

Calculation of rainfall intensity for different duration at different return period:

Rainfall Duration, hr	Return Period, Years		
	2	5	10
0.25	71.81	85.26	101.07
0.5	45.24	53.71	63.67
1	28.50	33.84	40.11
3	13.70	16.27	19.28
6	8.63	10.25	12.15
12	5.44	6.46	7.65
18	4.15	4.93	5.84
24	3.43	4.07	4.82

For t_c= 15 min, i = 85.26 mm/hr

For design we take maximum rainfall intensity, i= 87.35 mm/hr.

5.4.3 Design calculation of side drain:

Calculation of side drain for chainage 0+000m to 0+283m:

Rational formula:

$$Q = \frac{CIA}{360}$$

Where,

Q = Peak runoff in m^3/s

I = Critical intensity in mm/hr corresponding to time of concentration of catchment =87.35mm/hr

A = Catchment area, hectare = 1.36 ha

C = Runoff coefficient

= 0.4 for Loam, lightly, cultivated or covered

$$Q = \frac{0.4 * 87.35 * 0.7}{360} = 0.0679 \, m/s$$

For well finished concrete, Manning's coefficient (n) = 0.013

Minimum Longitudinal Drain Slope (S) = 0.50% (NRS 2070)

$Q = AV$

$$Q = \frac{AR^{\frac{2}{3}}S^{\frac{1}{2}}}{n}$$

Let B = 2D and road side slope of drain = 1V:1H

Then, A= B.D = $2D^2$ and P = B+2D = 2D+2D = 4D

$$R = \frac{A}{P} = \frac{2D}{4D} = \frac{D}{2}$$

Now,

$$Q = \frac{1}{n}\left(\frac{D}{2}\right)^{\frac{2}{3}} * 4D * \quad * S^{\frac{1}{2}}$$

$$0.132 = \frac{1}{0.013} \quad \frac{D}{* 4D **\theta)} \quad ^{\frac{2}{3}} 005$$

2

D = 0.1772m = 177.2mm

B = 2D = 0.3545m =354.45mm

Adopt a rectangular channel of width 200 mm and depth 400mm.

Check for safe velocity for side drain 3:

$v = \frac{1}{} R^{\frac{2}{3}} S^{\frac{1}{2}} = 1.79\ m/s$ < (2-2.5 m/s, safe velocity for lined concrete)

Calculation of dimension of side drain at different road section:

Table No. 27 Calculated Side drain dimension for different chainage

Chainage (m)	Side drain	catchment area (ha)	Q(m^3/s)	D(m)	B(m)
0+000 to 0+420	SD1	0.7	0.0679	0.1772	0.3545
0+420 to 1+550	SD2	2.75	0.2668	0.2961	0.5922
1+550 to 2+590	SD3	5.34	0.5182	0.3798	0.7595

5.4.4 Design of pipe culvert

Calculation of pipe culvert at 0+420m:

Design Discharge (Q) = 0.06793817 m^3/s

Manning's coefficient (n) = 0.013

Slope (S) = 1:100 = 0.01

Central angle for maximum discharge (θ) = 302°

Depth of flow for maximum discharge(y) = 0.938D

$$\frac{\theta \Pi r}{360°} + \frac{r \sin 360 - \theta}{2} \qquad (\quad ° \quad)$$

2

Area for maximum discharge (A) $\underline{r\theta\Pi}$ = = 3.059471219*r

Wetted perimeter for maximum discharge (P) = = 5.270894341*r

°

Hydraulic radius (R) = A/P

Now,

$$Q = \frac{\underline{AR^{\frac{2}{3}} S^{\frac{1}{2}}}}{n}$$

$$0.0679 = \frac{(3.0594 * r^2)^{\left(\frac{5}{3}\right)} * \left(\frac{1}{100}\right)^{\frac{1}{2}}}{0.013 * (5.2708 * r)^{\frac{2}{3}}}$$

Solving the above equation,

Radius of pipe culvert (r) = 0.127853772 m

Diameter (D) = 2r = 0.255707543 m

Provide pipe culvert of 0.9m diameter.

Calculation of pipe culvert at different road sections:

Table No. 28 Pipe culvert sizes as per chainage

Chainage	Pipe culvert	Catchment area (ha)	Q(m3/s)	r(m)	D(m)
at 0+283m	PC1	0.7	0.0679	0.1278	0.2557
at 0+420m	PC2	5.34	0.5182	0.2739	0.5478

Cross structures

Table No. 29 Cross drainage structures

Chainage (m)	Length (m)	Diameter (m)	Pipe Count	Clear Cover Depth (m)	Slope (1V:mH)	Remarks
0+283.872	9	0.9	1	0.6	100	Pipe culvert
0+420	9	0.9	1	0.6	100	Pipe culvert
0+850	9	0.9	1	0.6	100	Proposed hume pipe
1+550	9	0.9	1	0.6	100	Proposed hume pipe
2+530	9	0.5	1	0.6	100	Proposed hume pipe

5.5 Design and Calculations

Horizontal Curves

The sample calculation for horizontal curve data is show below.

Deflection angle (Δ) =8°14’31.9”

Radius (R) = 50 m

Tangent Length (T) $\left(\frac{\Delta}{2}\right) = 50 * tan\left(\frac{8\ 14\ 31\ 9}{2}\right)$ $= Rtan$ $= 3.603m$

Length of curve (L) $\frac{\pi R\Delta}{180} = = \frac{\pi * 50 * 8°14'31.9''}{180} = 7.193\ m$

= $\left(\sec\left(\frac{\Delta}{2}\right) - 1\right) = 50\left(\sec\left(\frac{8°14'31.9''}{2}\right.\right.$

Apex Distance (E) = $R-$ 1 $= 0.13m$

Chainage of IP = (0+000) +79.772 = 0+079.772 m

Chianage of BC = Chainage of IP – Tangent Length = 79.772 – 3.603=0+076.170m

Chainage of MC = Chainage of BC + L/2 = 76.170+7.193/2 = 0+079.766 m

Chainage of EC = Chainage of BC + L= 76.170 + 79.193 = 0+083.363m Similarly, other data are calculated which is given in Annex.

6. ESTIMATION AND COSTING

6.1 Quantity Estimation

Quantity estimation was carried out after the detailed engineering design of the road section.

Table No. 30 Abstract of cost

Abstract of Quantity		
Description	Quantity	Unit
Drain	1537.69	M3
Pavement	906.3012	M3
Base	3625.205	M3
SubBase	4078.355	M3
ShoulderLayer-1	582.6222	M3
Shoulder	6214.637	L
Cut	10776.37	M3
Fill	883.6871	M3
DrainCut	1816.495	M3
StructureCut	765.1219	M3
BackFill	98.2066	M3
MasonryRetainingWall	652.4631	M3
GabionRetainingWall	420	M3
Bridge	1	Num
PipeCulvert	5	Num

6.2 Engineering Cost Estimate

In Nepal, the process of estimating project costs involves a number of painstaking procedures that come after the alignment, detailed survey, and engineering design are finalized. In order to make the best selection possible, alignments are carefully selected to maximize variables including terrain, environmental effect, and community demands. Stakeholder input is essential. Precise information on land contours, current infrastructure, and any obstructions is provided by detailed surveys, which aid engineers in developing thorough engineering designs that adhere to strict safety and legal requirements. Nepalese costing is based on standard rate analysis set by the government, which includes district rates as well as other pertinent sources of labor, materials, and equipment. Although the majority of unit rates are created by means of in-depth investigation, some items, like bridges and finishing works, adhere to predetermined norms from comparable studies. Standardized designs and accepted processes serve as the foundation for quantity estimation, which guarantees accurate resource allocation. With the help of this methodical approach, project costs are carefully evaluated and in line with local customs and laws, making it easier to allocate funds and create budgets that are both effective and adhere to project goals.

Table No. 31 Summary of Cost

SUMMARY OF COST

S.N.	Description of works	Rate, (NRs)	Amount (NRs)	Remarks
I	General Item	Sub - Total (A)	3,346,586.32	2.23%
II	Site Clearance	Sub - Total (B)	15,011.64	0.01%
III	Earthworks	Sub - Total (C)	1,700,497.02	1.13%
IV	Pavement Works	Sub - Total (D)	76,137,844.95	50.63%
V	Cross Drainage Structures	Sub - Total (E)	15,773,202.74	10.49%
VI	Structure Works	Sub - Total (F)	10,499,218.19	6.98%
VII	Drainage Works	Sub - Total (G)	34,458,682.82	22.91%
VIII	Bio Engineering Works	Sub - Total (H)	1,455,084.00	0.97%

IX	Miscellaneous Works	Sub - Total (I)	6,997,325.40	4.65%
		Total with Provisional Sum (A)	150,383,453.08	100.0%
		Total without Provisional Sum(B)	148,383,453.08	
		VAT @ 13 % of (B)	19,289,848.90	
		Total with VAT	167,673,301.98	
		Contingencies @ 4% of (B)	5,935,338.12	
		Total with Provisional Sum, VAT & Contingencies	175,608,640.10	
		Physical Contingency @ 10% of (B)	14,838,345.31	
		Price adjustment @ 10% of (B)	14,838,345.31	
		Grand Total	205,285,330.72	
		Cost per kilometer	79,276,049.71	

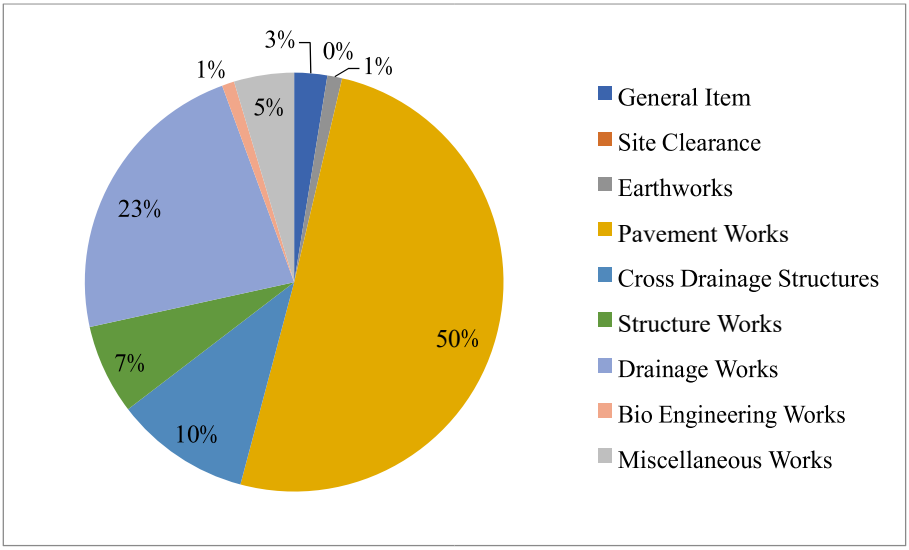


Figure 20: Pie-chart showing abstract of cost

6.2.1 Rate Analysis

Crucial elements including earthworks, retaining structures, side drains, and pipe culvert construction are given special attention in the thorough examination of rates

for the project's many components. To maintain consistency in costs, a fixed unit charge per meter is used to culverts and other road constructions. The costing methodology takes into account the road's phased construction approach, which calls for incremental construction progress. Bitumen, pipe culverts, and gravel prices are averaged. This method accounts for the reality that some building supplies won't be needed until after the site is accessible, therefore their expenses will be covered later in the project. Miscellaneous unit rates are also computed using the combined experience and knowledge of project planners and engineers, taking into account industry standards and lessons learned from previous projects. This methodical approach to cost estimating takes into account the dynamic nature of construction projects, the realities of on-site logistics, and ensures that resources are allocated efficiently.

7. CONCLUSION

Detailed engineering survey, design and cost estimation of the road section from Kalopati to Kasula Tol has been completed. The road section is 2.59 km and was designed using SW Road V2 Professional software. The total cost of the road section has been estimated to be Rs. 205,285,330.72 and Rs. 79,276,049.71per km. the cost estimated seems to be costly due to the fact:

- The Nepal Urban Road Standards was followed for the design of effective, safe, and smooth traffic movement.
- Special care was taken so that alignment did not cross cultivable land, existing structure and followed the existing trail as closely as possible.
- Pavement was designed using different methods and the result obtained from Road note 31 was adopted.
- Longitudinal and cross-drainage structures such as pipe culverts, drains, etc were designed using relevant formulas, whenever necessary.
- Cost estimation was done using an Excel sheet for rate analysis and SW Software for quantity estimation. District rate norms were adopted for standard rate analysis.

Even after taking special care while designing alignment, we have found that 24 poles need to be shifted and 24 permanent and temporary structures are likely to be affected.

Extra widening also couldn't be provided on various sections for which the provision has been made in the design but the execution depends solely on the decision of the undertaking municipality.

As we worked to finish our project, we faced a variety of challenges and came up with various solutions for the issues. Thus, we learned to be consistent, resolute, and decisive in our approach to completing our project work. This undertaking has given us more self-assurance and taught us the value of teamwork in completing the task at hand. The most significant lesson we took away from this project is the importance of time, since working on it for a full year even came with time limits. In summary, our technical, managerial, and communication abilities have enhanced, which will help us in our future careers as engineers.

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ANNEX I: COST ESTIMATE

Sample Survey data (Easting, Northing, Elevation)

INST ST.	POINTS	E	N	Z	REMARKS
ST01	1	344452.208	3062255.488	1315.088	REL
	2	344451.535	3062258.845	1314.770	REL
	3	344451.006	3062261.810	1314.619	REL
	4	344448.817	3062270.176	1314.417	REL
	5	344446.771	3062277.060	1313.729	REL
	6	344442.699	3062297.570	1313.384	REL
	7	344439.624	3062307.321	1313.309	REL
	8	344440.264	3062303.110	1313.437	EP
	9	344443.665	3062321.147	1313.116	RER
	10	344443.858	3062321.292	1313.215	EP
	11	344449.238	3062303.478	1313.353	RER
	12	344453.163	3062291.183	1313.734	EP
	13	344455.968	3062280.786	1313.957	RER
	14	344459.022	3062269.896	1314.402	RER
	15	344462.259	3062257.512	1315.155	RER
	16	344462.552	3062257.584	1315.318	EP
	17	344453.911	3062254.812	1315.067	EP
	18	344458.434	3062256.725	1314.936	ROC
	19	344455.445	3062268.136	1314.248	ROC
	20	344449.810	3062285.450	1313.681	ROC
	21	344446.449	3062296.060	1313.480	ROC
	22	344461.508	3062264.425	1315.267	BC
	23	344451.905	3062255.207	1315.256	BC

	24	344455.436	3062288.962	1314.016	BC

HORIZONTAL CURVE DATA TABLE												
IP (Num)	COORDINATE		Cum. Dist. (m)	WCB (deg)	Def. Angle (deg)	Tangent Length (m)	Simple Curve Data			CHAINAGE		
	X (m)	Y (m)					Radius (m)	Apex Dist (m)	Length of Curve (m)	BC of Simple Curve (m)	MC (m)	EC of Simple Curve (m)
1	344458.565	3062256.583	0	343.415	0	0	0	0	0	0+000	0+000	0+000
2	344435.795	3062333.036	79.772	351.657	8.242193	3.603	50	0.13	7.193	0+076.17	0+079.766	0+083.363
3	344428.233	3062384.605	131.893	343.124	8.533188	3.357	45	0.125	6.702	0+128.523	0+131.874	0+135.225
4	344390.248	3062509.819	262.742	349.9	6.775912	2.96	50	0.088	5.913	0+259.757	0+262.713	0+265.67
5	344383.648	3062546.873	300.378	2.96823	13.06812	7.445	65	0.425	14.825	0+292.902	0+300.314	0+307.727
6	344384.458	3062562.504	316.031	344.505	18.46308	2.438	15	0.197	4.834	0+313.497	0+315.914	0+318.33
7	344378.784	3062582.971	337.269	355.343	10.83786	1.423	15	0.067	2.837	0+335.708	0+337.126	0+338.545
8	344369.99	3062690.927	445.583	342.137	13.20628	8.682	75	0.501	17.287	0+436.754	0+445.397	0+454.041
9	344358.579	3062726.335	482.785	326.586	15.55045	6.827	50	0.464	13.57	0+475.734	0+482.519	0+489.304
10	344347.579	3062743.009	502.761	305.291	21.29551	12.221	65	1.139	24.159	0+490.232	0+502.312	0+514.391
11	344309.268	3062770.125	549.696	357.468	52.17768	14.69	30	3.403	27.32	0+534.417	0+548.077	0+561.737
12	344307.567	3062808.599	588.208	29.3354	31.86698	14.274	50	1.998	27.809	0+571.284	0+585.189	0+599.093
13	344335.536	3062858.367	645.296	350.91	38.4257	8.712	25	1.475	16.766	0+633.195	0+641.578	0+649.961
14	344332.757	3062875.736	662.886	314.846	36.06333	8.138	25	1.291	15.736	0+650.701	0+658.568	0+666.436
15	344311.104	3062897.273	693.426	321.499	6.652954	5.812	100	0.169	11.612	0+683.026	0+688.832	0+694.638
16	344290.841	3062922.747	725.977	357.971	36.47134	13.179	40	2.115	25.462	0+708.197	0+720.928	0+733.659
17	344289.798	3062952.158	755.406	19.4555	21.48483	12.332	65	1.159	24.374	0+737.578	0+749.765	0+761.951
18	344305.633	3062996.984	802.947	12.0271	7.42837	6.492	100	0.21	12.965	0+790.669	0+797.151	0+803.634
19	344318.486	3063057.312	864.628	16.9759	4.948756	0.864	20	0.019	1.727	0+857.959	0+858.823	0+859.687
20	344342.628	3063136.397	947.317	20.016	3.040056	13.268	500	0.176	26.529	0+928.243	0+941.508	0+954.773
21	344360.345	3063185.03	999.076	359.465	20.55076	9.064	50	0.815	17.934	0+984.199	0+993.166	1+002.133
22	344359.574	3063267.537	1081.59	298.904	60.56167	23.356	40	6.32	42.28	1+052.224	1+073.364	1+094.504

23	344282.301	3063310.201	1169.86	343.861	44.95724	8.276	20	1.644	15.693	1+151.141	1+158.988	1+166.834
24	344273.153	3063341.812	1202.76	297.64	46.22065	8.535	20	1.745	16.134	1+182.932	1+190.999	1+199.066
25	344246.833	3063355.595	1232.47	349.01	51.37013	12.024	25	2.741	22.414	1+208.218	1+219.425	1+230.632
26	344232.51	3063429.351	1307.61	3.18825	14.17801	6.218	50	0.385	12.373	1+287.524	1+293.71	1+299.896
27	344234.942	3063473.004	1351.33	338.784	24.4044	17.3	80	1.849	34.075	1+320.099	1+337.137	1+354.174
28	344220.468	3063510.289	1391.33	352.661	13.87754	6.085	50	0.369	12.11	1+370.785	1+376.841	1+382.896

HORIZONTAL CURVE DATA TABLE

IP (Num)	COORDINATE		Cum. Dist. (m)	WCB (deg)	Def. Angle (deg)	Tangent Length (m)	Simple Curve Data			CHAINAGE		
	X (m)	Y (m)					Radius (m)	Apex Dist (m)	Length of Curve (m)	BC of Simple Curve (m)	MC (m)	EC of Simple Curve (m)
29	344216.531	3063540.858	1422.15	346.946	5.715859	2.496	50	0.062	4.988	1+405.136	1+407.63	1+410.124
30	344208.993	3063573.369	1455.52	321.51	25.43524	16.926	75	1.886	33.295	1+424.075	1+440.722	1+457.37
31	344184.573	3063604.08	1494.76	316.081	5.429487	9.483	200	0.225	18.952	1+470.197	1+479.674	1+489.15
32	344146.13	3063644.002	1550.18	62.233	106.1522	19.961	15	9.969	27.791	1+515.128	1+529.023	1+542.918
33	344190.825	3063667.534	1600.69	12.2791	49.95392	9.316	20	2.063	17.437	1+564.153	1+572.872	1+581.59
34	344198.629	3063703.388	1637.38	348.542	23.73731	10.508	50	1.092	20.715	1+598.459	1+608.816	1+619.174
35	344188.857	3063751.599	1686.58	40.0152	51.47347	9.641	20	2.203	17.968	1+648.216	1+657.2	1+666.184
36	344214.91	3063782.631	1727.09	57.2106	17.19535	3.024	20	0.227	6.002	1+694.037	1+697.039	1+700.04
37	344228.646	3063791.48	1743.43	43.0864	14.12417	6.194	50	0.382	12.326	1+707.161	1+713.324	1+719.487
38	344259.143	3063824.085	1788.08	282.543	120.5434	26.268	15	15.249	31.558	1+731.669	1+747.448	1+763.227
39	344209.699	3063835.085	1838.73	8.36589	85.82287	13.944	15	5.48	22.468	1+773.667	1+784.901	1+796.136
40	344214.331	3063866.58	1870.56	339.384	28.98171	5.169	20	0.657	10.117	1+808.856	1+813.915	1+818.973
41	344186.888	3063939.529	1948.5	302.106	37.27792	11.805	35	1.937	22.772	1+879.938	1+891.324	1+902.71
42	344151.456	3063961.761	1990.33	351.285	49.17828	13.728	30	2.992	25.75	1+919.006	1+931.881	1+944.756
43	344141.498	3064026.721	2056.05	69.4155	78.13101	16.234	20	5.759	27.273	1+980.512	1+994.149	2+007.785
44	344167.088	3064036.331	2083.39	358.983	70.43298	10.588	15	3.36	18.439	2+008.299	2+017.519	2+026.738

45	344166.283	3064081.656	2128.72	347.943	11.03942	4.832	50	0.233	9.634	2+056.651	2+061.468	2+066.285
46	344154.756	3064135.623	2183.9	322.919	25.02369	11.096	50	1.216	21.837	2+105.541	2+116.46	2+127.378
47	344135.766	3064160.75	2215.4	333.954	11.03504	9.66	100	0.465	19.26	2+138.118	2+147.748	2+157.378
48	344076.751	3064281.506	2349.8	357.854	23.89998	21.164	100	2.215	41.713	2+260.96	2+281.817	2+302.674
49	344075.16	3064323.966	2392.29	335.361	22.49357	13.92	70	1.371	27.481	2+310.079	2+323.819	2+337.56
50	344060.905	3064355.046	2426.49	344.893	9.53172	4.169	50	0.173	8.318	2+353.665	2+357.824	2+361.983
51	344040.837	3064429.38	2503.48	322.154	22.73854	5.027	25	0.5	9.922	2+429.783	2+434.744	2+439.704
52	344031.206	3064441.776	2519.18	0.35079	38.19671	6.925	20	1.165	13.333	2+443.45	2+450.116	2+456.783
53	344031.554	3064498.514	2575.92	324.107	36.24345	19.636	60	3.131	37.954	2+486.961	2+505.938	2+524.915
54	344009.264	3064529.315	2613.94	14.1709	50.06353	9.34	20	2.073	17.475	2+533.959	2+542.697	2+551.435
55	344020.853	3064575.211	2661.28	0	0	0	0	0	0	2+589.432	2+589.432	2+589.432

VERTICAL CURVE DATA TABLE									
VIP No.	VIP		Length (m)	BVC		MVC		EVC	
	Chainage (m)	Elevation (m)		Chainage (m)	Elevation (m)	Chainage (m)	Elevation (m)	Chainage (m)	Elevation (m)
1	0+000	1314.936	0	0+000	1314.936	0+000	1314.936	0+000	1314.936
2	0+066.452	1313.186	12	0+060.452	1313.344	0+066.452	1313.205	0+072.452	1313.066
3	0+283.872	1308.823	12	0+277.872	1308.943	0+283.872	1309.041	0+289.872	1309.138
4	0+306.612	1310.017	12	0+300.612	1309.702	0+306.612	1309.86	0+312.612	1310.017
5	0+343.373	1310.019	12	0+337.373	1310.019	0+343.373	1309.974	0+349.373	1309.929
6	0+419.978	1308.867	12	0+413.978	1308.957	0+419.978	1308.942	0+425.978	1308.927
7	0+520.519	1309.87	12	0+514.519	1309.81	0+520.519	1309.998	0+526.519	1310.186
8	0+573.031	1312.639	12	0+567.031	1312.323	0+573.031	1312.528	0+579.031	1312.732
9	0+798.379	1316.134	12	0+792.379	1316.041	0+798.379	1316.167	0+804.379	1316.293
10	0+918.555	1319.305	0	0+918.555	1319.305	0+918.555	1319.305	0+918.555	1319.305
11	1+088.384	1323.993	12	1+082.384	1323.827	1+088.384	1323.948	1+094.384	1324.068
12	1+258.802	1326.145	12	1+252.802	1326.069	1+258.802	1326.208	1+264.802	1326.346

13	1+382.175	1330.278	12	1+376.175	1330.077	1+382.175	1330.213	1+388.175	1330.349
14	1+440.724	1330.971	0	1+440.724	1330.971	1+440.724	1330.971	1+440.724	1330.971
15	1+780.295	1335.705	12	1+774.295	1335.621	1+780.295	1335.722	1+786.295	1335.823
16	1+833.259	1336.745	12	1+827.259	1336.627	1+833.259	1336.823	1+839.259	1337.019
17	1+989.221	1343.879	20	1+979.221	1343.422	1+989.221	1344.117	1+999.221	1344.813
18	2+131.237	1357.133	12	2+125.237	1356.573	2+131.237	1356.965	2+137.237	1357.357
19	2+344.777	1365.107	12	2+338.777	1364.883	2+344.777	1365.261	2+350.777	1365.64
20	2+422.315	1372.005	20	2+412.315	1371.116	2+422.315	1371.621	2+432.315	1372.127
21	2+589.432	1374.039	0	2+589.432	1374.039	2+589.432	1374.039	2+589.432	1374.039

Summary of Quantity

Item Code	Name	Quantity	Unit
13.06	Surface Course_AC	1488.924	M3
13.01(B)	Prime Coat	22010.172	L
13.02(B)	Tack Coat	13206.102	L
12.06(B)	Base Material	3625.204	M3
12.01(A)	SubBase Material	4078.356	M3
10.04(II)	SubGrade Preparation	3301.526	M3

Pavement Quantity Estimation

Chainage(m)	MeanDistance (m)	Pavement			Shoulder		Shoulder Layer-1	Base	SubBase	SubGrade Preparation	Surface Course_AC	PrimeCoat	TackCoat	BaseMaterial	SubBase Material	SubGrade Preparation
		Surface Course_ AC M3	Prime Coat L	Tack Coat L	Prime Coat L	Tack Coat L	Asphalt M3	Base Material M3	SubBase Material M3	SubGrade Preparation M3						
0+000	10	3.5	70	42	15	9	2.25	14	15.75	12.75	5.75	85	51	14	15.75	12.75
0+020	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+040	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+060	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

0+080	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+100	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+120	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+140	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+160	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+180	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+200	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+220	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+240	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+260	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+280	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

Chainage(m)	MeanDistance (m)	Pavement			Shoulder		Shoulder Layer-1	Base	SubBase	SubGrade Preparation	Surface Course_AC	PrimeCoat	TackCoat	BaseMaterial	SubBase Material	SubGrade Preparation
		Surface Course_ AC M3	Prime Coat L	Tack Coat L	Prime Coat L	Tack Coat L	Asphalt M3	Base Material M3	SubBase Material M3	SubGrade Preparation M3						
0+300	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+320	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+340	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+360	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+380	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+400	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+420	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+440	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+460	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+480	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+500	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+520	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+540	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+560	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

0+580	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+600	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+620	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+640	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+660	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+680	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+700	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+720	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+740	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+760	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

Chainage(m)	MeanDistance (m)	Pavement			Shoulder		Shoulder Layer-1	Base	SubBase	SubGrade Preparation	Surface Course_AC	PrimeCoat	TackCoat	BaseMaterial	SubBase Material	SubGrade Preparation
		Surface Course_ AC M3	Prime Coat L	Tack Coat L	Prime Coat L	Tack Coat L	Asphalt M3	Base Material M3	SubBase Material M3	SubGrade Preparation M3						
0+780	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+800	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+820	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+840	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+860	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+880	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+900	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+920	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+940	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+960	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
0+980	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+000	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+020	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+040	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+060	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

1+080	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+100	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+120	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+140	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+160	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+180	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+200	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+220	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+240	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

Chainage(m)	MeanDistance (m)	Pavement			Shoulder		Shoulder Layer-1	Base	SubBase	SubGrade Preparation	Surface Course_AC	PrimeCoat	TackCoat	BaseMaterial	SubBase Material	SubGrade Preparation
		Surface Course_ AC M3	Prime Coat L	Tack Coat L	Prime Coat L	Tack Coat L	Asphalt M3	Base Material M3	SubBase Material M3	SubGrade Preparation M3						
1+260	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+280	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+300	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+320	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+340	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+360	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+380	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+400	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+420	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+440	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+460	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+480	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+500	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+520	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+540	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+560	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

1+580	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+600	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+620	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+640	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+660	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+680	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+700	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+720	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

Chainage(m)	MeanDistance (m)	Pavement			Shoulder		Shoulder Layer-1	Base	SubBase	SubGrade Preparation	Surface Course_AC	PrimeCoat	TackCoat	BaseMaterial	SubBase Material	SubGrade Preparation
		Surface Course_ AC M3	Prime Coat L	Tack Coat L	Prime Coat L	Tack Coat L	Asphalt M3	Base Material M3	SubBase Material M3	SubGrade Preparation M3						
1+740	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+760	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+780	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+800	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+820	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+840	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+860	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+880	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+900	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+920	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+940	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+960	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
1+980	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+000	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+020	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+040	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+060	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

2+080	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+100	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+120	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+140	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+160	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+180	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+200	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

Chainage(m)	MeanDistance (m)	Pavement			Shoulder		Shoulder Layer-1	Base	SubBase	SubGrade Preparation	Surface Course_AC	PrimeCoat	TackCoat	BaseMaterial	SubBase Material	SubGrade Preparation
		Surface Course_ AC M3	Prime Coat L	Tack Coat L	Prime Coat L	Tack Coat L	Asphalt M3	Base Material M3	SubBase Material M3	SubGrade Preparation M3						
2+220	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+240	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+260	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+280	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+300	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+320	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+340	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+360	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+380	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+400	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+420	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+440	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+460	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+480	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+500	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+520	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+540	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5
2+560	20	7	140	84	30	18	4.5	28	31.5	25.5	11.5	170	102	28	31.5	25.5

2+580	14.7	5.151	103.01	61.807	22.07	13.24	3.311	20.602	23.178	18.763	8.462	125.086	75.05	20.602	23.178	18.763
2+589.432	4.72	1.651	33.012	19.807	7.074	4.244	1.061	6.602	7.428	6.013	2.712	40.086	24.05	6.602	7.428	6.013

Summary of Quantity

Item Code	Name	Quantity	Unit
09.01(I-B)	Cut	10776.37	M3
09.09(B)	Fill	883.686	M3
09.04(I-B-i)	StructureCut	2581.617	M3
BFIC1	BackFill	98.209	M3

Estimation of earthwork

Chainage (m)	Mean Distance (m)	AREA (m2)					VOLUME (m3)				
		Cut	Fill	Structure Cut	Drain Cut	BackFill	Cut	Fill	Structure Cut	Drain Cut	BackFill
		Cut	Fill	StructureCut	DrainCut	BackFill	Cut	Fill	StructureCut	DrainCut	BackFill
0+000	10	4.593	0	0	0.68	0	45.93	0	0	6.8	0
0+020	20	1.537	0.276	0	0.454	0	30.731	5.519	0	9.084	0
0+040	20	0.83	0.355	0	0.465	0	16.6	7.105	0	9.295	0
0+060	20	2.595	0.008	0	0.649	0	51.899	0.157	0	12.974	0
0+080	20	5.544	0	0	0.68	0	110.882	0	0	13.6	0
0+100	20	7.821	0	0	0.68	0	156.411	0	0	13.6	0
0+120	20	8.211	0	0	0.68	0	164.227	0	0	13.6	0
0+140	20	7.808	0	0	0.68	0	156.169	0	0	13.6	0
0+160	20	5.793	0	0	0.68	0	115.865	0	0	13.6	0
0+180	20	3.771	0.004	0	0.68	0	75.418	0.088	0	13.6	0
0+200	20	1.551	0.161	0	0.586	0	31.023	3.217	0	11.726	0
0+220	20	1.568	0.25	0	0.471	0	31.36	5.002	0	9.424	0
0+240	20	1.908	0.134	0	0.603	0	38.168	2.683	0	12.05	0

0+260	20	2.916	0.003	0	0.655	0	58.313	0.065	0	13.106	0
0+280	20	4.933	0	0	0.68	0	98.667	0	0	13.6	0
0+300	20	0.323	1.584	0.487	0.075	0.029	6.453	31.68	9.741	1.496	0.576

Chainage (m)	Mean Distance (m)	AREA (m2)					VOLUME (m3)				
		Cut	Fill	Structure Cut	Drain Cut	BackFill	Cut	Fill	Structure Cut	Drain Cut	BackFill
		Cut	Fill	StructureCut	DrainCut	BackFill	Cut	Fill	StructureCut	DrainCut	BackFill
0+320	20	0.606	1.005	0.65	0.191	0.052	12.117	20.093	12.996	3.811	1.03
0+340	20	1.527	0.695	0.531	0.354	0.031	30.541	13.907	10.612	7.079	0.626
0+360	20	0.303	2.883	1.116	0.256	0.137	6.055	57.653	22.315	5.127	2.74
0+380	20	0.34	0.754	0.809	0.492	0.077	6.802	15.086	16.182	9.843	1.541
0+400	20	1.653	0.537	0.939	0.904	0.094	33.059	10.749	18.789	18.073	1.874
0+420	20	4.416	0	0	0.971	0	88.317	0	0	19.425	0
0+440	20	2.256	0.422	0.947	0.964	0.1	45.111	8.432	18.94	19.277	2.002
0+460	20	1.886	0.485	0.994	0.76	0.111	37.73	9.704	19.872	15.203	2.22
0+480	20	1.335	0.66	0.83	0.781	0.076	26.696	13.197	16.6	15.627	1.528
0+500	20	1.685	0.259	0.517	0.783	0.032	33.696	5.171	10.333	15.662	0.632
0+520	20	2.755	0.113	0	0.971	0	55.102	2.265	0	19.425	0
0+540	20	2.898	0.149	0	0.699	0	57.952	2.978	0	13.983	0
0+560	20	5.849	0	0	0.971	0	116.97	0	0	19.425	0
0+580	20	4.29	0.29	0	0.764	0	85.802	5.805	0	15.274	0
0+600	20	3.297	1.311	0	0.34	0	65.932	26.218	0	6.797	0
0+620	20	1.749	0.269	0	0.633	0	34.988	5.373	0	12.662	0
0+640	20	0.939	0.701	0.789	0.86	0.068	18.774	14.018	15.782	17.194	1.355
0+660	20	1.103	0.514	0.806	0.782	0.072	22.053	10.287	16.119	15.639	1.433
0+680	20	1.702	0.23	0	0.65	0	34.03	4.596	0	12.997	0

0+700	20	4.124	0.313	0	0.521	0	82.49	6.265	0	10.412	0
0+720	20	5.598	0.031	0	0.826	0	111.968	0.61	0	16.517	0
0+740	20	5.93	0.007	0	0.927	0	118.596	0.148	0	18.545	0
0+760	20	4.426	0	0	0.945	0	88.522	0	0	18.9	0
0+780	20	4.128	0.003	0	0.945	0	82.554	0.057	0	18.9	0
0+800	20	4.915	0	0	0.945	0	98.299	0	0	18.9	0
0+820	20	6.601	0	0	0.945	0	132.021	0	0	18.9	0

Chainage (m)	Mean Distance (m)	AREA (m2)					VOLUME (m3)				
		Cut	Fill	Structure Cut	Drain Cut	BackFill	Cut	Fill	Structure Cut	Drain Cut	BackFill
		Cut	Fill	StructureCut	DrainCut	BackFill	Cut	Fill	StructureCut	DrainCut	BackFill
0+840	20	8.016	0.13	0	0.729	0	160.328	2.593	0	14.584	0
0+860	20	2.415	1.009	0.931	0.798	0.076	48.304	20.172	18.618	15.966	1.518
0+880	20	3.1	0.258	0.758	0.971	0.07	61.991	5.165	15.153	19.425	1.398
0+900	20	1.918	0.801	0.581	0.405	0.041	38.352	16.014	11.62	8.107	0.815
0+920	20	1.574	1.406	1.36	0.268	0.19	31.476	28.13	27.198	5.363	3.793
0+940	20	2.148	1.172	1.222	0.459	0.151	42.957	23.449	24.434	9.187	3.015
0+960	20	1.356	0.971	1.079	0.445	0.125	27.13	19.421	21.578	8.904	2.51
0+980	20	3.884	0.087	0	0.757	0	77.686	1.742	0	15.141	0
1+000	20	9.099	0	0	0.945	0	181.977	0	0	18.9	0
1+020	20	10.347	0.018	0	0.945	0	206.936	0.367	0	18.9	0
1+040	20	11.484	0.009	0	0.945	0	229.673	0.173	0	18.9	0
1+060	20	8.253	0.126	0	0.7	0	165.056	2.522	0	14.01	0
1+080	20	5.354	0.219	0	0.549	0	107.073	4.378	0	10.977	0
1+100	20	4.49	0.239	0	0.549	0	89.793	4.773	0	10.976	0
1+120	20	4.623	0.37	0	0.945	0	92.459	7.396	0	18.9	0

1+140	20	7.446	0.66	0	0.945	0	148.914	13.192	0	18.9	0
1+160	20	10.96	0	0	0.945	0	219.194	0	0	18.9	0
1+180	20	7.087	0.25	0.919	0.945	0.102	141.738	5.007	18.374	18.9	2.047
1+200	20	6.804	0.046	0.48	0.945	0.029	136.075	0.916	9.592	18.9	0.578
1+220	20	6.548	0.116	0.54	0.945	0.032	130.959	2.321	10.801	18.9	0.636
1+240	20	5.224	0	0	0.945	0	104.484	0	0	18.9	0
1+260	20	3.142	0.668	0.944	0.945	0.094	62.847	13.364	18.885	18.9	1.887
1+280	20	2.413	0.707	0.593	0.403	0.042	48.251	14.136	11.85	8.051	0.84
1+300	20	7.249	0.015	0	0.922	0	144.978	0.297	0	18.432	0
1+320	20	6.911	0	0	0.945	0	138.224	0	0	18.9	0
1+340	20	7.708	0	0	0.945	0	154.151	0	0	18.9	0

Chainage (m)	Mean Distance (m)	AREA (m2)					VOLUME (m3)				
		Cut	Fill	Structure Cut	Drain Cut	BackFill	Cut	Fill	Structure Cut	Drain Cut	BackFill
		Cut	Fill	StructureCut	DrainCut	BackFill	Cut	Fill	StructureCut	DrainCut	BackFill
1+360	20	4.727	0.111	0	0.865	0	94.535	2.219	0	17.292	0
1+380	20	3.729	0.64	0	0.367	0	74.571	12.794	0	7.339	0
1+400	20	4.637	0.703	0	0.372	0	92.742	14.058	0	7.438	0
1+420	20	4.084	0.696	0	0.38	0	81.673	13.911	0	7.598	0
1+440	20	5.047	1.124	0	0.151	0	100.932	22.482	0	3.021	0
1+460	20	5.129	0.532	0	0.367	0	102.572	10.637	0	7.335	0
1+480	20	5.372	0	0	0.945	0	107.435	0	0	18.9	0
1+500	20	3.964	0	0	0.945	0	79.276	0.008	0	18.9	0
1+520	20	4.815	0.001	0	0.945	0	96.31	0.014	0	18.9	0
1+540	20	5.71	0	0	0.945	0	114.204	0	0	18.9	0
1+560	20	3.905	0	0	0.81	0	78.098	0	0	16.2	0

1+580	20	2.663	1.558	3.017	0.765	0.356	53.264	31.168	60.344	15.3	7.127
1+600	20	3.805	0.285	1.885	0.765	0.204	76.106	5.695	37.692	15.3	4.077
1+620	20	4.579	0.19	2.176	0.765	0.302	91.576	3.801	43.524	15.3	6.035
1+640	20	5.759	0	0	0.715	0	115.176	0.004	0	14.307	0
1+660	20	6.093	0.004	0	0.676	0	121.863	0.09	0	13.52	0
1+680	20	5.912	0	0	0.765	0	118.236	0	0	15.3	0
1+700	20	4.021	0.038	0	0.641	0	80.417	0.753	0	12.814	0
1+720	20	3.131	0.417	0	0.471	0	62.628	8.335	0	9.427	0
1+740	20	6.207	0	0	0.765	0	124.149	0	0	15.3	0
1+760	20	4.598	0.364	0	0.535	0	91.969	7.285	0	10.699	0
1+780	20	2.835	0.935	0	0.222	0	56.702	18.696	0	4.45	0
1+800	20	4.585	0	0	0.765	0	91.695	0	0	15.3	0
1+820	20	5.312	0.003	0	0.765	0	106.234	0.055	0	15.3	0
1+840	20	7.612	0	0	0.765	0	152.234	0	0	15.3	0
1+860	20	4.859	0	0	0.765	0	97.188	0	0	15.3	0

Chainage (m)	Mean Distance (m)	AREA (m2)					VOLUME (m3)				
		Cut	Fill	Structure Cut	Drain Cut	BackFill	Cut	Fill	Structure Cut	Drain Cut	BackFill
		Cut	Fill	StructureCut	DrainCut	BackFill	Cut	Fill	StructureCut	DrainCut	BackFill
1+880	20	2.326	0.023	0	0.649	0	46.515	0.465	0	12.971	0
1+900	20	4.161	0	0	0.765	0	83.213	0	0	15.3	0
1+920	20	7.154	0	0	0.765	0	143.077	0	0	15.3	0
1+940	20	4.75	0.489	0	0.482	0	95.003	9.775	0	9.631	0
1+960	20	4.071	0	0	0.75	0	81.425	0.002	0	15.001	0
1+980	20	3.67	0	0	0.765	0	73.403	0	0	15.3	0
2+000	20	2.646	0.151	0	0.543	0	52.926	3.011	0	10.851	0

2+020	20	6.808	0.012	0	0.765	0	136.155	0.235	0	15.3	0
2+040	20	6.826	0	0	0.765	0	136.513	0	0	15.3	0
2+060	20	6.901	0	0	0.765	0	138.013	0	0	15.3	0
2+080	20	3.175	0.257	0	0.765	0	63.494	5.145	0	15.3	0
2+100	20	1.504	1.076	3.25	0.765	0.519	30.081	21.516	64.997	15.3	10.372
2+120	20	3.16	0.346	6.293	0.765	1.474	63.199	6.915	125.852	15.3	29.48
2+140	20	5.481	0.019	0	0.765	0	109.625	0.372	0	15.3	0
2+160	20	2.925	1.621	0.271	0.765	0.029	58.509	32.411	5.417	15.3	0.584
2+180	20	1.706	1.439	0.491	0.765	0.034	34.112	28.774	9.814	15.3	0.679
2+200	20	0.318	2.456	0.751	0.704	0.063	6.367	49.123	15.016	14.075	1.265
2+220	20	0.188	2.114	0.665	0.254	0.052	3.755	42.275	13.296	5.076	1.037
2+240	20	1.093	0.169	0.639	0.717	0.048	21.854	3.385	12.786	14.331	0.959
2+260	20	4.271	0	0	0.765	0	85.411	0	0	15.3	0
2+280	20	5.823	0	0	0.716	0	116.469	0	0	14.313	0
2+300	20	5.332	0	0	0.765	0	106.649	0	0	15.3	0
2+320	20	1.901	0.829	0	0.765	0	38.018	16.575	0	15.3	0
2+340	20	2.399	0.392	0	0.765	0	47.986	7.832	0	15.3	0
2+360	20	3.064	0.444	0	0.765	0	61.274	8.889	0	15.3	0
2+380	20	6.468	0	0	0.765	0	129.368	0	0	15.3	0

Chainage (m)	Mean Distance (m)	AREA (m2)					VOLUME (m3)				
		Cut	Fill	Structure Cut	Drain Cut	BackFill	Cut	Fill	Structure Cut	Drain Cut	BackFill
		Cut	Fill	StructureCut	DrainCut	BackFill	Cut	Fill	StructureCut	DrainCut	BackFill
2+400	20	5.347	0	0	0.765	0	106.944	0	0	15.3	0
2+420	20	3.436	0	0	0.765	0	68.711	0	0	15.3	0
2+440	20	3.224	0.2	0	0.765	0	64.477	3.99	0	15.3	0

2+460	20	3.976	0.157	0	0.503	0	79.525	3.134	0	10.055	0
2+480	20	5.204	0	0	0.765	0	104.074	0	0	15.3	0
2+500	20	4.699	0.041	0	0.765	0	93.985	0.814	0	15.3	0
2+520	20	2.76	0.015	0	0.727	0	55.204	0.302	0	14.549	0
2+540	20	1.107	0.482	0	0.404	0	22.133	9.643	0	8.089	0
2+560	20	0.925	0.172	0	0.504	0	18.502	3.442	0	10.08	0
2+580	14.716	2.264	0	0	0.765	0	33.317	0	0	11.258	0
2+589.432	4.716	0	0	0	0	0	0	0	0	0	0

Item code	Name	Quantity	Unit
26.06(A)	RRM (1 in 6 C/S Ratio)	293.94	M3
20.09	Reinforcement	3.509	MT
20.01	PCC Base M10	496.098	M3
10.08	Stone Soling	372.074	M3

Drain Quantity Estimate

Structure (Drain) Quantity													
Chainage (m)	Length(m)	Left						Right					
		Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
0+000	10	DrainG	1.05	1.2	0.011	1.6	1.2						
0+020	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+040	20	DrainG	2.1	2.4	0.023	3.2	2.4						

0+060	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+080	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+100	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+120	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+140	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+160	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+180	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+200	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+220	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+240	20	DrainG	2.1	2.4	0.023	3.2	2.4						

Structure (Drain) Quantity													
Chainage (m)	Length(m)	Left						Right					
		Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
0+260	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+280	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+300	20	DrainG	2.1	2.4	0.023	3.2	2.4						

0+320	20	DrainG	2.1	2.4	0.023	3.2	2.4						
0+340	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+360	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+380	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+400	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+420	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+440	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+460	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+480	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+500	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+520	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+540	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+560	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+580	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+600	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+620	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+640	20	DrainG	2.55	3.15	0.03	4.2	3.15						
0+660	20	DrainG	2.55	3.15	0.03	4.2	3.15						

Structure (Drain) Quantity													
Chainage (m)	Length(m)	Left						Right					
		Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
0+680	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+700	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+720	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+740	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+760	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+780	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+800	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+820	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+840	20	DrainG	2.4	3.15	0.03	4.2	3.15						
0+860	20							DrainG	2.55	3.15	0.03	4.2	3.15
0+880	20							DrainG	2.55	3.15	0.03	4.2	3.15
0+900	20							DrainG	2.55	3.15	0.03	4.2	3.15
0+920	20							DrainG	2.55	3.15	0.03	4.2	3.15

0+940	20							DrainG	2.55	3.15	0.03	4.2	3.15
0+960	20							DrainG	2.55	3.15	0.03	4.2	3.15
0+980	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+000	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+020	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+040	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+060	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+080	20							DrainG	2.4	3.15	0.03	4.2	3.15

Structure (Drain) Quantity													
Chainage (m)	Length(m)	Left						Right					
		Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
1+100	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+120	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+140	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+160	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+180	20							DrainG	2.4	3.15	0.03	4.2	3.15

1+200	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+220	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+240	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+260	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+280	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+300	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+320	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+340	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+360	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+380	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+400	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+420	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+440	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+460	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+480	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+500	20							DrainG	2.4	3.15	0.03	4.2	3.15

Structure (Drain) Quantity			
Chainage		Left	Right

(m)	Length(m)	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
1+520	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+540	20							DrainG	2.4	3.15	0.03	4.2	3.15
1+560	20	DrainG	2.4	2.7	0.025	3.6	2.7						
1+580	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+600	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+620	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+640	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+660	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+680	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+700	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+720	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+740	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+760	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+780	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+800	20	DrainG	2.1	2.7	0.025	3.6	2.7						

1+820	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+840	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+860	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+880	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+900	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+920	20	DrainG	2.1	2.7	0.025	3.6	2.7						

Structure (Drain) Quantity													
Chainage (m)	Length(m)	Left						Right					
		Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
1+940	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+960	20	DrainG	2.1	2.7	0.025	3.6	2.7						
1+980	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+000	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+020	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+040	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+060	20	DrainG	2.1	2.7	0.025	3.6	2.7						

2+080	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+100	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+120	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+140	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+160	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+180	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+200	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+220	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+240	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+260	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+280	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+300	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+320	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+340	20	DrainG	2.1	2.7	0.025	3.6	2.7						

Structure (Drain) Quantity			
Chainage		Left	Right

(m)	Length(m)	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3	Drain	RRM (1 in 6 C/S Ratio) M3	RCC M20 DrainCover M3	Reinforcement MT	PCC Base M10 M3	Stone Soling M3
2+360	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+380	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+400	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+420	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+440	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+460	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+480	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+500	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+520	20	DrainG	2.1	2.7	0.025	3.6	2.7						
2+540	20							DrainG	2.1	2.7	0.025	3.6	2.7
2+560	20							DrainG	2.1	2.7	0.025	3.6	2.7
2+580	14.7							DrainG	1.545	1.987	0.019	2.649	1.987
2+589.432	4.72							DrainG	0.495	0.637	0.006	0.849	0.637

Summary of Quantity

Item Code	Name	Quantity	Unit
20.01	PCC Capping M10	46	M3

26.06(A)	RRM (1 in 6 C/S Ratio)	537.46	M3
10.08	Stone Soling	69	M3

Masonry Retaining Wall Quantity Estimate

Structure (MasonryRetainingWall) Quantity											
Chain age (m)	Length(m)	Left					Right				
		MasonryRetainingWall	Height M	RRM (1 in 6 C/S Ratio) M3	PCC Base M10 M3	Stone Soling M3	MasonryRetainingWall	Height M	RRM (1 in 6 C/S Ratio) M3	PCC Base M10 M3	Stone Soling M3
0+300	20						MasonryRetainingWallDyn	0.9	9.653	1.08	1.62
0+320	20						MasonryRetainingWallDyn	1.2	15.041	1.44	2.16
0+340	20						MasonryRetainingWallDyn	1	11.328	1.2	1.8
0+360	20						MasonryRetainingWallDyn	1.7	26.434	2.04	3.06
0+380	20						MasonryRetainingWallDyn	1.4	19.237	1.68	2.52
0+400	20						MasonryRetainingWallDyn	1.7	26.434	2.04	3.06
0+440	20						MasonryRetainingWallDyn	1.6	23.914	1.92	2.88
0+460	20						MasonryRetainingWallDyn	1.6	23.914	1.92	2.88
0+480	20						MasonryRetainingWallDyn	1.5	21.515	1.8	2.7
0+500	20						MasonryRetainingWallDyn	1	11.328	1.2	1.8
0+640	20						MasonryRetainingWallDyn	1.5	21.515	1.8	2.7

0+660	20						MasonryRetainingWallDyn	1.5	21.515	1.8	2.7
0+860	20	MasonryRetainingWallDyn	1.8	29.074	2.16	3.24					
0+880	20	MasonryRetainingWallDyn	1.3	17.079	1.56	2.34					

Structure (MasonryRetainingWall) Quantity											
Chain age (m)	Length(m)	Left					Right				
		MasonryRetainingWall	Height M	RRM (1 in 6 C/S Ratio) M3	PCC Base M10 M3	Stone Soling M3	MasonryRetainingWall	Height M	RRM (1 in 6 C/S Ratio) M3	PCC Base M10 M3	Stone Soling M3
0+900	20	MasonryRetainingWallDyn	1.1	13.125	1.32	1.98					
0+920	20	MasonryRetainingWallDyn	2	34.717	2.4	3.6					
0+940	20	MasonryRetainingWallDyn	1.9	31.835	2.28	3.42					
0+960	20	MasonryRetainingWallDyn	1.7	26.434	2.04	3.06					
1+180	20	MasonryRetainingWallDyn	1.5	21.515	1.8	2.7					
1+200	20	MasonryRetainingWallDyn	0.9	9.653	1.08	1.62					
1+220	20	MasonryRetainingWallDyn	1	11.328	1.2	1.8					
1+260	20	MasonryRetainingWallDyn	1.7	26.434	2.04	3.06					
1+280	20	MasonryRetainingWallDyn	1.1	13.125	1.32	1.98					
2+160	20						MasonryRetainingWallDyn	0.8	8.269	1	1.5

2+180	20						MasonryRetainingWallDyn	1	11.328	1.2	1.8
2+200	20						MasonryRetainingWallDyn	1.5	21.515	1.8	2.7
2+220	20						MasonryRetainingWallDyn	1.3	17.079	1.56	2.34
2+240	20						MasonryRetainingWallDyn	1.1	13.125	1.32	1.98

Summary of Quantity

Item Code	Name	Quantity	Unit
24.01(A-ii)	Gabion Works	420	M3
24.05	Geotextile	352	M2

Structure (GabionRetainingWall) Quantity

Chainage (m)	Length (m)	Left				Right			
		GabionRetainingWall	Height M	Gabion Works M3	Geotextile M2	GabionRetainingWall	Height M	Gabion Works M3	Geotextile M2
1+580	20					GabionRetainingWallDyn	3	90	76
1+600	20					GabionRetainingWallDyn	2	50	48
1+620	20					GabionRetainingWallDyn	2	50	48
2+100	20					GabionRetainingWallDyn	3	90	76
2+120	20					GabionRetainingWallDyn	4	140	104

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
Section I: General Items							
1.1		Insurance of works, equipment, Contractor's workmen and employees and Third party Insurance against damage to other persons and property.	LS	1.00	294,000.00	294,000.00	
1.5		Relocation of utilities including necessary materials and works in BOQ Items and other relevant unforeseen work items as necessisities and directed by the Engineer.	PS	1.00	2,000,000.00	2,000,000.00	
1.7	110	Providing and installation of project signboards with size of 1.8 x 1.2 m as per specification and instruction of engineer.	No	2.00	10,438.15	20,876.30	
1.8	104, 108	Traffic diversion/operation, Providing and maintenance of Temporary diversion of road/bridge to keep the road serviceable through out the contract period as per specification and instruction of engineer.	LS	1.00	100,000.00	100,000.00	

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1.9	109, 2902	Carry out routine/regular maintenance of the existing road to keep the road serviceable through out the contract period as per specification and instruction of the Engineer	Km-month	62.16	14,988.90	931,710.02	
					Sub - Total (A)	3,346,586.32	
Section II. Site Clearance							

ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District
Section : 0 to 2.59 km

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
2.1	201	Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable Material to be used or auctioned, up to a lead of 30 meters including removal and disposal of top organic soil not exceeding 150 mm in thickness.	Sqm.	2,719.50	5.52	15,011.64	
					Sub - Total (B)	15,011.64	
Section III. Earthworks							
3.1	905	Roadway Excavation in all types of soil & rock as per drawing and technical specification,including removal of stumps and other deleterious matter,with all lifts and lead and disposal at environmentally suitable place as per Drawing and instruction of Engineer.	Cum	10791.22	128.15	1,382,894.84	

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3.2	909	Providing, laying, spreading and compacting embankment with suitable material and compact to the required density as per Drawing and Technical Specifications.	Cum	133.20	323.59	43,102.18	

ABSTRACT OF COST

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
3.3	2900, 900	Clearance of landslides in all type of soil and rock and disposal of the same oat environmentally suitable place as instructed by the Engineer.	Cum	5000.00	54.90	274,500.00	
					Sub - Total (C)	1,700,497.02	
Section IV. Pavement Works							
4.1	1003, 1005	Compacting original ground supporting sub-grade Loosening of the ground upto a level of 500 mm below the sub-grade level, watered, graded and compacted in layers as per Drawing and Technical Specifications.	Cum	12,236.82	102.42	1,253,295.10	
4.2	1,204	Providing and laying granular sub-base on prepared surface, mixing at OMC, and compacting to achieve the desired density, complete as per Drawing and Technical Specifications by mechanical means.	Cum	4,558.00	4788.68	21,826,803.44	

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4.3	1,203	Providing and laying Crusher Run Macadam on a prepared surface, spreading and mixing , watering and compacting to form a layer of Base course as per Drawing and Technical Specifications.	Cum	4,005.72	6083.43	24,368,517.21	

ABSTRACT OF COST

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
4.4	1,201	Providing and laying granular sub-base on prepared surface, mixing at OMC, and compacting to achieve the desired density, complete as per Drawing and Technical Specifications for shoulders.	Cum	1,366.39	4788.68	6,543,204.46	
4.5	1,302	Providing and applying prime coat with hot bitumen (including appropriate cutter) on prepared surface of granular base including cleaning of road surface and spraying by mechanical means as per the Technical Specification .	Ltr.	18,396.99	134.12	2,467,404.29	0.9ltr/sqm
4.6	1,302	,Providing and applying tack coat with hot Bitumen at specified rate on the prepared surfaces including cleaning as per Technical Speciation .(Tack coat with bitumen by mechanical means)	Ltr.	12,264.66	123.24	1,511,496.69	0.6ltr/sqm
4.8	1,309	Bituminous Concrete / Asphalt Concrete Providing and laying Bituminous concrete/ Asphalt concrete using crushed aggregates of specified grading, premixed with bituminous binder and filler as per Drawing and Technical Specifications	Cum	751.64	24169.98	18,167,123.76	

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					Sub - Total (D)	76,137,844.95	
Section V. Cross Drainage Structures							

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ABSTRACT OF COST

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Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
5.1	907	Earth work in excavation of foundation of structures in all types of soil and rock, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications.	Cum	488.45	133.44	65,178.76	
5.2	701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.					
		a) 900mm diameter	Rm	62.50	18,429.46	1,151,841.25	
5.3	1006	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Cum	49.09	3,953.91	194,097.44	
5.4	2600, 2607, 3109	Providing and laying Stone Masonry work in cement mortar 1:4 in structure with 100 mm PVC pipe for weep holes and pointing with cement sand mortar all complete as per Drawing and Technical Specifications.	Cum	432.62	13,467.84	5,826,456.94	

Section : 0 to 2.59 km

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Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
5.5	2401	Supply and assemble of machine made mechanically salvaged gabion and mattresses produced from double twisted heavy coated GI wire of hexagonal mesh size of 100 mm x 120 mm, with mesh wire 3.0 mm, selvedge wire 3.9 mm, binding wire 2.4 mm and packing and filling of gabion create with rubble stone including transport and fixing of gabions in position, all complete as per	Cum	420.00	6,045.73	2,539,206.60	
5.6		Concrete Works			-	-	
5.6.1	2000	Providing and laying of Plain Cement Concrete M 15 in Foundation complete as per Drawing and Technical Specifications.	Cum	81.49	14,563.74	1,186,799.17	
5.7		Form Work				-	
5.7.1	1804, 1805	Providing , Preparing and Installing form work including necessary supports and removing after completion for foundation and footings-Class F1 finish.	Sqm.	5412.28	840.96	4,551,510.98	

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
5.7	909, 910	Providing and laying of Filter media with granular Material/stone crushed aggregates to a thickness of not less than 600 mm with smaller size towards the soil and bigger size towards the wall and provided over the entire surface behind abutment, wing wall and return wall to the full height compacted to a firm condition complete as per drawing and Technical Specification.	Cum	40.80	5,378.01	219,422.80	
5.80	2404	Providing and laying of a geotextile filter between pitching and embankment slopes as per Drawing and Technical Specifications.	Sqm.	208.70	185.38	38,688.80	
					Sub - Total (E)	15,773,202.74	
Section VI. Structure Works							

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Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
6.1	907	Earth work in excavation of foundation of structures in all types of soil and rock, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications.	Cum	765.40	133.44	102,134.97	
6.2	1006	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Cum	40.60	3,953.91	160,528.74	
6.3	2600, 2607, 3109	Providing and laying Stone Masonry work in cement mortar 1:4 in structure with 100 mm PVC pipe for weep holes and pointing with cement sand mortar all complete as per Drawing and Technical Specifications.	Cum	537.45	13,467.84	7,238,290.60	

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Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
6.4	2402	Supply and assemble of machine made mechanically salvaged gabion and mattresses produced from double twisted heavy coated GI wire of hexagonal mesh size of 100 mm x 120 mm, with mesh wire 3.0 mm, selvedge wire 3.9 mm, binding wire 2.4 mm and packing and filling of gabion create with rubble stone including transport and fixing of gabions in position, all complete	Cum	420.00	6,045.73	2,539,206.60	
6.5		Concrete Works					
6.5.1	2000	Providing and laying of Plain Cement Concrete M 15 in Foundation complete as per Drawing and Technical Specifications.	Cum	27.04	14,563.74	393,803.52	
6.70	2404	Providing and laying of a geotextile filter between pitching and embankment slopes as per Drawing and Technical Specifications.	Sqm.	352.00	185.38	65,253.76	
					Sub - Total (F)	10,499,218.19	
Section VII. Drainage Works							

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Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
7.1	907	Earth work in excavation of foundation of structures in all types of soil and rock, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications.	Cum	1815.98	133.44	242,324.37	
7.2	2600, 2607, 3109	Providing and placing concrete with 60% M 15/40 concrete and 40% boulders/stones with 110 mm HDPE pipe for weep holes complete as per Drawing and Technical Specifications.	Cum	293.94	11,244.45	3,305,193.63	
7.3		Concrete Works			-	-	
7.3.1	2000	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.RCC Grade M25	Cum	1068.38	17,567.17	18,768,413.08	
7.3.2	2000	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications. Grade M20	Cum	436.98	16,448.01	7,187,451.40	

Section : 0 to 2.59 km

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ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
7.4	1006	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Cum	436.98	3,953.91	1,727,779.59	
7.5	2014	Providing and laying , fitting and placing HYSD bar reinforcement complete as per Drawing and Technical Specifications.	Tonn.	23.91	134,986.23	3,227,520.75	
					Sub - Total (G)	34,458,682.82	
Section VIII. Bio Engineering Works							
8.1	201	Clearing Grass and Removal of Rubbish and Dressing and levelling the construction surface Clearing grass/ top soil and removal up to a distance of 50 meters outside the periphery of the area , including cutting and filling of small undulation.	Sqm.	3240.00	10.35	33,534.00	

Section : 0 to 2.59 km

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ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
8.2	2807	Planting rooted grass slips on the slopes <45o including preparation of slips on site. a max of 5 cm depth with metal rod or Operation includes digging planting hole to hard-wood peg, depending on the nature of the soil. The planting drills should be space	Sqm.	2025.00	389.00	787,725.00	
8.3	2807	Planting containerized tree and shrub seedlings, including pitting, transplanting, composting and placing tree guards, on toe of embankment slopes in plain areas, not less than 8 m from the road center line. Pit size 30 cm diameter x depth. Compost volume 1/4 of the volume of the pit, mixed with original soil.	Nos	2025.00	174.00	352,350.00	

Section : 0 to 2.59 km

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
8.4	2807	Supply, Preparation and planting of live cuttings of selected species (eg assuro, namdi phul, simali) of minimum 1 m length to 0.5 m into soft debris. Pegs spaced at 5 cm centres within rows, with 5-20 cm between rows, and interwoven with vegetation.	Rm	2025.00	139.00	281,475.00	
					Sub - Total (H)	1,455,084.00	
Section IX. Miscellaneous Works							
		Road furnishing and Protection Works					
9.1	1501	Supplying and erecting traffic sign in place including 50mm dia. Steel tube, 2mm. thick steel plate, cement concrete, painting, writing and supporting steel angle nut and bolit etc. complete					
		a) Single post	Nos.	39.00	3,819.77	148,971.03	
		b) Two or more post	Nos.	2.00	8,666.57	17,333.14	

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9.2	1506	Providing and Fixing Reinforcedcement concrete M15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. position a) One kilometer post	Nos.	2.00	6,653.89	13,307.78	

ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District
Section : 0 to 2.59 km

Prepared by: Checked by: Recommended By Approved by

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ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District

S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
9.3	1506	Providing and Fixing Reinforcedcement concrete M15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. position a) Five kilometer post	Nos.		12,070.20	-	
9.4	1509	Providing and erecting a "W" metal beam crashbarrier comprising of 3mm thick corrugated sheetmetal beam rail, 70cm above road/ground level, fixed on ISMC series channel vertical post, 150x75x5 mm spaced 2m center to center, 1.8m high, 1.1m below ground/road level metal beam rail to be fixed on the vertical post with a spacer of channel section 150x75x5mm, 330mm long complete as per Drawing and Technical Specifications.	Rm	431.67	8,217.60	3,547,291.39	

Section : 0 to 2.59 km

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
9.5	1507	Providing and installation of 150mm*150mm 1.5m long delineators (roadwayindicators, hazard markers,object markers),80-100 cm high above ground level,painted black and white in 20cm widestrips,buried or pressed into the ground and conforming to the drawings and Technical Specifications.	Nos.	518.00	1,390.02	720,030.36	
9.6	1504	Providing and laying of hot applied thermoplastic compound at least 2mm thick including reflectorizing glass beads as per DOR Traffic sign Manual/Specifications.The finished surface to be level, uniform and free from streaks and holes.On smooth surface (similar to Asphalt concrete and rigid pavement) b) More than two coats over new bitumin surface	Sqm.	195.00	1,723.58	336,098.10	
		Dayworks for emergency maintenance work					
		Day works shall be executed only on the written instruction of the Project Manager:					
9.9		Labour including hand tools					

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		a) Skilled labour	Day	50.00	1,200.00	60,000.00	
		b) Unskilled labour	Day	100.00	900.00	90,000.00	
9.10		Material (inculding transportation to site)					

ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District
Section : 0 to 2.59 km

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S.N.	Spec.	Description of works	Unit	Quantity	Rate, (NRs)	Amount (NRs)	Remarks
		a) Stone	Cum	800.00	1,665.15	1,332,120.00	
		b) Gravel	Cum	100.00	3,025.44	302,544.00	
		c)Cement	bag	50.00	859.36	42,968.00	
9.11		Equipments with fuel and crew members					
		a) Excavator	Hr	90.00	2,455.24	220,971.60	
		b) Tractor	Hr	50.00	869.00	43,450.00	
		c) Tipper/Truck	Hr	50.00	2,444.80	122,240.00	
					Sub - Total (I)	6,997,325.40	
					Total	150,383,453.08	
					Total with Provisional Sum (A)	150,383,453.08	

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Total without Provisional Sum(B)	148,383,453.08	
VAT @ 13 % of (B)	19,289,848.90	
Total with VAT	167,673,301.98	
Contingencies @ 4% of (B)	5,935,338.12	
Total with Provisional Sum, VAT & Contingencies	175,608,640.10	
Physical Contingency @ 10% of (B)	14,838,345.30	
Price adjustment @ 10% of (B)	14,838,345.30	
Grand Total	205,285,330.70	

ABSTRACT OF COST

Construction Period: 24.00 months F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project
Location : Bhaktapur District
Section : 0 to 2.59 km

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Summary of Quantity Sheet

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Location : Bhaktapur District

Section : 0 to 2.59 km

S No.	Description	Unit	Road way	Drain/shoulder	Masonry Wall	Gabion Wall	Chut	Pipe Culvert	Total
1	Site Clearance								
	Clearing of grass, removing roots, breaking sods, leveling the surface and disposal as per specification with all complete.	Sqm	2,719.50						2,719.50
2	Earthwork								
	Excavation for Roadway in all type of soil and rock material including disposal of excavated material at approved environmentally safe tipping sites by machine and manualy with all complete.	Cum	10,791.22						10,791.22
	Excavation for structures including cutting of slopes, shoring, shuttering, planking, ordinary sealing and disposal of materials upto a lead of 50m along the lead route in all type of soil with all complete	Cum	765.40	1,815.98			39.30	449.15	3,069.83
	Construction of embankments, shoulders and other miscellaneous filling and backfilling with approved materials including the cost of transportation of the material with all complete.	Cum	133.20						133.20
	Backfill behind structure with suitable common approved material with all complete.	Cum	97.90				7.86	212.75	318.51
	Clearance of landslides in soil and ordinary rock by machine and disposal of the same on the valley side or designated place as instructed by the Engineer.	Cum	5,000.00						5,000.00
3	Stone Masonry								
	Supply and place random rubble masonry work in 1:4 cement sand mortar including pointing works with all complete.	Cum			537.45		54.22	378.40	970.07

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Summary of Quantity Sheet

4	Form Work								
	Providing, preparing and installing Formwork including necessary support and removing after completion all complete as per Specification.[F1 Finish, 1804, 1805]	Sqm		5,412.28			3.60	79.90	5,495.78
	Providing, preparing and installing Formwork including falsework, necessary support and removing after completion all complete as per Specification.[F2 Finish, 1804, 1805]	Sqm	-						-
4	Gabion Works								

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Location : Bhaktapur District

Section : 0 to 2.59 km

S No.	Description	Unit	Road way	Drain/shoulder	Masonry Wall	Gabion Wall	Chut	Pipe Culvert	Total
	Supply and assemble of machine made mechanically salvaged gabion and mattresses produced from double twisted heavy coated GI wire of hexagonal mesh size of 100 mm x 120 mm, with mesh wire 3.0 mm, selvedge wire 3.9 mm, binding wire 2.4 mm and packing and filling of gabion create with rubble stone including transport and fixing of gabions in position, all complete as per DOR SSRBW - Section 2402	Cum				420.00		420.00	840.00
	Providing, laying and fixing of Geo-textile with all complete	Sqm				352.00		208.70	560.70

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Location : Bhaktapur District

Section : 0 to 2.59 km

S No.	Description	Unit	Road way	Drain/shoulder	Masonry Wall	Gabion Wall	Chut	Pipe Culvert	Total
5	Supply and place high tensile reinforcement (Fe500) including bending, binding etc all complete as specified with all complete.	Tonn.	-	23.91					23.91

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Summary of Quantity Sheet

6	Cement concrete work with all complete. It includes all labour and material required for mixing, placing in position, vibrating, compacting, finishing, curing and all other incidentals required to produce concrete of specified strength as per the specifications. The rate includes the work of making, fixing and removing of all centres and foRms required for the work.								
	M15/40 Grade	Cum			27.04		11.79	69.70	108.53
	M20/20 Grade	Cum		436.98					436.98
	M25 Grade	Cum	-	1,068.38					1,068.38
	Providing and placing concrete with 60% M 15/40 concrete and 40% boulders/stones as per specification Lead 30m, lift 1.5m , using concrete mixer and vibrator.	Cum		293.94					293.94
7	Backfilling in structures, cross drainage structures and sub soil drains with graded filter material with all complete	Cum						40.80	40.80
8	Supply and Place NP-3, RCC hume pipe with all complete.								
	900 mm diameter pipe	Rm						62.50	62.50
	600 mm diameter pipe	Rm						-	-
9	Pavement Works								
	Preparation of subgrade (filling or cutting up to a depth of 150 mm) to designed grade and camber including watering and compaction with all complete.	Sqm	24,473.64						24,473.64
	Supply, place and compact quarry sieved subbase material with application binding material at stock pile with all complete	Cum	4,558.00						4,558.00

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Summary of Quantity Sheet

	Providing, laying, spreading, watering, levelling and compaction of crusher run materials for base course lead upto 10m. (a) Machine works [1202]	Cum	4,005.72						4,005.72
	Supply, place and compact shoulder material ,all complete.	Cum	1,366.39						1,366.39

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Location : Bhaktapur District

Section : 0 to 2.59 km

S No.	Description	Unit	Road way	Drain/shoulder	Masonry Wall	Gabion Wall	Chut	Pipe Culvert	Total
	Anti- Stripping agent Providing and mixing of Anti stripping agent as per Design/ direction of Engineer	Kg	929.05						929.05
10	Bituminous Courses								
	Providing and spraying bituminous Prime coat MC 30/70 including cleaning the road surface using wire brushes, booms etc before applying prime coat all complete (1301, 1302)application rate 0.9 ltr/m2	Ltr.	18,396.99						18,396.99
	Providing and spraying bituminous Tack coat MC 30/70 including cleaning the road surface using wire brushes, booms etc before applying tack coat all complete (1301, 1302), application rate 0.6 ltr/m2	Ltr.	12,264.66						12,264.66

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Location : Bhaktapur District

Section : 0 to 2.59 km

S No.	Description	Unit	Road way	Drain/shoulder	Masonry Wall	Gabion Wall	Chut	Pipe Culvert	Total
									-

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Summary of Quantity Sheet

11	Stone pitching/Soling								
	Stone soling in foudation	Cum		436.98	40.60		11.79	37.30	526.67
12	Provide and erect "W" metal beam crashbarrier comprising of 3.43 mm thick corrugated sheet metal beam rail, 700 mm above road/ground level, fixed on ISMC series channel vertical post, 150mm x 75 mm x 5mm spaced at 2m c/c, 1.8m high of which 1.1m shall be below ground/road level. All steel parts and fitment shall be galvanised by hot dip process, all fittings to confirm to IS 1367 and IS 1364, metal beam rail to be fixed on the vertical post with a spacer of channel section 150*75*5mm, 330mm long, as per drawing and specifications all complete.	Rm	431.67						431.67
13	Supply and place RCC delineator with all complete	Nos	518.00						518.00
14	Supply and place one kilometer stone with all complete.	Nos	2.00						2.00
15	Supply and place 5th kilometer stone with all complete.	Nos	-						-
16	Supply and place permanent traffic sign with all complete.	Nos	38.85						39.00
18	Supply and place standard size sign board for contract infoRmation with all complete.	Nos	2.00						2.00
19	Supplying and applying thermoplastic paint for Road marking including cleaning, watering, brooming etc. all complete (10cm. wide strip) over new bitumin surface	Sqm	194.21						195.00
20	Bio Engineering Works								
21	Slope preparation for bio-engineering works.	Sqm	3,240.00						3,240.00

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Summary of Quantity Sheet

	Grass Plantation works including supply of Plants with all complete	Sqm	2,025.00						2,025.00
	Brush layering works including supplying of plants with all complete	Rm	2,025.00						2,025.00
	Supply and planting tree/shrubs	Nos	2,025.00						2,025.00

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Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Earthwork in Roadway						Excess filling	Structure Pro. Length	E/W for Retaining wall / Gabion				Road Way Cutting Soil type						Remarks
		Road way Cutting			Filling					Cutting		Back filling		BMS		Soft Rock		Hard Rock		
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
0+000	10.00	4.59	2.30	23.00	-	-	-	-	10.00	-	-	-	-	86	19.78	12	2.76	2	0.46	
0+020	20.00	1.54	3.07	61.40	0.28	0.14	2.80	-	20.00	-	-	-	-	86	52.80	12	7.37	2	1.23	
0+040	20.00	0.83	1.19	23.80	0.36	0.32	6.40	-	20.00	-	-	-	-	86	20.47	12	2.86	2	0.48	
0+060	20.00	2.60	1.71	34.20	0.01	0.18	3.60	-	20.00	-	-	-	-	86	29.41	12	4.10	2	0.68	
0+080	20.00	5.54	4.07	81.40	-	0.01	0.20	-	20.00	-	-	-	-	86	70.00	12	9.77	2	1.63	
0+100	20.00	7.82	6.68	133.60	-	-	-	-	20.00	-	-	-	-	86	114.90	12	16.03	2	2.67	
0+120	20.00	8.21	8.02	160.40	-	-	-	-	20.00	-	-	-	-	86	137.94	12	19.25	2	3.21	
0+140	20.00	7.81	8.01	160.20	-	-	-	-	20.00	-	-	-	-	86	137.77	12	19.22	2	3.20	
0+160	20.00	5.79	6.80	136.00	-	-	-	-	20.00	-	-	-	-	86	116.96	12	16.32	2	2.72	
0+180	20.00	3.77	4.78	95.60	-	-	-	-	20.00	-	-	-	-	86	82.22	12	11.47	2	1.91	
0+200	20.00	1.55	2.66	53.20	0.16	0.08	1.60	-	20.00	-	-	-	-	86	45.75	12	6.38	2	1.06	

0+220	20.00	1.57	1.56	31.20	0.25	0.21	4.20	-	20.00	-	-	-	-	86	26.83	12	3.74	2	0.62	
0+240	20.00	1.91	1.74	34.80	0.13	0.19	3.80	-	20.00	-	-	-	-	86	29.93	12	4.18	2	0.70	
0+260	20.00	2.92	2.42	48.40	-	0.07	1.40	-	20.00	-	-	-	-	86	41.62	12	5.81	2	0.97	
0+280	20.00	4.93	3.93	78.60	-	-	-	-	20.00	-	-	-	-	86	67.60	12	9.43	2	1.57	
0+300	20.00	0.32	2.63	52.60	1.58	0.79	15.80	-	20.00	0.49	9.80	0.03	0.60	86	45.24	12	6.31	2	1.05	
0+320	20.00	0.61	0.47	9.40	1.01	1.30	26.00	16.60	20.00	0.65	13.00	0.05	1.00	86	8.08	12	1.13	2	0.19	
0+340	20.00	1.53	1.07	21.40	0.70	0.85	17.00	-	20.00	0.53	10.60	0.03	0.60	86	18.40	12	2.57	2	0.43	
0+360	20.00	0.30	0.92	18.40	2.88	1.79	35.80	17.40	20.00	1.12	22.40	0.14	2.80	86	15.82	12	2.21	2	0.37	
0+380	20.00	0.34	0.32	6.40	0.75	1.82	36.40	30.00	20.00	0.81	16.20	0.08	1.60	86	5.50	12	0.77	2	0.13	
0+400	20.00	1.65	1.00	20.00	0.54	0.65	13.00	-	20.00	0.94	18.80	0.09	1.80	86	17.20	12	2.40	2	0.40	

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Thapathali, Kathmandu Earthwork

Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Earthwork in Roadway						Excess filling	Structure Pro. Length	E/W for Retaining wall / Gabion				Road Way Cutting Soil type						Remarks
		Road way Cutting			Filling					Cutting		Back filling		BMS		Soft Rock		Hard Rock		
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
0+420	20.00	4.42	3.04	60.80	-	0.27	5.40	-	20.00	-	-	-	-	86	52.29	12	7.30	2	1.22	

0+440	20.00	2.26	3.34	66.80	0.42	0.21	4.20	-	20.00	0.95	19.00	0.10	2.00	86	57.45	12	8.02	2	1.34	
0+460	20.00	1.89	2.08	41.60	0.49	0.45	9.00	-	20.00	0.99	19.80	0.11	2.20	86	35.78	12	4.99	2	0.83	
0+480	20.00	1.34	1.61	32.20	0.66	0.57	11.40	-	20.00	0.83	16.60	0.08	1.60	86	27.69	12	3.86	2	0.64	
0+500	20.00	1.69	1.51	30.20	0.26	0.46	9.20	-	20.00	0.52	10.40	0.03	0.60	86	25.97	12	3.62	2	0.60	
0+520	20.00	2.76	2.22	44.40	0.11	0.19	3.80	-	20.00	-	-	-	-	86	38.18	12	5.33	2	0.89	
0+540	20.00	2.90	2.83	56.60	0.15	0.13	2.60	-	20.00	-	-	-	-	86	48.68	12	6.79	2	1.13	
0+560	20.00	5.85	4.38	87.60	-	0.08	1.60	-	20.00	-	-	-	-	86	75.34	12	10.51	2	1.75	
0+580	20.00	4.29	5.07	101.40	0.29	0.15	3.00	-	20.00	-	-	-	-	86	87.20	12	12.17	2	2.03	
0+600	20.00	3.30	3.80	76.00	1.31	0.80	16.00	-	20.00	-	-	-	-	86	65.36	12	9.12	2	1.52	
0+620	20.00	1.75	2.53	50.60	0.27	0.79	15.80	-	20.00	-	-	-	-	86	43.52	12	6.07	2	1.01	
0+640	20.00	0.94	1.35	27.00	0.70	0.49	9.80	-	20.00	0.79	15.80	0.07	1.40	86	23.22	12	3.24	2	0.54	
0+660	20.00	1.10	1.02	20.40	0.51	0.61	12.20	-	20.00	0.81	16.20	0.07	1.40	86	17.54	12	2.45	2	0.41	
0+680	20.00	1.70	1.40	28.00	0.23	0.37	7.40	-	20.00	-	-	-	-	86	24.08	12	3.36	2	0.56	
0+700	20.00	4.12	2.91	58.20	0.31	0.27	5.40	-	20.00	-	-	-	-	86	50.05	12	6.98	2	1.16	
0+720	20.00	5.60	4.86	97.20	0.03	0.17	3.40	-	20.00	-	-	-	-	86	83.59	12	11.66	2	1.94	
0+740	20.00	5.93	5.77	115.40	0.01	0.02	0.40	-	20.00	-	-	-	-	86	99.24	12	13.85	2	2.31	
0+760	20.00	4.43	5.18	103.60	-	0.01	0.20	-	20.00	-	-	-	-	86	89.10	12	12.43	2	2.07	

0+780	20.00	4.13	4.28	85.60	-	-	-	-	20.00	-	-	-	-	86	73.62	12	10.27	2	1.71	
0+800	20.00	4.92	4.52	90.40	-	-	-	-	20.00	-	-	-	-	86	77.74	12	10.85	2	1.81	
0+820	20.00	6.60	5.76	115.20	-	-	-	-	20.00	-	-	-	-	86	99.07	12	13.82	2	2.30	

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Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Earthwork in Roadway						Excess filling	Structure Pro. Length	E/W for Retaining wall / Gabion				Road Way Cutting Soil type						Remarks
		Road way Cutting			Filling					Cutting		Back filling		BMS		Soft Rock		Hard Rock		
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
0+840	20.00	8.02	7.31	146.20	0.13	0.07	1.40	-	20.00	-	-	-	-	86	125.73	12	17.54	2	2.92	
0+860	20.00	2.42	5.22	104.40	1.01	0.57	11.40	-	20.00	0.93	18.60	0.08	1.60	86	89.78	12	12.53	2	2.09	
0+880	20.00	3.10	2.76	55.20	0.26	0.64	12.80	-	20.00	0.76	15.20	0.07	1.40	86	47.47	12	6.62	2	1.10	
0+900	20.00	1.92	2.51	50.20	0.80	0.53	10.60	-	20.00	0.58	11.60	0.04	0.80	86	43.17	12	6.02	2	1.00	
0+920	20.00	1.57	1.75	35.00	1.41	1.11	22.20	-	20.00	1.36	27.20	0.19	3.80	86	30.10	12	4.20	2	0.70	
0+940	20.00	2.15	1.86	37.20	1.17	1.29	25.80	-	20.00	1.22	24.40	0.15	3.00	86	31.99	12	4.46	2	0.74	
0+960	20.00	1.36	1.76	35.20	0.97	1.07	21.40	-	20.00	1.08	21.60	0.13	2.50	86	30.27	12	4.22	2	0.70	
0+980	20.00	3.88	2.62	52.40	0.09	0.53	10.60	-	20.00	-	-	-	-	86	45.06	12	6.29	2	1.05	

1+000	20.00	9.10	6.49	129.80	-	0.05	1.00	-	20.00	-	-	-	-	86	111.63	12	15.58	2	2.60	
1+020	20.00	10.35	9.73	194.60	0.02	0.01	0.20	-	20.00	-	-	-	-	86	167.36	12	23.35	2	3.89	
1+040	20.00	11.48	10.92	218.40	0.01	0.02	0.40	-	20.00	-	-	-	-	86	187.82	12	26.21	2	4.37	
1+060	20.00	8.25	9.87	197.40	0.13	0.07	1.40	-	20.00	-	-	-	-	86	169.76	12	23.69	2	3.95	
1+080	20.00	5.35	6.80	136.00	0.22	0.18	3.60	-	20.00	-	-	-	-	86	116.96	12	16.32	2	2.72	
1+100	20.00	4.49	4.92	98.40	0.24	0.23	4.60	-	20.00	-	-	-	-	86	84.62	12	11.81	2	1.97	
1+120	20.00	4.62	4.56	91.20	0.37	0.31	6.20	-	20.00	-	-	-	-	86	78.43	12	10.94	2	1.82	
1+140	20.00	7.45	6.04	120.80	0.66	0.52	10.40	-	20.00	-	-	-	-	86	103.89	12	14.50	2	2.42	
1+160	20.00	10.96	9.21	184.20	-	0.33	6.60	-	20.00	-	-	-	-	86	158.41	12	22.10	2	3.68	
1+180	20.00	7.09	9.03	180.60	0.25	0.13	2.60	-	20.00	0.92	18.40	0.10	2.00	86	155.32	12	21.67	2	3.61	
1+200	20.00	6.80	6.95	139.00	0.05	0.15	3.00	-	20.00	0.48	9.60	0.03	0.60	86	119.54	12	16.68	2	2.78	
1+220	20.00	6.55	6.68	133.60	0.12	0.09	1.80	-	20.00	0.54	10.80	0.03	0.60	86	114.90	12	16.03	2	2.67	
1+240	20.00	5.22	5.89	117.80	-	0.06	1.20	-	20.00	-	-	-	-	86	101.31	12	14.14	2	2.36	

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Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

	Length	Earthwork in Roadway		Excess filling		E/W for Retaining wall / Gabion	Road Way Cutting Soil type	

Chainage	(m)	Road way Cutting			Filling				Structure Pro. Length	Cutting		Back filling		BMS		Soft Rock		Hard Rock		Remarks
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
1+260	20.00	3.14	4.18	83.60	0.67	0.34	6.80	-	20.00	0.94	18.80	0.09	1.80	86	71.90	12	10.03	2	1.67	
1+280	20.00	2.41	2.78	55.60	0.71	0.69	13.80	-	20.00	0.59	11.80	0.04	0.80	86	47.82	12	6.67	2	1.11	
1+300	20.00	7.25	4.83	96.60	0.02	0.36	7.20	-	20.00	-	-	-	-	86	83.08	12	11.59	2	1.93	
1+320	20.00	6.91	7.08	141.60	-	0.01	0.20	-	20.00	-	-	-	-	86	121.78	12	16.99	2	2.83	
1+340	20.00	7.71	7.31	146.20	-	-	-	-	20.00	-	-	-	-	86	125.73	12	17.54	2	2.92	
1+360	20.00	4.73	6.22	124.40	0.11	0.06	1.20	-	20.00	-	-	-	-	86	106.98	12	14.93	2	2.49	
1+380	20.00	3.73	4.23	84.60	0.64	0.38	7.60	-	20.00	-	-	-	-	86	72.76	12	10.15	2	1.69	
1+400	20.00	4.64	4.19	83.80	0.70	0.67	13.40	-	20.00	-	-	-	-	86	72.07	12	10.06	2	1.68	
1+420	20.00	4.08	4.36	87.20	0.70	0.70	14.00	-	20.00	-	-	-	-	86	74.99	12	10.46	2	1.74	
1+440	20.00	5.05	4.57	91.40	1.12	0.91	18.20	-	20.00	-	-	-	-	86	78.60	12	10.97	2	1.83	
1+460	20.00	5.13	5.09	101.80	0.53	0.83	16.60	-	20.00	-	-	-	-	86	87.55	12	12.22	2	2.04	
1+480	20.00	5.37	5.25	105.00	-	0.27	5.40	-	20.00	-	-	-	-	86	90.30	12	12.60	2	2.10	
1+500	20.00	3.96	4.67	93.40	-	-	-	-	20.00	-	-	-	-	86	80.32	12	11.21	2	1.87	
1+520	20.00	4.82	4.39	87.80	-	-	-	-	20.00	-	-	-	-	86	75.51	12	10.54	2	1.76	
1+540	20.00	5.71	5.27	105.40	-	-	-	-	20.00	-	-	-	-	86	90.64	12	12.65	2	2.11	

1+560	20.00	3.91	4.81	96.20	-	-	-	-	20.00	-	-	-	-	86	82.73	12	11.54	2	1.92	
1+580	20.00	2.66	3.28	65.60	1.56	0.78	15.60	-	20.00	3.02	60.40	0.36	7.20	86	56.42	12	7.87	2	1.31	
1+600	20.00	3.81	3.23	64.60	0.29	0.93	18.60	-	20.00	1.89	37.70	0.20	4.00	86	55.56	12	7.75	2	1.29	
1+620	20.00	4.58	4.19	83.80	0.19	0.24	4.80	-	20.00	2.18	43.60	0.30	6.00	86	72.07	12	10.06	2	1.68	
1+640	20.00	5.76	5.17	103.40	-	0.10	2.00	-	20.00	-	-	-	-	86	88.92	12	12.41	2	2.07	
1+660	20.00	6.09	5.93	118.60	-	-	-	-	20.00	-	-	-	-	86	102.00	12	14.23	2	2.37	

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Thapathali, Kathmandu Earthwork

Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Earthwork in Roadway						Excess filling	Structure Pro. Length	E/W for Retaining wall / Gabion				Road Way Cutting Soil type						Remarks
		Road way Cutting			Filling					Cutting		Back filling		BMS		Soft Rock		Hard Rock		
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
1+680	20.00	5.91	6.00	120.00	-	-	-	-	20.00	-	-	-	-	86	103.20	12	14.40	2	2.40	
1+700	20.00	4.02	4.97	99.40	0.04	0.02	0.40	-	20.00	-	-	-	-	86	85.48	12	11.93	2	1.99	
1+720	20.00	3.13	3.58	71.60	0.42	0.23	4.60	-	20.00	-	-	-	-	86	61.58	12	8.59	2	1.43	
1+740	20.00	6.21	4.67	93.40	-	0.21	4.20	-	20.00	-	-	-	-	86	80.32	12	11.21	2	1.87	
1+760	20.00	4.60	5.41	108.20	0.36	0.18	3.60	-	20.00	-	-	-	-	86	93.05	12	12.98	2	2.16	

1+780	20.00	2.84	3.72	74.40	0.94	0.65	13.00	-	20.00	-	-	-	-	86	63.98	12	8.93	2	1.49	
1+800	20.00	4.59	3.71	74.20	-	0.47	9.40	-	20.00	-	-	-	-	86	63.81	12	8.90	2	1.48	
1+820	20.00	5.31	4.95	99.00	-	-	-	-	20.00	-	-	-	-	86	85.14	12	11.88	2	1.98	
1+840	20.00	7.61	6.46	129.20	-	-	-	-	20.00	-	-	-	-	86	111.11	12	15.50	2	2.58	
1+860	20.00	4.86	6.24	124.80	-	-	-	-	20.00	-	-	-	-	86	107.33	12	14.98	2	2.50	
1+880	20.00	2.33	3.60	72.00	0.02	0.01	0.20	-	20.00	-	-	-	-	86	61.92	12	8.64	2	1.44	
1+900	20.00	4.16	3.25	65.00	-	0.01	0.20	-	20.00	-	-	-	-	86	55.90	12	7.80	2	1.30	
1+920	20.00	7.15	5.66	113.20	-	-	-	-	20.00	-	-	-	-	86	97.35	12	13.58	2	2.26	
1+940	20.00	4.75	5.95	119.00	0.49	0.25	5.00	-	20.00	-	-	-	-	86	102.34	12	14.28	2	2.38	
1+960	20.00	4.07	4.41	88.20	-	0.25	5.00	-	20.00	-	-	-	-	86	75.85	12	10.58	2	1.76	
1+980	20.00	3.67	3.87	77.40	-	-	-	-	20.00	-	-	-	-	86	66.56	12	9.29	2	1.55	
2+000	20.00	2.65	3.16	63.20	0.15	0.08	1.60	-	20.00	-	-	-	-	86	54.35	12	7.58	2	1.26	
2+020	20.00	6.81	4.73	94.60	0.01	0.08	1.60	-	20.00	-	-	-	-	86	81.36	12	11.35	2	1.89	
2+040	20.00	6.83	6.82	136.40	-	0.01	0.20	-	20.00	-	-	-	-	86	117.30	12	16.37	2	2.73	
2+060	20.00	6.90	6.87	137.40	-	-	-	-	20.00	-	-	-	-	86	118.16	12	16.49	2	2.75	
2+080	20.00	3.18	5.04	100.80	0.26	0.13	2.60	-	20.00	-	-	-	-	86	86.69	12	12.10	2	2.02	

Thapathali, Kathmandu Earthwork

Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Earthwork in Roadway						Excess filling	Structure Pro. Length	E/W for Retaining wall / Gabion				Road Way Cutting Soil type						Remarks
		Road way Cutting			Filling					Cutting		Back filling		BMS		Soft Rock		Hard Rock		
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
2+100	20.00	1.50	2.34	46.80	1.08	0.67	13.40	-	20.00	3.25	65.00	0.52	10.40	86	40.25	12	5.62	2	0.94	
2+120	20.00	3.16	2.33	46.60	0.35	0.72	14.40	-	20.00	6.29	125.80	1.47	29.40	86	40.08	12	5.59	2	0.93	
2+140	20.00	5.48	4.32	86.40	0.02	0.19	3.80	-	20.00	-	-	-	-	86	74.30	12	10.37	2	1.73	
2+160	20.00	2.93	4.20	84.00	1.62	0.82	16.40	-	20.00	0.27	5.40	0.03	0.60	86	72.24	12	10.08	2	1.68	
2+180	20.00	1.71	2.32	46.40	1.44	1.53	30.60	-	20.00	0.49	9.80	0.03	0.60	86	39.90	12	5.57	2	0.93	
2+200	20.00	0.32	1.02	20.40	2.46	1.95	39.00	18.60	20.00	0.75	15.00	0.06	1.20	86	17.54	12	2.45	2	0.41	
2+220	20.00	0.19	0.26	5.20	2.11	2.29	45.80	40.60	20.00	0.67	13.30	0.05	1.00	86	4.47	12	0.62	2	0.10	
2+240	20.00	1.09	0.64	12.80	0.17	1.14	22.80	10.00	20.00	0.64	12.80	0.05	1.00	86	11.01	12	1.54	2	0.26	
2+260	20.00	4.27	2.68	53.60	-	0.09	1.80	-	20.00	-	-	-	-	86	46.10	12	6.43	2	1.07	
2+280	20.00	5.82	5.05	101.00	-	-	-	-	20.00	-	-	-	-	86	86.86	12	12.12	2	2.02	
2+300	20.00	5.33	5.58	111.60	-	-	-	-	20.00	-	-	-	-	86	95.98	12	13.39	2	2.23	
2+320	20.00	1.90	3.62	72.40	0.83	0.42	8.40	-	20.00	-	-	-	-	86	62.26	12	8.69	2	1.45	
2+340	20.00	2.40	2.15	43.00	0.39	0.61	12.20	-	20.00	-	-	-	-	86	36.98	12	5.16	2	0.86	

2+360	20.00	3.06	2.73	54.60	0.44	0.42	8.40	-	20.00	-	-	-	-	86	46.96	12	6.55	2	1.09	
2+380	20.00	6.47	4.77	95.40	-	0.22	4.40	-	20.00	-	-	-	-	86	82.04	12	11.45	2	1.91	
2+400	20.00	5.35	5.91	118.20	-	-	-	-	20.00	-	-	-	-	86	101.65	12	14.18	2	2.36	
2+420	20.00	3.44	4.40	88.00	-	-	-	-	20.00	-	-	-	-	86	75.68	12	10.56	2	1.76	
2+440	20.00	3.22	3.33	66.60	0.20	0.10	2.00	-	20.00	-	-	-	-	86	57.28	12	7.99	2	1.33	
2+460	20.00	3.98	3.60	72.00	0.16	0.18	3.60	-	20.00	-	-	-	-	86	61.92	12	8.64	2	1.44	
2+480	20.00	5.20	4.59	91.80	-	0.08	1.60	-	20.00	-	-	-	-	86	78.95	12	11.02	2	1.84	
2+500	20.00	4.70	4.95	99.00	0.04	0.02	0.40	-	20.00	-	-	-	-	86	85.14	12	11.88	2	1.98	

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Thapathali, Kathmandu Earthwork

Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Earthwork in Roadway						Excess filling	Structure Pro. Length	E/W for Retaining wall / Gabion				Road Way Cutting Soil type						Remarks
		Road way Cutting			Filling					Cutting		Back filling		BMS		Soft Rock		Hard Rock		
		Area (m^2)	Av area (m^2)	Volume (m^3)	Area (m^2)	Av area (m^2)	Volume (m^3)	Volume (m^3)	L (m)	Area (m^2)	Vol (m^3)	Area (m^2)	Vol (m^3)	%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
2+520	20.00	2.76	3.73	74.60	0.02	0.03	0.60	-	20.00	-	-	-	-	86	64.16	12	8.95	2	1.49	
2+540	20.00	1.11	1.94	38.80	0.48	0.25	5.00	-	20.00	-	-	-	-	86	33.37	12	4.66	2	0.78	
2+560	20.00	0.93	1.02	20.40	0.17	0.33	6.60	-	20.00	-	-	-	-	86	17.54	12	2.45	2	0.41	

2+580	14.75	2.26	1.59	23.45	-	0.09	1.33	-	14.75	-	-	-	-	86	20.17	12	2.81	2	0.47	
2+589	4.75	-	1.13	5.37	-	-	-	-	4.75	-	-	-	-	86	4.62	12	0.64	2	0.11	
Total	2,589.50			10,791.22			887.53	133.20			765.40		97.90		9,280.41		1,294.91		215.80	

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Earthwork calculation for Drain

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage (m)	Length (m)	Area (m^2)	Volume (m^3)	Drainage Cutting Soil type						Remarks
				BMS		Soft Rock		Hard Rock		
				%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
0+000	10.00	0.68	6.80	80	5.44	15	1.02	5	0.34	
0+020	20.00	0.45	9.00	80	7.20	15	1.35	5	0.45	
0+040	20.00	0.47	9.30	80	7.44	15	1.40	5	0.47	
0+060	20.00	0.65	13.00	80	10.40	15	1.95	5	0.65	
0+080	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+100	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+120	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+140	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+160	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+180	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+200	20.00	0.59	11.80	80	9.44	15	1.77	5	0.59	
0+220	20.00	0.47	9.40	80	7.52	15	1.41	5	0.47	
0+240	20.00	0.60	12.00	80	9.60	15	1.80	5	0.60	
0+260	20.00	0.66	13.10	80	10.48	15	1.97	5	0.66	
0+280	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
0+300	20.00	0.08	1.50	80	1.20	15	0.23	5	0.08	
0+320	20.00	0.19	3.80	80	3.04	15	0.57	5	0.19	
0+340	20.00	0.35	7.00	80	5.60	15	1.05	5	0.35	
0+360	20.00	0.26	5.20	80	4.16	15	0.78	5	0.26	
0+380	20.00	0.49	9.80	80	7.84	15	1.47	5	0.49	
0+400	20.00	0.90	18.00	80	14.40	15	2.70	5	0.90	

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0+420	20.00	0.97	19.40	80	15.52	15	2.91	5	0.97	
0+440	20.00	0.96	19.20	80	15.36	15	2.88	5	0.96	
0+460	20.00	0.76	15.20	80	12.16	15	2.28	5	0.76	
0+480	20.00	0.78	15.60	80	12.48	15	2.34	5	0.78	
0+500	20.00	0.78	15.60	80	12.48	15	2.34	5	0.78	
0+520	20.00	0.97	19.40	80	15.52	15	2.91	5	0.97	
0+540	20.00	0.70	14.00	80	11.20	15	2.10	5	0.70	
0+560	20.00	0.97	19.40	80	15.52	15	2.91	5	0.97	
0+580	20.00	0.76	15.20	80	12.16	15	2.28	5	0.76	
0+600	20.00	0.34	6.80	80	5.44	15	1.02	5	0.34	
0+620	20.00	0.63	12.60	80	10.08	15	1.89	5	0.63	
0+640	20.00	0.86	17.20	80	13.76	15	2.58	5	0.86	
0+660	20.00	0.78	15.60	80	12.48	15	2.34	5	0.78	
0+680	20.00	0.65	13.00	80	10.40	15	1.95	5	0.65	
0+700	20.00	0.52	10.40	80	8.32	15	1.56	5	0.52	
0+720	20.00	0.83	16.60	80	13.28	15	2.49	5	0.83	
0+740	20.00	0.93	18.60	80	14.88	15	2.79	5	0.93	
0+760	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
0+780	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
0+800	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
0+820	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
0+840	20.00	0.73	14.60	80	11.68	15	2.19	5	0.73	
0+860	20.00	0.80	16.00	80	12.80	15	2.40	5	0.80	

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0+880	20.00	0.97	19.40	80	15.52	15	2.91	5	0.97	

Chainage (m)	Length (m)	Area (m^2)	Volume (m^3)	Drainage Cutting Soil type						Remarks
				BMS		Soft Rock		Hard Rock		
				%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
0+900	20.00	0.41	8.10	80	6.48	15	1.22	5	0.41	
0+920	20.00	0.27	5.40	80	4.32	15	0.81	5	0.27	
0+940	20.00	0.46	9.20	80	7.36	15	1.38	5	0.46	
0+960	20.00	0.45	8.90	80	7.12	15	1.34	5	0.45	
0+980	20.00	0.76	15.20	80	12.16	15	2.28	5	0.76	
1+000	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+020	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+040	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+060	20.00	0.70	14.00	80	11.20	15	2.10	5	0.70	
1+080	20.00	0.55	11.00	80	8.80	15	1.65	5	0.55	
1+100	20.00	0.55	11.00	80	8.80	15	1.65	5	0.55	
1+120	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+140	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+160	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+180	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+200	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+220	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+240	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+260	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+280	20.00	0.40	8.00	80	6.40	15	1.20	5	0.40	

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1+300	20.00	0.92	18.40	80	14.72	15	2.76	5	0.92	
1+320	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+340	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+360	20.00	0.87	17.30	80	13.84	15	2.60	5	0.87	
1+380	20.00	0.37	7.40	80	5.92	15	1.11	5	0.37	
1+400	20.00	0.37	7.40	80	5.92	15	1.11	5	0.37	
1+420	20.00	0.38	7.60	80	6.08	15	1.14	5	0.38	
1+440	20.00	0.15	3.00	80	2.40	15	0.45	5	0.15	
1+460	20.00	0.37	7.40	80	5.92	15	1.11	5	0.37	
1+480	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+500	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+520	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+540	20.00	0.95	18.90	80	15.12	15	2.84	5	0.95	
1+560	20.00	0.81	16.20	80	12.96	15	2.43	5	0.81	
1+580	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+600	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+620	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+640	20.00	0.72	14.30	80	11.44	15	2.15	5	0.72	
1+660	20.00	0.68	13.60	80	10.88	15	2.04	5	0.68	
1+680	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+700	20.00	0.64	12.80	80	10.24	15	1.92	5	0.64	
1+720	20.00	0.47	9.40	80	7.52	15	1.41	5	0.47	
1+740	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	

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1+760	20.00	0.54	10.70	80	8.56	15	1.61	5	0.54	
1+780	20.00	0.22	4.40	80	3.52	15	0.66	5	0.22	

Chainage (m)	Length (m)	Area (m^2)	Volume (m^3)	Drainage Cutting Soil type						Remarks
				BMS		Soft Rock		Hard Rock		
				%	Volume (m^3)	%	Volume (m^3)	%	Volume (m^3)	
1+800	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+820	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+840	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+860	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+880	20.00	0.65	13.00	80	10.40	15	1.95	5	0.65	
1+900	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+920	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
1+940	20.00	0.48	9.60	80	7.68	15	1.44	5	0.48	
1+960	20.00	0.75	15.00	80	12.00	15	2.25	5	0.75	
1+980	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+000	20.00	0.54	10.80	80	8.64	15	1.62	5	0.54	
2+020	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+040	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+060	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+080	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+100	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+120	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+140	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+160	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	

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Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

2+180	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+200	20.00	0.70	14.00	80	11.20	15	2.10	5	0.70	
2+220	20.00	0.25	5.00	80	4.00	15	0.75	5	0.25	
2+240	20.00	0.72	14.40	80	11.52	15	2.16	5	0.72	
2+260	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+280	20.00	0.72	14.40	80	11.52	15	2.16	5	0.72	
2+300	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+320	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+340	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+360	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+380	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+400	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+420	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+440	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+460	20.00	0.50	10.00	80	8.00	15	1.50	5	0.50	
2+480	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+500	20.00	0.77	15.30	80	12.24	15	2.30	5	0.77	
2+520	20.00	0.73	14.60	80	11.68	15	2.19	5	0.73	
2+540	20.00	0.40	8.00	80	6.40	15	1.20	5	0.40	
2+560	20.00	0.50	10.00	80	8.00	15	1.50	5	0.50	
2+580	14.75	0.77	11.28	80	9.02	15	1.69	5	0.56	
2+589	4.75	-	-	80	-	15	-	5	-	

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Earthwork calculation for Drain

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Total	2,589.50		1,815.98		1,452.78		272.70		91.10	

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Detail Quantity Estimate of Road Works

Chainage	Mean Distance (m)	Subgrade		Subbase			Width	Base		width	Pavement
		Width (m)	Area (m^2)	Width (m)	Thickness (m)	Quantity (m^3)	m	Thickness(m)	Quantity (m^3)		Area (m^2)
0+000	10.00	8.50	85.000	7.00	0.225	15.750	7.000	0.2	14.000	7.000	70.00
0+020	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+040	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+060	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+080	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+100	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+120	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+140	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+160	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+180	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+200	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+220	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+240	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+260	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+280	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+300	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+320	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+340	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+360	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+380	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+400	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

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0+420	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+440	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+460	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+480	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+500	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+520	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+540	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

Detail Quantity Estimate of Road Works

Chainage	Mean Distance (m)	Subgrade		Subbase			Width	Base		width	Pavement
		Width (m)	Area (m^2)	Width (m)	Thickness (m)	Quantity (m^3)	m	Thickness(m)	Quantity (m^3)		Area (m^2)
0+560	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+580	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+600	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+620	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+640	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+660	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+680	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+700	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+720	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+740	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+760	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+780	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+800	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+820	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

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0+840	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+860	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+880	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+900	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+920	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+940	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+960	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
0+980	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+000	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+020	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+040	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+060	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+080	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+100	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

Detail Quantity Estimate of Road Works

Chainage	Mean Distance (m)	Subgrade		Subbase			Width	Base		width	Pavement
		Width (m)	Area (m^2)	Width (m)	Thickness (m)	Quantity (m^3)	m	Thickness(m)	Quantity (m^3)		Area (m^2)
1+120	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+140	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+160	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+180	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+200	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+220	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+240	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

1+260	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+280	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+300	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+320	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+340	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+360	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+380	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+400	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+420	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+440	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+460	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+480	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+500	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+520	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+540	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+560	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+580	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+600	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+620	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+640	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+660	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

Detail Quantity Estimate of Road Works

Chainage	Mean Distance (m)	Subgrade		Subbase			Width	Base		width	Pavement
		Width (m)	Area (m^2)	Width (m)	Thickness (m)	Quantity (m^3)	m	Thickness(m)	Quantity (m^3)		Area (m^2)

1+680	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+700	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+720	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+740	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+760	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+780	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+800	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+820	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+840	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+860	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+880	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+900	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+920	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+940	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+960	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
1+980	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+000	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+020	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+040	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+060	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+080	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+100	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+120	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+140	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

2+160	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+180	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+200	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+220	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

Detail Quantity Estimate of Road Works

Chainage	Mean Distance (m)	Subgrade		Subbase			Width	Base		width	Pavement
		Width (m)	Area (m^2)	Width (m)	Thickness (m)	Quantity (m^3)	m	Thickness(m)	Quantity (m^3)		Area (m^2)
2+240	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+260	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+280	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+300	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+320	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+340	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+360	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+380	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+400	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+420	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+440	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+460	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+480	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+500	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+520	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+540	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+560	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00

2+580	14.75	8.50	125.375	7.00	0.225	23.231	7.000	0.2	20.650	7.000	103.25
2+589	4.75	8.50	40.375	7.00	0.225	7.481	7.000	0.2	6.650	7.000	33.25
2+620	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+640	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+660	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+680	20.00	8.50	170.000	7.00	0.225	31.500	7.000	0.2	28.000	7.000	140.00
2+700	14.43	7.06	101.876	5.56	0.225	18.052	5.560	0.2	16.046	5.560	80.23
2+709	4.43	7.00	31.010	5.50	0.225	5.482	5.500	0.2	4.873	5.500	24.37
Total	2688.36		22823.64			4228.00			3758.22		18791.10

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Quantity calculation of Pavements

1. Name of Work: Subgrade Preparation

S.N.	Description	No	Length	Breadth	Quantity	Remarks
1	Quantity with Extrawidening	1.00	22823.64		22823.64	
2	Junction (T & Cross)	10.00	30.00	5.50	1650.00	
Deduction						
3	Slab Culverts	0.00	5.00	10.00	0.00	
4	Box Culverts	0.00	10.00	10.00	0.00	
				Total	24473.64	m^2

S.N.	Description	No	Length	Breadth	Height	Quantity	Remarks
1	Quantity with Extrawidening	1.00	2688.36	1.50	0.35	1411.39	
Deduction							
2	Junction (T & Cross)	10.00	30.00	1.00	0.15	45.00	

3	Slab Culverts	0.00	5.00	1.00	0.15	0.00	
4	Box Culverts	0.00	10.00	1.00	0.15	0.00	
				Total		1366.39	m^3

2. Name of Work: Subbase Finishing

S.N.	Description	No	Length	Breadth	Height	Quantity	Remarks
1	Quantity with Extrawidening	1.00	4228.00			4228.00	
2	Junction (T & Cross)	10.00	30.00	5.50	0.20	330.00	
Deduction							
3	Slab Culverts	0.00	5.00	8.50	0.20	0.00	
4	Box Culverts	0.00	10.00	8.50	0.20	0.00	
				Total		4558.00	m^3

3. Name of Work: Base Finishing

S.N.	Description	No	Length	Breadth	Height	Quantity	Remarks
1	Quantity with Extrawidening	1.00	3758.22			3758.22	
2	Junction (T & Cross)	10.00	30.00	5.50	0.15	247.50	
Deduction							
3	Slab Culverts	0.00	5.00	8.50	0.20	0.00	
4	Box Culverts	0.00	10.00	8.50	0.20	0.00	
				Total		4005.72	m^3

4. Name of Work: Surface Wearing Coat Preparation

S.N.	Description	No	Length	Breadth	Quantity	Remarks
1	Quantity with Extrawidening	1.00	18791.10		18791.10	
2	Junction (T & Cross)	10.00	30.00	5.50	1650.00	
Deduction						
3	Slab Culverts	0.00	5.00	8.50	0.00	
4	Box Culverts	0.00	10.00	8.50	0.00	
				Total	20441.10	m^2

5. Name of Work: Shoulder Preparation

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Quantity calculation of Pavements

7. Name of Work: M25 for Rigid pavement

S.N.	Description	No	Length	Breadth	Height	Quantity	Remarks
1	Concrete M25/20	1.00	0.00	7.00	0.20	0.00	m^3
2	Reinforcement 25 Dia dowel bar (45 cm length @ 300 mm c/c)	-23.00	0.45			0.0	ton
3	Reinforcement 12 mm Dia tie bar (64 cm length @ 900 mm c/c)	0.00	0.64			0.00	ton
4	Reiforcement						
	main temperature bar 12mm dia	0.00	7.00			0.00	ton
	Distribution bar 10mm dia	46.00	0.00			0.00	ton
						0.00	ton
5	Stone soling	1.00	0.00	7.00	0.15	0.00	m3
6	Formwork	0.00	4.00	3.50	0.20	0.00	m2

DRAIN COVER: PLAIN TYPE

Length of drain 2,590.00

Cement Concrete drain cover slab of 0.5 m length

Length	Breadth	Height	Volume
0.5	0.8	0.15	0.06000
0.5	0.9	0.15	0.06750
0.5	1.05	0.15	0.07875
		Total	0.20625

m3

No of Cover = 5,180.00

Reinforcement for 0.5m length

Dia	nos	Length	unit weight	Weight(KG)
12	5	0.48	0.89	2.136
10	4	1	0.62	2.48
			Total	4.616

Summary Of Quantities

Cement Concrete (M25)	1068.375	m3
Reinforcement	23,910.88	kg

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

Chainage	Length	Left				Right				Remarks
		Length	Dr. Type	Area (m^2)	Volume (m^3)	Length	Dr. Type	Area (m^2)	Volume (m^3)	
0+000	10	10	DrainG		1.05	0				
0+020	20	20	DrainG		2.10	0				
0+040	20	20	DrainG		2.10	0				
0+060	20	20	DrainG		2.10	0				
0+080	20	20	DrainG		2.10	0				
0+100	20	20	DrainG		2.10	0				
0+120	20	20	DrainG		2.10	0				
0+140	20	20	DrainG		2.10	0				
0+160	20	20	DrainG		2.10	0				
0+180	20	20	DrainG		2.10	0				
0+200	20	20	DrainG		2.10	0				
0+220	20	20	DrainG		2.10	0				
0+240	20	20	DrainG		2.10	0				
0+260	20	20	DrainG		2.10	0				
0+280	20	20	DrainG		2.10	0				
0+300	20	20	DrainG		2.10	0				
0+320	20	20	DrainG		2.10	0				
0+340	20	20	DrainG		2.55	0				
0+360	20	20	DrainG		2.55	0				

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

0+380	20	20	DrainG		2.55	0				
0+400	20	20	DrainG		2.55	0				
0+420	20	20	DrainG		2.55	0				
0+440	20	20	DrainG		2.55	0				
0+460	20	20	DrainG		2.55	0				
0+480	20	20	DrainG		2.55	0				
0+500	20	20	DrainG		2.55	0				
0+520	20	20	DrainG		2.55	0				
0+540	20	20	DrainG		2.55	0				
0+560	20	20	DrainG		2.55	0				
0+580	20	20	DrainG		2.55	0				
0+600	20	20	DrainG		2.55	0				
0+620	20	20	DrainG		2.55	0				
0+640	20	20	DrainG		2.55	0				
0+660	20	20	DrainG		2.55	0				
0+680	20	20	DrainG		2.40	0				
0+700	20	20	DrainG		2.40	0				
0+720	20	20	DrainG		2.40	0				
0+740	20	20	DrainG		2.40	0				
0+760	20	20	DrainG		2.40	0				
0+780	20	20	DrainG		2.40	0				

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

0+800	20	20	DrainG		2.40	0				
0+820	20	20	DrainG		2.40	0				
0+840	20	20	DrainG		2.40	0				
0+860	20	0				20	DrainG		2.55	
0+880	20	0				20	DrainG		2.55	

Chainage	Length	Left				Right				Remarks
		Length	Dr. Type	Area (m^2)	Volume (m^3)	Length	Dr. Type	Area (m^2)	Volume (m^3)	
0+900	20	0				20	DrainG		2.55	
0+920	20	0				20	DrainG		2.55	
0+940	20	0				20	DrainG		2.55	
0+960	20	0				20	DrainG		2.55	
0+980	20	0				20	DrainG		2.4	
1+000	20	0				20	DrainG		2.4	
1+020	20	0				20	DrainG		2.4	
1+040	20	0				20	DrainG		2.4	
1+060	20	0				20	DrainG		2.4	
1+080	20	0				20	DrainG		2.4	
1+100	20	0				20	DrainG		2.4	
1+120	20	0				20	DrainG		2.4	
1+140	20	0				20	DrainG		2.4	

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

1+160	20	0				20	DrainG		2.4	
1+180	20	0				20	DrainG		2.4	
1+200	20	0				20	DrainG		2.4	
1+220	20	0				20	DrainG		2.4	
1+240	20	0				20	DrainG		2.4	
1+260	20	0				20	DrainG		2.4	
1+280	20	0				20	DrainG		2.4	
1+300	20	0				20	DrainG		2.4	
1+320	20	0				20	DrainG		2.4	
1+340	20	0				20	DrainG		2.4	
1+360	20	0				20	DrainG		2.4	
1+380	20	0				20	DrainG		2.4	
1+400	20	0				20	DrainG		2.4	
1+420	20	0				20	DrainG		2.4	
1+440	20	0				20	DrainG		2.4	
1+460	20	0				20	DrainG		2.4	
1+480	20	0				20	DrainG		2.4	
1+500	20	0				20	DrainG		2.4	
1+520	20	0				20	DrainG		2.4	
1+540	20	0				20	DrainG		2.4	
1+560	20	20	DrainG		2.40	0				

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

1+580	20	20	DrainG		2.10	0				
1+600	20	20	DrainG		2.10	0				
1+620	20	20	DrainG		2.10	0				
1+640	20	20	DrainG		2.10	0				
1+660	20	20	DrainG		2.10	0				
1+680	20	20	DrainG		2.10	0				
1+700	20	20	DrainG		2.10	0				
1+720	20	20	DrainG		2.10	0				
1+740	20	20	DrainG		2.10	0				
1+760	20	20	DrainG		2.10	0				
1+780	20	20	DrainG		2.10	0				

Chainage	Length	Left				Right				Remarks
		Length	Dr. Type	Area (m^2)	Volume (m^3)	Length	Dr. Type	Area (m^2)	Volume (m^3)	
1+800	20	20	DrainG		2.10	0				
1+820	20	20	DrainG		2.10	0				
1+840	20	20	DrainG		2.10	0				
1+860	20	20	DrainG		2.10	0				
1+880	20	20	DrainG		2.10	0				
1+900	20	20	DrainG		2.10	0				
1+920	20	20	DrainG		2.10	0				
1+940	20	20	DrainG		2.10	0				

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

1+960	20	20	DrainG		2.10	0				
1+980	20	20	DrainG		2.10	0				
2+000	20	20	DrainG		2.10	0				
2+020	20	20	DrainG		2.10	0				
2+040	20	20	DrainG		2.10	0				
2+060	20	20	DrainG		2.10	0				
2+080	20	20	DrainG		2.10	0				
2+100	20	20	DrainG		2.10	0				
2+120	20	20	DrainG		2.10	0				
2+140	20	20	DrainG		2.10	0				
2+160	20	20	DrainG		2.10	0				
2+180	20	20	DrainG		2.10	0				
2+200	20	20	DrainG		2.10	0				
2+220	20	20	DrainG		2.10	0				
2+240	20	20	DrainG		2.10	0				
2+260	20	20	DrainG		2.10	0				
2+280	20	20	DrainG		2.10	0				
2+300	20	20	DrainG		2.10	0				
2+320	20	20	DrainG		2.10	0				
2+340	20	20	DrainG		2.10	0				
2+360	20	20	DrainG		2.10	0				

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Detail Quantity Caculation Sheet of Drain

For Masonry Work

2+380	20	20	DrainG		2.10	0				
2+400	20	20	DrainG		2.10	0				
2+420	20	20	DrainG		2.10	0				
2+440	20	20	DrainG		2.10	0				
2+460	20	20	DrainG		2.10	0				
2+480	20	20	DrainG		2.10	0				
2+500	20	20	DrainG		2.10	0				
2+520	20	20	DrainG		2.10	0				
2+540	20	0				20	DrainG		2.1	
2+560	20	0				20	DrainG		2.1	
2+580	14.747	0				14.747	DrainG		1.545	
2+589.494	4.747	0				4.747	DrainG		0.495	
		1830				759.49				
Total	2589.49				202.80				91.14	

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Detail Quantity Caculation Sheet of Drain

For PCC & Stone Soiling Work

Length	PCC M15						Plum Concrete	Remarks
	Drain Bed			Stone soling (Base)			wall	
	Breadth	Height	Volume	Breadth	Height	Volume	Volume	
2589.49	1.125	0.15	436.976	1.125	0.15	436.976	293.94	Drain Type Rectangular

Summary of Quantity for Trapezoidal Drain

SN	Description	Quantity	Unit	Remarks
1	M15 PCC	436.98	m^3	
2	Plum concrete	293.94	m^3	
3	Form work	4143.18	Sqm	
4	Stone soiling work	436.98	m^3	
5	M25 concrete	1068.38	m3	
6	Reinforcement	23910.88	kg	

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Matrix of Structures

A Pipe Culvert (900mm) Single Cell

Chainage	Length (m)	Diameter (m)	Pipe Count	Remarks
0+850	9	0.9	1	Proposed pipe culvert for side change
1+550	9	0.9	1	Proposed pipe culvert for side change
0+420	9	0.9	1	Pipe culvert for Flushing
0+284	9	0.9	1	Pipe culvert for Flushing
2+530	9	0.9	1	Proposed pipe culvert for side change
Total=		Nos	5.00	

C bridge

Chainage	Span	Width (m)	Depth (m)	Remarks
0+328	10	7	3	
Total (m)	10.00	Nos	1.00	

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Quantity of different items for one culvert (Single Cell):

Pipe size:	0.90	m	Single Cell				
Road formation width	10.00	m	U/S Head Wall		L	4.74	m
Average formation width taken	11.00	m			H	2.40	m
Pipe length	12.50	m			Base width	1.32	m
Catch pit opening, L	2.10	m	D/S Head Wall		L	6.00	m
B	1.50	m			H	5.00	m
H	2.40	m			Base width	2.75	m

Item No Quantity Calculations:

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3.02 a)	General excavation in ordinary soil for pipe culvert		L	B	H		Q	
	- U/S catch pit and H/ wall		4.74	4.14	2.40		47.10	
	- D/S H wall		6.00	0.91	5.00			
3.04	Central Pipe portion		7.93	1.74	2.21		30.49	
	- Outlet structure						12.24	
3.05	Total quantity						89.83	m3
	Back filling, common material							
	over pipe culvert		10.55	1.30	2.33		31.96	
	Back filling behind catch pit walls		9.06	0.98	m2		8.88	
	Head walls below pipe beds	2	4.74	0.18	m2		1.71	
	Total quantity						42.55	m3
	Back filling behind structure with graded filter material.							
	U/S Head wall		4.74	0.25	2.10		2.49	
	D/S Head wall		6.00	0.25	4.10		6.15	
	Deduction of pipe portion	2	0.25	0.95	m2		-0.48	
	Total quantity						8.16	m3

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Supply and place coursed random rubble masonry							
Catch pit head wall	1	4.02	0.81	2.40		7.81	
Catch pit hill side wall	1	4.02	0.91	2.40		8.78	
Catch pit side walls	2	1.50	0.81	2.40		5.83	
Catch pit opening bed	1	2.10	1.50	0.30		0.95	
D/S Head wall	1	6.00	1.63	5.00		48.90	
Deduction for PC in U/S	1	0.93			0.64	-0.60	
Deduction for PC in D/S	1	1.08			0.64	-0.69	
Oulet structure		2.40	1.54	m2		3.70	
Parapet for Catchpit headwall	2	1.00	0.25	m2		0.50	
Parapet headwall for D/S	2	1.00	0.25	m2		0.50	
Total quantity						75.68	m3
Supply and place 100 mm PCC M10/40							
Catch pit and U/S head wall foundation		4.74	4.14	0.10		1.96	

D/S head wall foundation		6.00	3.15	0.30		5.67	
Pipe beding	1	9.60	1.30	0.40		4.99	
Oulet structure	1	2.40	5.50	0.10		1.32	
Total quantity						13.94	m3
Providing, preparing and installing form work							
Catch pit and U/S head wall foundation		4.74	4.14	0.10		1.78	
D/S head wall foundation		6.00	3.15	0.30		5.49	
Pipe beding		9.60	1.90	0.40		7.68	
Outlet structure		2.40	5.50	0.10		1.03	
Total quantity						15.98	m3
Supply and place Hume Pipe (NP 3) as instructed							

Quantity of different items for one culvert (Single Cell): 5.01

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5.02

5.06 a)

5.07

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Quantity of different items for one culvert (Single Cell):

	including curing all complete							
5.09	Hume Pipe (NP 3)	1	12.50				12.50	lin.m
	Total quantity						12.50	lin.m
	Providing, Laying and fixing of geo-textile							
5.10	Catch pit head wall	1	4.74		1.65		7.82	
	Catch pit hill side wall	1	2.10		1.65		3.47	
	Catch pit side walls	2	1.50		1.65		4.95	
	D/S head wall	1	6.00		4.25		25.50	
	Total quantity						41.74	lin.m
	Providing and laying Dry Stone soling below wall							
	below U/S catch pit wall		4.74	4.14	0.20		3.92	
	below D/S Head wall		6.00	2.95	0.20		3.54	
	Total quantity						7.46	m3

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Quantity of different items for one culvert (Single Cell):

Item No:	Summary of quantity for one culvert		No of culvert	Qty/no	T Qty	Unit	Remarks
3.02 a)	General Excavation for common material		5.00	89.83	449.15	m3	
3.04	Back filling by common material		5.00	42.55	212.75	m3	
3.05	Back filling behind structure with graded filter material.		5.00	8.16	40.80	m3	
5.01	Supply and place coursed random rubble masonry		5.00	75.68	378.40	m3	
5.02	PCC M15		5.00	13.94	69.70	m3	
5.06 a)	Providing, preparing and installing form work		5.00	15.98	79.90	m2	
5.07	Supply and place Hume Pipe (NP 3) as instructed		5.00	12.50	62.50	lin.m	
5.09	Providing, Laying and fixing of geo-textile		5.00	41.74	208.70	m2	
5.10	Providing and laying Dry Stone soling below wall		5.00	7.46	37.30	m3	
5.11	Gabion Wall for Protection		5.00	15.00	75.00	m3	1*1*1 box

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Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Chainage	Length (m)	Cross Sectional Structures								Remarks
		Left side				Right side				
		Retaining wall	Gabion Filling			Retaining/ Breast Wall	Gabion Filling			
		Height	Stone Filling (m3)	Gabion Area Box (m2)	Geo- textile (m2)	Height	Stone Filling (m3)	Gabion Area Box (m2)	Geo- textile (m2)	
1+580	20.00					3	90		76.00	Retaining
1+600	20.00					2	50		48.00	Retaining
1+620	20.00					2	50		48.00	Retaining
2+100	20.00					3	90		76.00	Retaining
2+120	20.00					4	140		104.00	Retaining
Total	-		0.00	0.00	0.00		420.00	0.00	352.00	

Masonry Retaining Wall Quantity Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Section : 0 to 2.59 km

Chainage	Length (m)	Structure quantity								Stone Soiling	PCC M10	Remarks
		Left side				Right side						
		Type	Height	Area(m^2)	Volume (m^3)	Type	Height	Area(m^2)	Volume (m^3)			
0+300	20	-				MWRET	0.9		9.65	1.76	1.17	Retaining
0+320	20	-				MWRET	1.2		15.04	2.34	1.56	Retaining
0+340	20	-				MWRET	1		11.33	1.95	1.30	Retaining
0+360	20	-				MWRET	1.7		26.43	3.32	2.21	Retaining
0+380	20	-				MWRET	1.4		19.24	2.73	1.82	Retaining
0+400	20	-				MWRET	1.7		26.43	3.32	2.21	Retaining
0+440	20	-				MWRET	1.6		23.91	3.12	2.08	Retaining
0+460	20	-				MWRET	1.6		23.91	3.12	2.08	Retaining
0+480	20	-				MWRET	1.5		21.52	2.93	1.95	Retaining
0+500	20	-				MWRET	1		11.33	1.95	1.30	Retaining
0+640	20	-				MWRET	1.5		21.52	2.93	1.95	Retaining

0+660	20	-				MWRET	1.5		21.52	2.93	1.95	Retaining
0+860	20	MWRET	1.8		29.07	-				3.51	2.34	Retaining
0+880	20	MWRET	1.3		17.08	-				2.54	1.69	Retaining
0+900	20	MWRET	1.1		13.13	-				2.15	1.43	Retaining
0+920	20	MWRET	2.0		34.72	-						
0+940	20	MWRET	1.9		31.84	-						
0+960	20	MWRET	1.7		26.43	-						
1+180	20	MWRET	1.5		21.52	-						
1+200	20	MWRET	0.9		9.65	-						
1+220	20	MWRET	1.0		11.33	-						

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Masonry Retaining Wall Quantity Calculation

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Section : 0 to 2.59 km

Chainage	Length (m)	Structure quantity								Stone Soiling	PCC M10	Remarks
		Left side				Right side						
		Type	Height	Area(m^2)	Volume (m^3)	Type	Height	Area(m^2)	Volume (m^3)			
1+260	20	MWRET	1.7		26.43	-						
1+280	20	MWRET	1.1		13.13	-						
2+160	20	-				MWRET	0.8		8.27			
2+180	20	-				MWRET	1		11.33			
2+200	20	-				MWRET	1.5		21.52			
2+220	20	-				MWRET	1.3		17.08			
2+240	20	-				MWRET	1.1		13.13			

Descripition	Unit	Quantity	Remarks
Masonry Retaining wall	m_3	537.45	
Stone Soiling	m_3	40.60	
PCC M15	m_2	27.04	

Total	560				234.31				303.14	40.6	27.04	

Summary

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Quantity Calculation for Chute Structure

No. of structures 2.00

Item no.	Description of Works	No	length	Breadth	Height	Quantity	Total	Unit	Remarks
1	E/W in excavation for foundation of Structures	1	13.1	3	0.5	19.65	39.3	m^3	
2	Backfilling with suitable material as approved by the engineer	1	Backfill @ 20 % of E/W in excavation			3.93	7.86	m^3	
3	Supply and place dry stone soling (pitching)	1	13.1	3	0.15	5.895	11.79	m^3	
4	Plain Cement Concrete for Structures								
	Supply and place concrete class M 15 for wall bed	1	13.1	3	0.15	5.895	11.79	m^3	
5	Stone Masonry for Structures								
	Supply and place un-coursed random rubble masonry work in 1:4 cement sand mortar.								

	Along the Structure	18	0.8	3	0.3	12.96	25.92	m^3	
	Side wall	2	13.1	0.45	1.2	14.148	28.296	m^3	
	Total					27.108	54.216	m^3	

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Site Clearance

S.No	Chainage		Length	Breadth	Area	Net Area	Quantity (Sq.m)	Remarks
	From	To						
1	0+000	2+590	2,590.00	7.00	18,130.00	15%	2719.50	
						Total	2,719.50	

Ministry of Physical Infrastructure and Transportation

Department of Roads

Thapathali Campus

ABSTRACT OF COST

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Location : Bhaktapur District

Section : 0 to 2.59 km

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
Section I: General Items				
	Insurance of works, equipment, Contractor's workmen and employees and Third party Insurance against damage to other persons and property.	LS	294,000.00	
	Carry out additional tests for material and works as required and instructed by the Engineer.	PS	500,000.00	
	Relocation of services (electrical pole, tap stand etc) all complete as instructed by Engineer.	PS	1,500,000.00	
	Relocation of Water Supply Pipe all complete as instructed by Engineer.	PS	1,500,000.00	
	Supplying and erecting 1.2m.x 0.75m. size Project sign board in place including 50mm dia. Steel tube, 2mm. thick steel plate, cement concrete, painting, writing and supporting steel angle nut and bolit etc. all complete	No	15,000.00	
	Carry out routine/regular maintenance of the existing road to keep the road serviceable through out the contract period as per specification and instruction of the Engineer	Km-Month	20,375.00	
	#REF!	Km-Month	20,375.00	
			Sub - Total (A)	

Prepared by: Checked by: Approved by

Section II. Site Clearance				

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
201	Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable Material to be used or auctioned, up to a lead of 30 meters including removal and disposal of top organic soil not exceeding 150 mm in thickness.In area of thorny jungle (more than 15 numbers per 100 sqm)	Sqm.	5.52	
202	Removing all type of Hume Pipes and Stacking within a lead of 50 metres including Earthwork and Dismantling of Masonry Works.Up to 600 mm dia	Rm	655.50	
202	Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including scaffolding wherever necessary, sorting the dismantled Material, disposal of unserviceable Material and stacking the serviceable Material with all lifts and lead of 1000 meters.Cement Concrete Grade M-15 & M-20.	Cum	4483.12	
202	Dismantling boulders laid in wire crates including opening of crates and stacking dismantled material.	Cum	1145.06	
202	Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and lead of 1000 meters-random rubble stone masonry in cement mortar.	Cum	1772.61	
202	Scarifying the existing bituminous road surface to a depth of 50 mm and disposal of scarified Material with in all lifts and lead as per Drawing and Technical Specifications.	Cum	12.15	
			Sub - Total (B)	
Section III. Earthworks				
905	Roadway Excavation in all types of soil as per drawing and technical specification,including removal of stumps and other deleterious matter,with all lifts and lead as per Drawing and instruction of the Engineer.	Cum	128.15	

909	Providing, laying, spreading and compacting embankment with roadway cutting material and compact to the required density as per Drawing and Technical Specifications.(Mechanical Method)	Cum	323.59	
			Sub - Total (C)	
Section IV. Pavement Works				

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
1003, 1005	Compacting original ground supporting sub-grade Loosening of the ground upto a level of 500 mm below the sub-grade level, watered, graded and compacted in layers as per Drawing and Technical Specifications.	Cum	102.42	
1004	Providing, laying, spreading, watering, levelling and compaction of natural gravel for capping layer according to the Standard Specification (capping layer with PI<6).	Cum	5785.84	
1201	Providing and laying granular sub-base on prepared surface, mixing at OMC, and compacting to achieve the desired density, complete as per Drawing and Technical Specifications by mechanical means.	Cum	4788.68	
1204	Providing and laying Crusher Run Macadam on a prepared surface, spreading and mixing , watering and compacting to form a layer of Base course as per Drawing and Technical Specifications.	Cum	6083.43	
1201	Providing and laying granular sub-base on prepared surface, mixing at OMC, and compacting to achieve the desired density, complete as per Drawing and Technical Specifications by mechanical means.	Cum	4788.68	
1302	Providing and applying prime coat with hot bitumen (including appropriate cutter) on prepared surface of granular base including cleaning of road surface and spraying by mechanical means as per the Technical Specification .	Ltr.	134.12	0.9ltr/sqm
1302	,Providing and applying tack coat with hot Bitumen at specified rate on the prepared surfaces including cleaning as per Technical Speciation .(Tack coat with bitumen by mechanical means)	Ltr.	123.24	0.7ltr/sqm

1307	Providing and laying dense bituminous macadam using crushed aggregates of specified grading, premixed with bituminous binder and filler as per Drawing and Technical Specifications.	Cum	20266.25	
1309	Bituminous Concrete / Asphalt Concrete Providing and laying Bituminous concrete/ Asphalt concrete using crushed aggregates of specified grading, premixed with bituminous binder and filler as per Drawing and Technical Specifications	Cum	24169.98	
			Sub - Total (D)	

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
Section V. Cross Drainage Structures				
907	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications. Ordinary Rock (a) Depth upto 3m Mechanical Methods	Cum	133.44	
908	Providing suitable material and Back filling behind abutment, wing wall and return wall complete as per Drawing and Technical Specifications.Locally available Material including compaction by tamping rod (without watering)	Cum	454.85	
701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.			
	a) 900mm diameter	Rm	18,429.46	
	b) 1200mm diameter	Rm	23,513.48	
1006	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Cum	3,953.91	
2600, 2607	Providing and laying Stone Masonry work in cement mortar 1:4 in structure complete as per Drawing and Technical Specifications	Cum	13,467.84	

2402	Assembling mechanical woven Gabion boxes /mattresses, placing in position including stretching; forming compartments; tying the sides and diaphragms with binding wire in each mesh; tying with bracing wires and tie wires; and tying down the lid complete as per specification (stone filling not included)	Sqm.	408.05	
	Stone filling in gabbion crates	Cum	3,210.42	
	Concrete Works			
2000	Providing and laying of Plain Cement Concrete M 10 (or 1:3:6 for nominal mix) in Foundation complete as per Drawing and Technical Specifications.	Cum	12,145.45	
2000	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.PCC Grade M15	Cum	14,563.74	
2000	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.RCC Grade M20	Cum	16,448.01	

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
2000	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.RCC Grade M25	Cum	17,567.17	
	Form Work			
1804, 1805	Providing , Preparing and Installing form work including necessary supports and removing after completion for foundation and footings (a) using timber (soft wood) - Class F1 finish.	Sqm.	840.96	
1804, 1805	Providing , Preparing and Installing form work including necessary supports and removing after completion ---For Vertical plain surface [class F2 finish] height upto 3 m	Sqm.	978.43	
909, 910	Providing and laying of Filter media with granular Material/stone crushed aggregates to a thickness of not less than 600 mm with smaller size towards the soil and bigger size towards the wall and provided over the entire surface behind abutment, wing wall and return wall to the full height compacted to a firm condition complete as per drawing and Technical Specification.	Cum	5,378.01	

2404	Providing and laying of a geotextile filter between pitching and embankment slopes as per Drawing and Technical Specifications.	Sqm.	185.38	
2014	Providing and laying , fitting and placing HYSD bar reinforcement in substructure complete as per Drawing and Technical Specifications	Tonn.	134,986.23	
701	Providing, jointing and laying HDPE pipes with or without collar etc. complete in place as per Drawing and Technical Specifications.a) 110 mm/125 mm outer dia.	Rm	919.19	
			Sub - Total (E)	
Section VI. Structure Works				
907	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications. Ordinary Rock (a) Depth upto 3m Mechanical Methods	Cum	133.44	
908	Providing suitable material and Back filling behind abutment, wing wall and return wall complete as per Drawing and Technical Specifications.Locally available Material including compaction by tamping rod (without watering)	Cum	454.85	

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
1006	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Cum	3,953.91	
2600, 2607	Providing and laying Stone Masonry work in cement mortar 1:4 in structure complete as per Drawing and Technical Specifications	Cum	13,467.84	
2402	Assembling mechanical woven Gabion boxes /mattresses, placing in position including stretching; forming compartments; tying the sides and diaphragms with binding wire in each mesh; tying with bracing wires and tie wires; and tying down the lid complete as per specification (stone filling not included)	Sqm.	408.05	

	Stone filling in gabbion crates	Cum	3,210.42	
	Concrete Works			
2000	Providing and laying of Plain Cement Concrete M 10 (or 1:3:6 for nominal mix) in Foundation complete as per Drawing and Technical Specifications.	Cum	12,145.45	
2421	Providing and placing concrete with 60% M 15/40 concrete and 40% boulders/stones as per specification Lead 30m, lift 1.5m , using concrete mixer and vibrator.	Cum	11,244.45	
1804, 1805	Providing , Preparing and Installing form work including necessary supports and removing after completion ---For Vertical plain surface [class F2 finish] height upto 3 m	Sqm.	978.43	
2404	Providing and laying of a geotextile filter between pitching and embankment slopes as per Drawing and Technical Specifications.	Sqm.	185.38	
			Sub - Total (F)	
Section VII. Drainage Works				
907	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications. Ordinary Rock (a) Depth upto 3m Mechanical Methods	Cum	133.44	

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
701	Providing, jointing and laying HDPE pipes with or without collar etc. complete in place as per Drawing and Technical Specifications.a) 110 mm/125 mm outer dia.	Rm	919.19	
2600, 2607	Providing and laying Stone Masonry work in cement mortar 1:4 in structure complete as per Drawing and Technical Specifications	Cum	13,467.84	
	Concrete Works			

2000	Providing and laying of Plain Cement Concrete M 10 (or 1:3:6 for nominal mix) in Foundation complete as per Drawing and Technical Specifications.	Cum	12,145.45	
2000	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.RCC Grade M20	Cum	16,448.01	
1006	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Cum	3,953.91	
	Form Work			
1804, 1805	Providing , Preparing and Installing form work including necessary supports and removing after completion for foundation and footings (a) using timber (soft wood) - Class F1 finish.	Sqm.	840.96	
1804, 1805	Providing , Preparing and Installing form work including necessary supports and removing after completion ---For Vertical plain surface [class F2 finish] height upto 3 m	Sqm.	978.43	
909, 910	Providing and laying of Filter media with granular Material/stone crushed aggregates to a thickness of not less than 600 mm with smaller size towards the soil and bigger size towards the wall and provided over the entire surface behind abutment, wing wall and return wall to the full height compacted to a firm condition complete as per drawing and Technical Specification.	Cum	5,378.01	
2404	Providing and laying of a geotextile filter between pitching and embankment slopes as per Drawing and Technical Specifications.	Sqm.	185.38	
2014	Providing and laying , fitting and placing HYSD bar reinforcement in sub-structure complete as per Drawing and Technical Specifications	Tonn.	134,986.23	
			Sub - Total (G)	
Section VIII. Bio Engineering Works				

Spec.	Description of works	Unit	Rate, (NRs)	Remarks

201	Clearing Grass and Removal of Rubbish and Dressing and levelling the construction surface Clearing grass/ top soil and removal up to a distance of 50 meters outside the periphery of the area , including cutting and filling of small undulation.	Sqm.	10.35	
2807	Planting rooted grass slips on the slopes <45o including preparation of slips on site. a max of 5 cm depth with metal rod or Operation includes digging planting hole to hard-wood peg, depending on the nature of the soil. The planting drills should be space	Sqm.	389.00	
2807	Planting containerized tree and shrub seedlings, including pitting, transplanting, composting and placing tree guards, on toe of embankment slopes in plain areas, not less than 8 m from the road center line. Pit size 30 cm diameter x depth. Compost volume 1/4 of the volume of the pit, mixed with original soil.	Nos	174.00	
2807	Supply, Preparation and planting of live cuttings of selected species (eg assuro, namdi phul, simali) of minimum 1 m length to 0.5 m into soft debris. Pegs spaced at 5 cm centres within rows, with 5-20 cm between rows, and interwoven with vegetation.	Rm	139.00	
			Sub - Total (H)	
Section IX. Miscellaneous Works				
	Road furnishing and Protection Works			
1501	Supplying and erecting traffic sign in place including 50mm dia. Steel tube, 2mm. thick steel plate, cement concrete, painting, writing and supporting steel angle nut and bolit etc. complete			
	a) Single post	Nos.	3,819.77	
	b) Two or more post	Nos.	8,666.57	
1506	Providing and Fixing Reinforcedcement concrete M15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. position a) One kilometer post	Nos.	6,653.89	

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
1506	Providing and Fixing Reinforcedcement concrete M15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. position a) Five kilometer post	Nos.	12,070.20	
1509	Providing and erecting a "W" metal beam crashbarrier comprising of 3mm thick corrugated sheetmetal beam rail, 70cm above road/ground level, fixed on ISMC series channel vertical post, 150x75x5 mm spaced 2m center to center, 1.8m high, 1.1m below ground/road level metal beam rail to be fixed on the vertical post with a spacer of channel section 150x75x5mm, 330mm long complete as per Drawing and Technical Specifications.	Rm	8,217.60	
1507	Providing and installation of 150mm*150mm 1.5m long delineators (roadwayindicators, hazard markers,object markers),80-100 cm high above ground level,painted black and white in 20cm widestrips,buried or pressed into the ground and conforming to the drawings and Technical Specifications.	Nos.	1,390.02	
1504	Providing and laying of hot applied thermoplastic compound at least 2mm thick including reflectorizing glass beads as per DOR Traffic sign Manual/Specifications.The finished surface to be level, uniform and free from streaks and holes.On smooth surface (similar to Asphalt concrete and rigid pavement) b) More than two coats over new bitumin surface	Sqm.	1,723.58	
	Supply and place cats eye as per engineers instruction all complete	Nos.	1,000.00	
	Dayworks			
	Day works shall be executed only on the written instruction of the Project Manager:			
	Labour			
	a) Operator/Foreman/Supervisor	Day	815.00	

	b) Skilled labour	Day	1,200.00	
	c) Unskilled labour	Day	900.00	
	d) Heavy driver	Day	950.00	
	Material			
	a) Stone	Cum	1,665.15	

Spec.	Description of works	Unit	Rate, (NRs)	Remarks
	b) Aggregate	Cum	4,879.44	
	Equipment			
	a) JCB backoe/Loader	Hr	2,455.24	
	b) Tractor	Hr	869.00	
	c) Tipper/Truck 4.6 Cu.m capacity	Hr	2,444.80	

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Instiute of Engineering
Thapathali Campus

Rate Analysis

F/Y : 080/81

Detail Engineering Survey Design and DPR Preparation of Haku Falcha to Dudhpati Road Project

Description of works:	Providing and installation of project signboards with size of 1.8 x 1.2 m as per specification and instruction of engineer.	Unit : 1 nos
Spec. cl. No: 110		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
1.3	Skilled	md	0.100	1200.00	120.00										
	Unskilled	md	0.500	900.00	450.00	Project signboards with size of 1.8 x 1.2 m having details of contract in the format and wording as directed by the Engineer	nos	1.00	8506.65	8506.65					
				Sub total of A =	570.00				Sub total of B =	8506.65				Sub total of C =	0.00
				Sub total of A +B + C =	9076.65				Contractor's overhead expenses 15% =		1361.50			Rate (1m3)=	10438.15

Description of works:	Clearing and grubbing road land including uprooting rank vegetation, grass, bushes, shrubs, saplings and trees girth up to 300 mm, removal of stumps of trees cut earlier and disposal of unserviceable materials and stacking of serviceable Material to be used or auctioned, up to a lead of 30 meters including removal and disposal of top organic soil not exceeding 150 mm in thickness.In area of thorny jungle (more than 15 numbers per 100 sqm)	Unit : 1 m2
Spec. cl. No: 201		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.01.a	Unskilled	md	9.0000	900.00	8100.00						Tools and plants	hour	12.00	3328.40	39940.80
				Sub total of A =	8100.00				Sub total of B =	0.00				Sub total of C =	39940.80
				Sub total of A +B + C =	48040.80				Contractor's overhead expenses 15% =		7206.12			Rate =	5.52

Description of works:	Cutting of trees, including cutting of trunks, branches and removal of stumps, roots, stacking of serviceable Material with all lifts and up to a lead of 1000 meters and earth filling in the depression/pit.Girth from 300 mm to 600 mm	Unit : 1 No.
Spec. cl. No: 201		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.2.a	Unskilled	md	25.0000	900.00	22500.00						Tools and plants	hour	6.00	869.00	5214.00
				Sub total of A =	22500.00				Sub total of B =	0.00				Sub total of C =	5214.00
				Sub total of A +B + C =	27714.00				Contractor's overhead expenses 15% =		4157.10			Rate =	1062.37

Description of works:	Cutting of Trees, including cutting of Trunks, Branches and Removal Cutting of trees, including cutting of trunks, branches and removal of stumps, roots, stacking of serviceable Material with all lifts and up to a lead of 1000 meters and earth filling in the depression/pit.Girth from 600 mm to 900 mm	Unit : 1 No.
Spec. cl. No: 201		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount

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2.2.a	Unskilled	md	25.0000	900.00	22500.00						Tools and plants	hour	6.00	869.00	5214.00
				Sub total of A =	22500.00				Sub total of B =	0.00				Sub total of C =	5214.00
				Sub total of A +B + C =	27714.00				Contractor's overhead expenses 15% =		4157.10			Rate =	3187.11
Description of works:	Clearing Grass and Removal of Rubbish and Dressing and levelling the construction surface Clearing grass/ top soil and removal up to a distance of 50 meters outside the periphery of the area ,														
	including cutting and filling of small undulation. Unit : 1 m2														
Spec. cl. No: 201															

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Unskilled	md	100.00	900.00	90000.00						Tools and plants	%	0.00		0.00
				Sub total of A =	90000.00				F15	0.00				Sub total of C =	0.00
				Sub total of A +B + C =	90000.00				Contractor's overhead expenses 15% =		13500.00			Rate =	10.35
Description of works:	Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including scaffolding wherever necessary, sorting the dismantled Material, disposal of unserviceable Material and stacking the serviceable Material with all lifts and lead of 1000 meters.Cement Concrete Grade M-15 & M20.														
Spec. cl. No: 202															Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.4-II-A	Skilled	md	1.000	1200.00	1200.00						Air Compressor	hour	6.00	1199.88	7199.28
	Unskilled	md	6.000	900.00	5400.00						Drilling machine with bit and accessories	hour	6.00	3328.40	19970.40
											Tractor trolley	hour	6.00	869.00	5214.00
				Sub total of A =	6600.00				Sub total of B =	0.00				Sub total of C =	32383.68
				Sub total of A +B + C =	38983.68				Contractor's overhead expenses 15% =		5847.55			Rate (1m3)=	4483.12
Description of works:	Dismantling of existing structures like culverts, bridges, retaining walls and other structure comprising of masonry, cement concrete, wood work, steel work, including scaffolding wherever necessary, sorting the dismantled material, disposal of unserviceable material and stacking the serviceable material with all lifts and lead of 1000 meters-random rubble stone masonry in cement mortar.														
Spec. cl. No: 202															Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.4-III-A	Skilled	md	1.000	1200.00	1200.00						Tractor/trolley	hour	6.00	869.00	5214.00
	Unskilled	md	10.000	900.00	9000.00										
				Sub total of A =	10200.00				Sub total of B =	0.00				Sub total of C =	5214.00
				Sub total of A +B + C =	15414.00				Contractor's overhead expenses 15% =		2312.10			Rate (1m3)=	1772.61
Description of works:	Dismantling boulders laid in wire crates including opening of crates and stacking dismantled material.														
Spec. cl. No: 202															Unit : 1 m3

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Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.4-III-F	Skilled	md	1.000	1200.00	1200.00						Tractor/trolley	hour	6.00	869.00	5214.00
	Unskilled	md	15.000	900.00	13500.00										
				Sub total of A =	14700.00				Sub total of B =	0.00				Sub total of C =	5214.00
				Sub total of A +B + C =	19914.00				Contractor's overhead expenses 15% =		2987.10			Rate (1m3)=	1145.06

Description of works:	Removing all type of Hume Pipes and Stacking within a lead of 50 metres including Earthwork and Dismantling of Masonry Works.Up to 600 mm dia	Unit : 1 m
Spec. cl. No: 202		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.4-IX-A	Skilled	md	1.000	1200.00	1200.00						Tools and plants	%	0.00		0.00
	Unskilled	md	5.000	900.00	4500.00										
				Sub total of A =	5700.00				Sub total of B =	0.00				Sub total of C =	0.00
				Sub total of A +B + C =	5700.00				Contractor's overhead expenses 15% =		855.00			Rate (1m)=	655.50

Description of works:	Removing all type of Hume Pipes and Stacking within a lead of 50 metres including Earthwork and Dismantling of Masonry Works. 600 mm - 900 mm dia	Unit : 1 m
Spec. cl. No: 202		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.4-IX-B	Skilled	md	1.000	1200.00	1200.00						Tools and plants	%	0.00		0.00
	Unskilled	md	8.000	900.00	7200.00										
				Sub total of A =	8400.00				Sub total of B =	0.00				Sub total of C =	0.00
				Sub total of A +B + C =	8400.00				Contractor's overhead expenses 15% =		1260.00			Rate (1m)=	966.00

Description of works:	Removing all type of Hume Pipes and Stacking within a lead of 50 metres including Earthwork and Dismantling of Masonry Works. Above 900 mm dia	Unit : 1 m
Spec. cl. No: 202		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
2.4-IX-C	Skilled	md	1.000	1200.00	1200.00						Tools and plants	%	0.00		0.00
	Unskilled	md	12.000	900.00	10800.00										
				Sub total of A =	12000.00				Sub total of B =	0.00				Sub total of C =	0.00
				Sub total of A +B + C =	12000.00				Contractor's overhead expenses 15% =		1800.00			Rate (1m)=	1380.00

Description of works:	Scarifying the existing bituminous road surface to a depth of 50 mm and disposal of scarified Material with in all lifts and lead as per Drawing and Technical Specifications.	Unit : 1 m2
Spec. cl. No: 1003		

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Norms No.	Labour (A)					Material (B)					11				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
10.2 B	Skilled	md	1.000	1200.00	1200.00						Tractor/trolley	hour	6.00	869.00	5214.00
	Unskilled	md	6.000	900.00	5400.00						Tractor with ripper	hour	6.00	869.00	5214.00
											Loader tipper	hour	6.00	2444.80	14668.80
				Sub total of A =	6600.00				Sub total of B =	0.00				Sub total of C =	25096.80
				Sub total of A +B + C =	31696.80				Contractor's overhead expenses 15% =		4754.52			Rate (1m2)=	12.15

Description of works:	Providing, jointing and laying HDPE pipes with or without collar etc. complete in place as per Drawing and Technical Specifications.a) 110 mm/125 mm outer dia.	Unit : 1 m
Spec. cl. No: 701		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
7.01.a	Skilled	md	3.0	1200.00	3600.00	HDP pipe	m	50.00	564.61	28230.50	Generator (<2kva)	hr.	6.00	834.24	5005.44
	Unskilled	md	3.0	900.00	2700.00						Screw Jack	hr.	6.00	20.00	120.00
											electric heating plate	hr.	6.00	20.00	120.00
											Tools and plants	%	3.00		189.00
				Sub total of A =	6300.00				Sub total of B =	28230.50				Sub total of C =	5434.44
				Sub total of A +B + C =	39964.94				Contractor's overhead expenses 15% =		5994.74			Rate (50 m)=	45959.68
														Rate (1 m)	919.19

Description of works:	Providing and Laying Reinforced Cement Concrete Flush jointed Pipe for culverts	Unit : 1 rm
Spec. cl. No: 701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.1200 mm internal dia.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
7.02.F	Skilled	md	2.000	1200.00	2400.00	RCC Pipe	m	12.5	18568.37	232104.62	Ballies, crow, bars, chain , pulleys , block and ropes etc.		3.00%	of total cost	7444.11
	Unskilled	md	12.000	900.00	10800.00	Cement	kg	140.000	17.19	2406.60					
						Sand	m3	0.180	2366.35	425.94					
				Sub total of A =	13200.00				Sub total of B =	234937.16				Sub total of C =	7444.11
				Sub total of A +B + C =	255581.27				Contractor's overhead expenses 15% =		38337.19			Unit Rate =	23513.48

Description of works:	Providing and Laying Reinforced Cement Concrete Flush jointed Pipe for culverts	Unit : 1 rm
Spec. cl. No: 701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.900 mm internal dia.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
7.02.D	Skilled	md	1.000	1200.00	1200.00	RCC Pipe	m	12.5	14740.37	184254.62	Ballies, crow, bars, chain , pulleys , block and ropes etc.		3.00%	of total cost	5834.57
	Unskilled	md	8.000	900.00	7200.00	Cement	kg	90.000	17.19	1547.10					

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						Sand	m3	0.120	2366.35	283.96						
Sub total of A =					8400.00	Sub total of B =				186085.68	Sub total of C =					5834.57
Sub total of A +B + C =					200320.25	Contractor's overhead expenses 15% =					30048.04			Unit Rate =		18429.46
Description of works:	Providing and Laying Reinforced Cement Concrete Flush jointed Pipe for culverts															
Spec. cl. No: 701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.600 mm internal dia.															Unit : 1 rm
Norms No.	Labour (A)					Material (B)					Equipment (C)					
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	
7.02.C	Skilled	md	1.000	1200.00	1200.00	RCC Pipe	m	12.5	7680.33	96004.12	Ballies, crow, bars, chain , pulleys , block and ropes etc.		3.00%	of total cost	3153.47	
	Unskilled	md	7.000	900.00	6300.00	Cement	kg	80.000	17.19	1375.20						
						Sand	m3	0.100	2366.35	236.63						
Sub total of A =					7500.00	Sub total of B =				97615.95	Sub total of C =					3153.47
Sub total of A +B + C =					108269.42	Contractor's overhead expenses 15% =					16240.41			Unit Rate =		9960.79
Description of works:	Providing and Laying Reinforced Cement Concrete Flush jointed Pipe for culverts															
Spec. cl. No: 701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.450 mm internal dia.															Unit : 1 rm
Norms No.	Labour (A)					Material (B)					Equipment (C)					
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	
7.02.B	Skilled	md	1.000	1200.00	1200.00	RCC Pipe	m	12.5	5980.33	74754.12	Ballies, crow, bars, chain , pulleys , block and ropes etc.		3.00%	of total cost	2483.11	
	Unskilled	md	6.000	900.00	5400.00	Cement	kg	70.000	17.19	1203.30						
						Sand	m3	0.090	2366.35	212.97						
Sub total of A =					6600.00	Sub total of B =				76170.39	Sub total of C =					2483.11
Sub total of A +B + C =					85253.50	Contractor's overhead expenses 15% =					12788.03			Unit Rate =		7843.32
Description of works:	Providing and Laying Reinforced Cement Concrete Flush jointed Pipe for culverts															
Spec. cl. No: 701	Providing and Laying Reinforced cement concrete NP3 Flush jointed pipe for culverts including fixing with cement mortar 1:2 as per Drawing and Technical Specifications.300 mm internal dia.															Unit : 1 rm
Norms No.	Labour (A)					Material (B)					Equipment (C)					
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	
7.02.A	Skilled	md	0.050	1200.00	60.00	RCC Pipe	m	1.0	4620.33	4620.33	Ballies, crow, bars, chain , pulleys , block and ropes etc.		3.00%	of total cost	154.86	
	Unskilled	md	0.200	900.00	180.00	Cement	kg	9.062	17.19	155.77						
						Sand	m3	0.008	2366.35	18.93						
						Jute	kg	0.375	338.61	126.97						
Sub total of A =					240.00	Sub total of B =				4922.00	Sub total of C =					154.86
Sub total of A +B + C =					5316.86	Contractor's overhead expenses 15% =					797.53			Unit Rate =		6114.39
Description of works:	Roadway Excavation in all types of soil as per drawing and technical specification,including removal of stumps and other deleterious matter,with all lifts and lead as per Drawing and															Unit : 1 m3

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Spec. cl. No: 905	instruction of the Engineer.(for 12 cum)	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.01.1a	Unskilled	md	8.000	900.00	7200.00						Tools and plant		3.00%	of L.C.	252.00
	Skilled	md	1.000	1200.00	1200.00										
				Sub total of A =	8400.00				Sub total of B =	0.00				Sub total of C =	252.00
				Sub total of A +B + C =	8652.00				Contractor's overhead expenses 15% =		1297.80			Unit Rate =	829.15

Description of works:	Roadway Excavation in all types of soil as per drawing and technical specification,including removal of stumps and other deleterious matter,with all lifts and lead as per Drawing and	Unit : 1 m3
Spec. cl. No: 905	instruction of the Engineer.Mechanical Method(for 360 cum)	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
Machine	100														
9.01.1b	Unskilled	md	1.00	900.00	900.00					0.00	Excavator	hr	6.0000	3328.40	19970.40
	Skilled	md	3.00	1200.00	3600.00										
				Sub total of A =	900.00				Sub total of B =	0.00				Sub total of C =	19970.40
				Sub total of A +B + C =	20870.40				Contractor's overhead expenses 15% =		3130.56			Unit Rate =	66.67

Roadway excavation using machine (100%)

Description of works:	Roadway Excavation in ordinary rock as per Drawing and Technical specification,including all lift and leadas per Drawing and instruction of the Engineer.(for 60 cum)	Unit : 1 m3
Spec. cl. No: 905		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.01.2a	Unskilled	md	50.000	900.00	45000.00						Tools and plant		3.00%	of L.C.	1458.00
	Skilled	md	3.000	1200.00	3600.00										
				Sub total of A =	48600.00				Sub total of B =	0.00				Sub total of C =	1458.00
				Sub total of A +B + C =	50058.00				Contractor's overhead expenses 15% =		7508.70			Unit Rate =	959.45

Description of works:	Roadway Excavation in ordinary rock as per Drawing and Technical specification,including all lift and lead as per Drawing and instruction of the Engineer.Mechanical ethod(for 120cum)	Unit : 1 m3
Spec. cl. No: 905		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.01.2b	Unskilled	md	3.000	900.00	2700.00						Hydrolic Excavator	hr	6	3328.40	19970.40
	Skilled	md	1.000	1200.00	1200.00										

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				Sub total of A =	3900.00				Sub total of B =	0.00				Sub total of C =	19970.40
				Sub total of A +B + C =	23870.40				Contractor's overhead expenses 15% =		3580.56			Unit Rate =	228.76
Description of works:				Roadway Excavation in hardrock with rockbreakers,including breaking rock,lifts and lead for disposal as per Drawing and Technical Specifications Mechanical Methods											Unit : 1 m3
Spec. cl. No: 905															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.01.3a	Unskilled	md	10.000	900.00	9000.00						Hydrolic Excavator	hr	6	3328	19968.00
	Skilled	md	1.000	1200.00	1200.00										
				Sub total of A =	10200.00				Sub total of B =	0.00				Sub total of C =	19968.00
				Sub total of A +B + C =	30168.00				Contractor's overhead expenses 15% =		4525.20			Unit Rate =	2168.33
Description of works:				Roadway Excavation in hard rock manually chiseling including breakingrock,lifts and lead for disposal as perDrawing and Technical Specifications ,Manual Methods											Unit : 1 m3
Spec. cl. No: 905															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.01.3b	Unskilled	md	58.000	900.00	52200.00						Crow bar and other T & P	%	3		1566.00
	Skilled	md	2.000	1200.00	2400.00										
	Blacksmith	md	1.000	1200.00	1200.00										
				Sub total of A =	52200.00				Sub total of B =	0.00				Sub total of C =	1566.00
				Sub total of A +B + C =	53766.00				Contractor's overhead expenses 15% =		8064.90			Unit Rate =	3864.43
Roadway excavation in all type of soils including Rock and safe disposal of materials all omplete. (Weighted rate)															Unit : 1 m3
Description of works:						Quantity					Rate			Weighted Rate	
Earthwork excavation in BMS (70%)						9280.41					66.67			128.15	
Earthwork excavation in Soft Rock (25%)						1294.91					228.76				
Earthwork excavation in Hard Rock (5%)						215.80					2168.33				
Description of works:				Roadway Excavation in hard rock with mechanical drilling, including blasting and breaking, and disposal of cut road within all lifts and leads as per Drawing and instruction of the Engineer.											Unit : 1 m3
Spec. cl. No: 905															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount

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9.01.3a	Unskilled	md	20.000	900.00	18000.00	Gelatine	Kg	32	331.55	10609.6	Dozer	hr	6	4407.84	26447.04
	Skilled	md	1.000	1200.00	1200.00	Detonator	Nos	126	331.55	41775.3	Jack hammer	hr	30	-	#VALUE!
	Driller	md	3.000	815.00	2445.00	Fuse Wire	m	180	331.55	59679	Air compressor	hr	12	426.80	5121.60
	Blaster	md	1.000	815.00	815.00										
				Sub total of A =	22460.00				Sub total of B =	112063.90				Sub total of C =	#VALUE!
				Sub total of A +B + C =	#VALUE!				Contractor's overhead expenses 15% =		#VALUE!			Unit Rate =	#VALUE!

Description of works: Providing, laying, spreading and compacting embankment with roadway cutting material and compact to the required density as per Drawing and Technical Specifications.(Manually) Providing, laying, spreading and compacting embankment with roadway cutting material and compact to the required density as per Drawing and Technical Specifications.(Manually)

Spec. cl. No: 909

Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.05.01	Unskilled	md	50.000	900.00	45000.00	water	lit.	24000	0.26	6240.00	Roller (8 ~ 10 t0nnes)	hr	6.000	1090.4	6542.40
	skilled	md	2.000	1200.00	2400.00										
				Sub total of A =	47400.00				Sub total of B =	6240.00	Sub total of C =				6542.40
				Sub total of A +B + C =	60182.40				Contractor's overhead expenses 15% =		9027.36			Unit Rate =	692.10

Description of works: Providing, laying, spreading and compacting embankment with roadway cutting material and compact to the required density as per Drawing and Technical Specifications.(Mechanical Method)

Spec. cl. No: 909

Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.05.02	Skilled	md	1.000	1200.00	1200.00	water	lit.	72000	0.26	18720.00	Grader	hr	6.000	2997.52	17985.12
	Unskilled	md	10.000	900.00	9000.00						Roller (8 ~ 10 t0nnes)	hr	6.000	1843.68	11062.08
											Dozer	hr	6.000	4407.84	26447.04
				Sub total of A =	10200.00				Sub total of B =	18720.00	Sub total of C =				55494.24
				Sub total of A +B + C =	84414.24				Contractor's overhead expenses 15% =		12662.14			Unit Rate =	323.59

Description of works: Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications. Ordinary Soil (a) Depth upto 3.0 m Manual methods

Spec. cl. No: 907

Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -1A-i	Unskilled	md	8.000	900.00	7200.00						Tools and plant		3.00%	of L.C.	252.00
	Skilled	md	1.000	1200.00	1200.00										
				Sub total of A =	8400.00				Sub total of B =	0.00	Sub total of C =				252.00
				Sub total of A +B + C =	8652.00				Contractor's overhead expenses 15% =		1297.80			Unit Rate =	994.98

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Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material	Unit : 1 m3
Spec. cl. No: 907	as per Drawing and Technical Specifications. Ordinary Soil (a) Depth 3 m to 6 m Manual Methods	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -1A-ii	Unskilled	md	12.000	900.00	10800.00						Tools and plant		3.00%	of L.C.	360.00
	Skilled	md	1.000	1200.00	1200.00										
				Sub total of A =	12000.00				Sub total of B =	0.00	Sub total of C =				360.00
				Sub total of A +B + C =	12360.00				Contractor's overhead expenses 15% =		1854.00			Unit Rate =	1421.40

Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material as per Drawing and Technical Specifications. Ordinary Soil	Unit : 1 m3
Spec. cl. No: 907	(a) Depth up to 6 m Manual Methods	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -1A-iii	Unskilled	md	18.000	900.00	16200.00						Tools and plant		3.00%	of L.C.	558.00
	Skilled	md	2.000	1200.00	2400.00										
				Sub total of A =	18600.00				Sub total of B =	0.00	Sub total of C =				558.00
				Sub total of A +B + C =	19158.00				Contractor's overhead expenses 15% =		2873.70			Unit Rate =	2203.17

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Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material	Unit : 1 m3
Spec. cl. No: 907	as per Drawing and Technical Specifications. Ordinary Soil (a) Depth up to 3 m Mechanical Methods	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
Norms No.	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -1B-i	Unskilled	md	3.000	900.00	2700.00						Hydraulic Excavator		6	3328.4	19970.40
	Skilled	md	1.000	1200.00	1200.00										
				Sub total of A =	3900.00				Sub total of B =	0.00	Sub total of C =				19970.40
				Sub total of A +B + C =	23870.40				Contractor's overhead expenses 15% =		3580.56			Unit Rate =	114.38

Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material	Unit : 1 m3
Spec. cl. No: 907	as per Drawing and Technical Specifications. Ordinary Soil (a) Depth 3m to 6 m Mechanical Methods	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -1B-ii	Unskilled	md	3.000	900.00	2700.00						Hydraulic Excavator		6	3328.4	19970.40
	Skilled	md	1.000	1200.00	1200.00										
				Sub total of A =	3900.00				Sub total of B =	0.00	Sub total of C =				19970.40
				Sub total of A +B + C =	23870.40				Contractor's overhead expenses 15% =		3580.56			Unit Rate =	130.72

Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material	Unit : 1 m3
Spec. cl. No: 907	as per Drawing and Technical Specifications. Ordinary Soil (a) Depth above 6m Mechanical Methods	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -1B-iii	Unskilled	md	4.000	900.00	3600.00						Hydraulic Excavator		6	3328.4	19970.40
	Skilled	md	2.000	1200.00	2400.00										
				Sub total of A =	6000.00				Sub total of B =	0.00	Sub total of C =				19970.40
				Sub total of A +B + C =	25970.40				Contractor's overhead expenses 15% =		3895.56			Unit Rate =	165.92

Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material	Unit : 1 m3
Spec. cl. No: 907	as per Drawing and Technical Specifications. Ordinary Rock (a) Depth upto 3m Manual Methods	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -2A-i	Unskilled	md	10.000	900.00	9000.00						Hydraulic Excavator		0	3328.4	0.00

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	Skilled	md	1.000	1200.00	1200.00											
	Sub total of A =				10200.00	Sub total of B =				0.00	Sub total of C =					0.00
Sub total of A +B + C =					10200.00	Contractor's overhead expenses 15% =					1530.00		Unit Rate =			1173.00

Description of works:	Earth work in excavation of foundation of structures, including construction of shoring and bracing, removal of stumps and other deleterious matter and backfilling with approved Material
Spec. cl. No: 907	as per Drawing and Technical Specifications. Ordinary Rock (a) Depth upto 3m Mechanical Methods

Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.4 -2A-i	Unskilled	md	3.000	900.00	2700.00						Hydraulic Excavator		6	3328.4	19970.40
	Skilled	md	1.000	1200.00	1200.00										
	Sub total of A =				3900.00	Sub total of B =				0.00	Sub total of C =				19970.40
Sub total of A +B + C =					23870.40	Contractor's overhead expenses 15% =					3580.56		Unit Rate =		305.01

Earth work in excavation of foundation of structures all complete. (Weighted rate) — Unit : 1 m3

Description of works:	Quantity	Rate	Weighted Rate	
Earthwork excavation in soil (90%)	90.00	102.94	133.44	
Earthwork excavation in ordinary Rock (10%)	10.00	30.50		

Description of works:	Providing suitable material and Back filling behind abutment, wing wall and return wall complete as per Drawing and Technical Specifications.Locally available Material including compaction by tamping rod (without watering)
Spec. cl. No: 908	

Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
9.11.c	Skilled	md	0.2	1200	240.00	Locally available materials	cum	12	0	0					
	Unskilled	md	4.000	900.00	3600.00					0	Tools and plant		3.00%	of L.C.	115.20
	Sub total of A =				3840.00	Sub total of B =				0.00	Sub total of C =				115.20
Sub total of A +B + C =					3955.20	Contractor's overhead expenses 15% =					593.28		Unit Rate =		454.85

Description of works:	Providing and laying of Filter media with granular Material/stone crushed aggregates to a thickness of not less than 600 mm with smaller size towards the soil and bigger size towards the
Spec. cl. No: 909,910	wall and provided over the entire surface behind abutment, wing wall and return wall to the full height compacted to a firm condition complete as per drawing and Technical Specification.

Unit : 1 m3

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount

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9.12	Unskilled	md	10.000	900.00	9000.00	Filter material	12	cum	3025.44	36305.28					0.00
	skilled	md	1.000	1200.00	1200.00	water	1000	Lit	0.26	260					
				Sub total of A =	10200.00				Sub total of B =	36565.28	Sub total of C =				0.00
				Sub total of A +B + C =	46765.28				Contractor's overhead expenses 15% =		7014.79			Unit Rate =	5378.01

Description of works:	Compacting original ground supporting sub-grade Loosening of the ground upto a level of 500 mm below the sub-grade level, watered, graded and compacted in layers as per Drawing and	Unit : 1 m^3
Spec. cl. No: 1003,1005	Technical Specifications.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
10.4	Skilled	md	1.00	1200.00	1200.00	water	lit.	24000.000	0.26	6240.00	Grader (75 Hp)	hr	6.00	2997.52	17985.12
	Unskilled	md	5.00	900.00	4500.00						Roller 8-10t	hr	12.000	1090.40	13084.80
											Tractor with ripper		12.000	869.00	10428.00
				Sub total of A =	5700.00				Sub total of B =	6240.00	Sub total of C =				41497.92
				Sub total of A +B + C =	53437.92				Contractor's overhead expenses 15% =		8015.69			Unit Rate =	61453.61
														Rate per Cum =	102.42

Description of works:	Cement Treated Soil Sub Base/ Base Providing, laying and spreading soil on a prepared sub grade, pulverizing, adding the designed quantity of cement to the spread soil, mixing in place ,	Unit : 1 m^3
Spec. cl. No: 1202	grading and compacting at OMC to achieve the desired unconfined compressive strength and to form a layer of sub-base/base as per Drawing and Technical Specifications.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
12.2	Skilled	md	3.0000	1200.00	3600.00	Soil /borrowpit material	cu.m.	384.00	2450.79	941103.36	Excavator	hr	6.0000	3328.40	19970.40
	Unskilled	md	15.0000	900.00	13500.00	Cement	tonne	21.00	17187.10	360929.10	Motor grader	hr	6.0000	2997.52	17985.12
						water	lit	72000.00	0.26	18720.00	Vibratory roller	hr	6.0000	1843.68	11062.08
											Tractor with rotavator	hr	12.0000	869.00	10428.00
				Sub total of A =	17100.00				Sub total of B =	1320752.46	Sub total of C =				59445.60
				Sub total of A +B + C =	1397298.06				Contractor's overhead expenses 15% =		209594.71			Unit Rate =	5356.31

Description of works:	Providing and laying granular sub-base on prepared surface, mixing at OMC, and compacting to achieve the desired density, complete as per Drawing and Technical Specifications by	Unit : 1 m^3
Spec. cl. No: 1201	mechanical means.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
12.01.a	Skilled	md	2.0000	1200.00	2400.00	Subbase agg.	cu.m.	384.00	3025.44	1161768.96	Grader	hr	6.0000	2997.52	17985.12
	Unskilled	md	12.0000	900.00	10800.00	water	lit	18000.00	0.26	4680.00	Vibrator Rolller	hr	12.0000	1843.68	22124.16
											Loader	hr	12.0000	2455.24	29462.88
				Sub total of A =	13200.00				Sub total of B =	1166448.96	Sub total of C =				69572.16

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					Sub total of A +B + C =	1249221.12				Contractor's overhead expenses 15% =	187383.17			Unit Rate =	4788.68
Description of works:	Providing and laying Crusher Run Macadam on a prepared surface, spreading and mixing , watering and compacting to form a layer of Base course as per Drawing and Technical Specifications.														Unit : 1 m³
Spec. cl. No: 1204															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
12.07.a	Skilled	md	3.0000	1200.00	3600.00	Aggregrate 45-22.5mm	cu.m.	24.1200	2450.79	59113.05	Grader	hr	6.0000	2997.52	17985.12
	Unskilled	md	14.0000	900.00	12600.00	Aggregrate 22.5 - 5.6mm	cu.m.	237.6000	3952.44	939099.74	Vibrator Rolller	hr	6.0000	1843.68	11062.08
						Aggregrate below 5.6mm	cu.m.	213.48	3988.93	851556.77					
						water	lit	36000.00	0.26	9360.00					
					Sub total of A =	16200.00				Sub total of B =	1859129.56			Sub total of C =	29047.20
					Sub total of A +B + C =	1904376.76				Contractor's overhead expenses 15% =	285656.51			Unit Rate =	6083.43
Description of works:	Providing, laying, spreading and compacting Water bound macadam including brooming requisite type of screening/ binding Materials to fill up the interstices of coarse aggregate, watering and compacting to the required density as per Drawing and Technical Specifications.														Unit : 1 m³
Spec. cl. No: 1203															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
12.06.b	Skilled	md	3.0000	1200.00	3600.00	Aggregrate as per specification	cu.m.	435.0000	2450.79	1066093.65	Grader	hr	6.0000	2997.52	17985.12
	Unskilled	md	15.0000	900.00	13500.00	Stone screening 13.2mm grading I	cu.m.	57.6000	4129.93	237883.96	Vibrator Rolller	hr	6.0000	1843.68	11062.08
						water	lit	144000.00	0.26	37440.00					
					Sub total of A =	17100.00				Sub total of B =	1341417.61			Sub total of C =	29047.20
					Sub total of A +B + C =	1387564.81				Contractor's overhead expenses 15% =	208134.72			Unit Rate =	4432.50
Description of works:	Providing and applying prime coat with hot bitumen (including appropriate cutter) on prepared surface of granular base including cleaning of road surface and spraying by mechanical means as per the Technical Specification .														Unit : 1 ltr
Spec. cl. No: 1302															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.1.a	Skilled	md	3.0000	1200.00	3600.00	Bitumen cutback	lit	5250.0000	91.14	478485.00	Boiler	hr	8.0000	1136.76	9094.08
	Unskilled	md	50.0000	900.00	45000.00	MC30/MC70					Bitumen Distributor	hr	6.0000	2785.44	16712.64
						water	lit	10000.0000	0.26	2600.00	Air Compressor	hr	8.0000	1199.88	9599.04
											Mechanical broom	hr	8.0000	1419.40	11355.20
											Generator	hr	8.0000	834.24	6673.92
					Sub total of A =	48600.00				Sub total of B =	481085.00			Sub total of C =	53434.88

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					Sub total of A +B + C =	583119.88			Contractor's overhead expenses 15% =		87467.98			Unit Rate =	134.12
Description of works:		,Providing and applying tack coat with hot Bitumen at specified rate on the prepared surfaces including cleaning as per Technical Speciation .(Tack coat with bitumen by mechanical means)													Unit : 1 ltr
Spec. cl. No: 1302															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.2.b	Skilled	md	3.0000	1200.00	3600.00	Bitumen cutback	lit	5250.0000	91.14	478485.00	Boiler	hr	6.0000	1136.76	6820.56
	Unskilled	md	20.0000	900.00	18000.00	MC30/MC70					Bitumen Distributor	hr	6.0000	2785.44	16712.64
						water	lit	0.0000	0.26	0.00	Air Compressor	hr	6.0000	1199.88	7199.28
											Mechanical broom	hr	0.0000	1419.40	0.00
											Generator	hr	6.0000	834.24	5005.44
					Sub total of A =	21600.00			Sub total of B =	478485.00	Sub total of C =				35737.92
					Sub total of A +B + C =	535822.92			Contractor's overhead expenses 15% =		80373.44			Unit Rate =	123.24
Description of works:		Providing and laying dense bituminous macadam using crushed aggregates of specified grading, premixed with bituminous binder and filler as per Drawing and Technical Specifications.													Unit : 1 m3
Spec. cl. No: 1308															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.30	Skilled	md	5.00	1200.00	6000.00	Bitumen	lit	9560.00	91.14	871298.40	Batch mix HMP	hr	6.00	33455.96	200735.76
	Unskilled	md	16.00	900.00	14400.00	Aggregate 37.5-25mm 15%	cum	31.60	3952.44	124897.10	Vibratory Roller	hr	6.00	1843.68	11062.08
						Aggregate 25-10mm 45%	cum	18.67	4129.93	77105.79	Paver Finisher	hr	6.00	2312.64	13875.84
						Aggregate 10-5mm 25%	cum	27.29	3988.93	108857.89	Generator	hr	6.00	834.24	5005.44
						Aggregate 5mm below 15%	cum	63.20	4129.93	261011.57	Pneumatic roller	hr	6	2191.64	13149.84
						Filler	tonne	4.31	993.87	4283.57	Smooth Wheel Roller	hr	6	1090.4	6542.40
					Sub total of A =	20400.00			Sub total of B =	1447454.32	Sub total of C =				250371.36
					Sub total of A +B + C =	1718225.68			Contractor's overhead expenses 15% =		257733.85			Unit Rate =	20266.25
Description of works:		Bituminous Concrete / Asphalt Concrete													Unit : 1 m3
Spec. cl. No: 1309		Providing and laying Bituminous concrete/ Asphalt concrete using crushed aggregates of specified grading, premixed with bituminous binder and filler as per Drawing and Technical Specifications													
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount

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13.60	Skilled	md	5.00	1200.00	6000.00	Bitumen	lit	12940.00	91.14	1179351.60	Pneumatic roller	hr	6.00	2191.64	13149.84
	Unskilled	md	15.00	900.00	13500.00	Aggregates 20-10 mm	Cum	49.48	4129.93	204348.93	Paver finisher	hr	6.00	2312.64	13875.84
						Aggregates 10-5 mm	Cum	32.52	3988.93	129720.00	Batch mix HMP	hr	6.00	33455.96	200735.76
						Aggregates 5 mm and below	Cum	56.55	3988.93	225573.99	Generator	hr	6.00	834.24	5005.44
						filler	tonne	2.83	993.87	2812.65	smooth wheeled roller	hr	12	1090.4	13084.80
				Sub total of A =	19500.00				Sub total of B =	1741807.17	Sub total of C =				245851.68
				Sub total of A +B + C =	2007158.85				Contractor's overhead expenses 15% =		301073.83			Unit Rate =	24169.98

Description of works:	Providing and laying surface dressing as wearing course in single coat using gravel of specified size on a recently applied layer of bituminous binder on prepared surface as per Drawing	Unit : 1 Sqm
Spec. cl. No: 1303	and Technical Specifications.19 mm nominal chipping size	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.05.04	Skilled	md	3.0000	1200.00	3600.00	Chips	cum	102.0000	4129.93	421252.86	Chips spreader	hr	6.0000	0.00	0.00
	Unskilled	md	12.0000	900.00	10800.00						Pneumatic Roller	hr	12.0000	2191.64	26299.68
				Sub total of A =	14400.00				Sub total of B =	421252.86	Sub total of C =				26299.68
				Sub total of A +B + C =	461952.54				Contractor's overhead expenses 15% =		69292.88			Unit Rate =	88.54

Description of works:	Providing and laying surface dressing as wearing course in single coat using gravel of specified size on a recently applied layer of bituminous binder on prepared surface as per Drawing	Unit : 1 Sqm
Spec. cl. No: 1301, 1303	and Technical Specifications.10 mm nominal chipping size	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.05.04	Skilled	md	3.0000	1200.00	3600.00	Chips	Cum	80.3000	3988.93	320311.07	Chips spreader	hr	6.0000	0.00	0.00
	Unskilled	md	12.0000	900.00	10800.00						Pneumatic Roller	hr	12.0000	2191.64	26299.68
				Sub total of A =	14400.00				Sub total of B =	320311.07	Sub total of C =				26299.68
				Sub total of A +B + C =	361010.75				Contractor's overhead expenses 15% =		54151.61			Unit Rate =	46.13

Description of works:	Providing and laying open-graded premix carpet of 20 mm thickness composed of 13.2 mm to 5.6 mm aggregates as wearing course on a previously prepared base as per drawing and Technical Specifications .	Unit : 1 Sqm
Spec. cl. No: 1301		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.09.B.1	Skilled	md	5.0000	1200.00	6000.00	Crushed stone chipping 13.2mm to 5.6mm	Cum	108.0000	3952.44	426863.52	hot mix plant	hr	6.0000	33455.96	200735.76
	Unskilled	md	16.0000	900.00	14400.00	Bitumen	tonne	5.8400	91140.00	532257.60	generator	hr	6.0000	834.24	5005.44
											paver	hr	6.0000	2312.64	13875.84
											smooth wheeled roller	hr	6.0000	2191.64	13149.84
				Sub total of A =	20400.00				Sub total of B =	959121.12	Sub total of C =				232766.88
				Sub total of A +B + C =	1212288.00				Contractor's overhead expenses 15% =		181843.20			Unit Rate =	348.53

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Description of works:	Providing and fixing of retro-reflectorized warning,Regulatory and informatory sign as per specification 1 made of high intensity grade sheeting,fixed over aluminum sheeting, 1.5mm thick	Unit : 1 no.
Spec. cl. No: 1501	supported on a 50mm internal dia stee ltube or mildsteel angle iron post 75mmx40mmx6mm firmly fixed to the ground by means of properly designed foundation with M10/40grade cement concrete 30cmx30cm,30cmbelow ground leve lor as per Drawing and Technical Specifications.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
Norms No.	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
15.20	Skilled	md	1.000	1200.00	1200.00	Painting angle iron post two coats	Sqm	8.780	186.96	1641.50	Tractor with trolley	hr	3	869	2607
	Unskilled	md	3.000	900.00	2700.00	M10 grade	m3	0.270	10561.26	2851.54					
						Mild steel angle iron 75 x 40 x 6 mm, 3. m long @ 6.8 kg/m Aluminum sheeting fixed with encapsulated lens type reflective sheeting of size including lettering and signs as applicable	Kg	204.00	97.19	19826.76					
						Excavation for foundation	Cum	0.54	99.46	53.70					
						60 cm height equilateral triangle	sqm	1.04	2245.10	2334.90					
				Sub total of A =	3900.00				Sub total of B =	26708.40				Sub total of C =	2607.00
				Sub total of A +B + C =	33215.40				Contractor's overhead expenses 15% =		4982.31			Unit Rate =	3819.77

Description of works:	Providing and applying two coats of readymix paint of approved brand on steel surfac eafter through cleaning of surface to give an even shade as per Drawing and Technical Specifications.	Unit : 1 Sqm
Spec. cl. No: 1501		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
15.50	Skilled	md	1.000	1200.00	1200.00	paint	lit	2.500	607.61	1519.02	scaffolding	%	1		15.1902
	Unskilled	md	1.000	900.00	900.00						surface preparation	%	5		105
				Sub total of A =	2100.00				Sub total of B =	1519.02	Sub total of C =				120.19
				Sub total of A +B + C =	3739.21				Contractor's overhead expenses 15% =		560.88			Unit Rate =	215.00

Description of works:	Providing and laying of hot applied thermoplastic compound at least 2mm thick including reflectorizing glass beads as per DOR Traffic sign Manual/Specifications.The finished surface to be	Unit : 1 sqm
Spec. cl. No: 1504	level, uniform and free from streaks and holes.On smooth surface (similar to Asphalt concrete and rigid pavement)	

Norms No.	b) More than two coats over new bitumin urface SLabour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
5.90	Skilled	md	2.000	1200.00	2400.00	Hot applied thermoplastic compound	lit	930.000	607.61	565077.30	Road Marking Machine	Hr	10	323.8	3238
	Unskilled	md	4.000	900.00	3600.00	Reflectorizing glass beads	kg	100	165.00	16500.00	Tractor / trolley	Hr	10	869	8690
				Sub total of A =	6000.00				Sub total of B =	581577.30	Sub total of C =				11928.00
				Sub total of A +B + C =	599505.30				Contractor's overhead expenses 15% =		89925.80			Unit Rate =	1723.58

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Description of works:	Providing and Fixing Reinforcedcement concrete M15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. position	Unit : 1 no.
Spec. cl. No: 1506	a) One kilometer post	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
15.11.ii	Skilled	md	2.000	1200.00	2400.00	M15/40 RCC	m3	1.400	12664.13	17729.78	Tractor trolley	hr	3	869	2607
	Unskilled	md	7.000	900.00	6300.00	M10/40 PCC	m3	2.380	10561.26	25135.79					
						Excavation for foundation	m3	2.380	99.46						
						Painting two coats on concrete surface	m2	11.900	186.96	2224.82					
						Lettering on km post	cm-letter	1680.000	10.00	16800.00					
						Reinforcement bar	kg	82.880	94.19	7806.46					
				Sub total of A =	8700.00				Sub total of B =	69696.85				Sub total of C =	2607.00
				Sub total of A +B + C =	81003.85				Contractor's overhead expenses 15% =		12150.58			Unit Rate =	6653.89

Description of works:	Providing and Fixing Reinforcedcement concrete M15 grade kilometer Post including painting and printing as per Standard Drawing-2070 and Technical Specifications. position	Unit : 1 no.
Spec. cl. No: 1506	a) Five kilometer post	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
15.11.i	Skilled	md	1.000	1200.00	1200.00	M15/40 RCC	m3	1.200	12664.13	15196.95	Tractor trolley	hr	3	869	2607
	Unskilled	md	6.000	900.00	5400.00	M10/40 PCC	m3	1.200	10561.26	12673.51					
						Excavation for foundation	m3	1.200	99.46						
						Painting two coats on concrete surface	m2	10.200	186.96	1906.99					
						Lettering on km post	cm-letter	1800.000	10.00	18000.00					
						Reinforcement bar	kg	63.600	94.19	5990.48					
				Sub total of A =	6600.00				Sub total of B =	53767.93				Sub total of C =	2607.00
				Sub total of A +B + C =	62974.93				Contractor's overhead expenses 15% =		9446.24			Unit Rate =	12070.20

Description of works:	Providing and installation of 150mm*150mm 1.5m long delineators (roadwayindicators, hazard markers,object markers),80-100 cm high above ground level,painted black and white in 20cm	Unit : 1 no.
Spec. cl. No: 1507	widestrips,buried or pressed into the ground and conforming to the drawings and Technical Specifications.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
15.12	Skilled	md	1.000	1200.00	1200.00	M15 grade concrete	m3	1.010	12664.13	12790.77	Tractor trolley	hr	3	869	2607
	Unskilled	md	7.000	900.00	6300.00	Excavation of foundation	m3	0.470	99.46	46.74					
						Enamel paint	Sqm	14.400	186.96	2692.22					
						Reinforcement bar	kg	112.8	94.19	10624.63					
				Sub total of A =	7500.00				Sub total of B =	26154.36				Sub total of C =	2607.00
				Sub total of A +B + C =	36261.36				Contractor's overhead expenses 15% =		5439.20			Unit Rate =	1390.02

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Description of works:	Providing , Preparing and Installing form work including necessary supports and removing after completion for foundation and footings	Unit : 10 m2
Spec. cl. No: 1804,1805	(a) using timber (soft wood) - Class F1 finish.	

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
18.01.a	Skilled	md	1.50	1200.00	1800.00	Planks 38mm thick.	m3	0.42	5956.78	2501.84					
	Unskilled	md	2.00	900.00	1800.00	struts, ballies, etc.	m3	0.18	5956.78	1072.22					
						Nails,spikes,etc.	kg	1.00	138.61	138.61					
				Sub total of A =	3600.00				Sub total of B =	3712.67	Sub total of C =				0.00
				Sub total of A +B + C =	7312.67				Contractor's overhead expenses 15% =		1096.90			Rate (10 m2) =	8409.57
														Unit Rate (1 m2) =	840.96

Description of works:	Providing , Preparing and Installing form work including necessary supports and removing after completion ---For Vertical plain surface [class F2 finish] height upto 3 m	Unit : 10 m2
Spec. cl. No: 1804,1805		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
18.01.b	Skilled	md	2.20	1200.00	2640.00	Struts ballies	m3	0.40	7148.13	2859.25					
	Unskilled	md	2.20	900.00	1980.00	Nails,spikes,etc.	kg	2.5	138.61	346.52					
						Plywood 9mm thick	m2	11.00	62.03	682.33					
				Sub total of A =	4620.00				Sub total of B =	3888.10	Sub total of C =				0.00
				Sub total of A +B + C =	8508.10				Contractor's overhead expenses 15% =		1276.22			Unit Rate :	9784.32
														Unit Rate (1 m2) =	978.43

Description of works:	Providing and laying of Plain Cement Concrete M 10 (or 1:3:6 for nominal mix) in Foundation complete as per Drawing and Technical Specifications.	Unit : 1 m3
Spec. cl. No: 2000		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
20.01	Skilled	md	2.00	1200.00	2400.00	cement	mt	3.450	17187.10	59295.49	mixer (0.28/ 0.20 m^3)	hr	6.00	344.52	2067.12
	Unskilled	md	22.00	900.00	19800.00	aggregate 40mm	m3	13.500	3952.44	53357.94	generator	hr	6.00	834.24	5005.44
						coarse sand	m3	6.750	2366.35	15972.86					
						water	lit	2000.000	0.26	520.00					
				Sub total of A =	22200.00				Sub total of B =	129146.29	Sub total of C =				7072.56
				Sub total of A +B + C =	158418.85				Contractor's overhead expenses 15% =		23762.83			Unit Rate =	12145.45
					10561.26										

Description of works:	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.PCC Grade M15	Unit : 1 m3
Spec. cl. No: 2000		

Norms No.	Labour (A)	Material (B)	Equipment (C)
Norms No.			

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	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
20.02.a	Skilled	md	3.00	1200.00	3600.00	cement	mt	4.130	17187.10	70982.72	mixer (0.28/ 0.20 m^3)	hr	6.00	344.52	2067.12
	Unskilled	md	30.00	900.00	27000.00	aggregate 40mm	m3	8.100	3952.44	32014.76	generator	hr	6.00	834.24	5005.44
						aggregate 20mm	m3	4.050	4879.44	19761.73					
						aggregate 10mm	m3	1.350	4245.21	5731.03					
						coarse sand	m3	6.750	2366.35	15972.86					
					343.74	water	lit	2000.000	0.26	520.00					
					Sub total of A =	30600.00				Sub total of B =	144983.10	Sub total of C =			7072.56
												Form work	$% of ABC		7306.23
				Sub total of A +B + C+D =	189961.89					Contractor's overhead expenses 15% =		28494.28		Unit Rate =	14563.74
					12664.126										

Description of works:	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.PCC Grade M20	Unit : 1 m3
Spec. cl. No: 2000		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
20.02.b	Skilled	md	3.00	1200.00	3600.00	cement	mt	5.160	17187.10	88685.43	mixer (0.28/ 0.20 m^3)	hr	6.00	344.52	2067.12
	Unskilled	md	30.00	900.00	27000.00	aggregate 40mm	m3	5.400	3952.44	21343.17	generator	hr	6.00	834.24	5005.44
						aggregate 20mm	m3	5.400	4879.44	26348.97					
						aggregate 10mm	m3	2.700	4245.21	11462.06					
						coarse sand	m3	6.750	2366.35	15972.86					
						water	lit	2500.00	0.26	650.00					
					Sub total of A =	30600.00				Sub total of B =	163812.49	Sub total of C =			7072.56
					Sub total of A +B + C =	201485.05				Contractor's overhead expenses 15% =		30222.76		Unit Rate =	15447.19
						13432.34									

Description of works:	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.RCC Grade M20	Unit : 1 m3
Spec. cl. No: 2000		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
20.02.c	Skilled	md	3.00	1200.00	3600.00	cement	mt	5.210	17187.10	89544.79	mixer (0.28/ 0.20 m^3)	hr	6.00	344.52	2067.12
	Unskilled	md	30.00	900.00	27000.00	aggregate 10-20mm	m3	8.100	4879.44	39523.46	generator	hr	6.00	834.24	5005.44
						aggregate 10mm & down	m3	5.400	4245.21	22924.13					
						coarse sand	m3	6.750	2366.35	15972.86					
						water	lit	2500.000	0.26	650.00					
					Sub total of A =	30600.00				Sub total of B =	168615.24	Sub total of C =			7072.56
												Formwork @4% of ABC			8251.51
					Sub total of A +B + C =	214539.31				Contractor's overhead expenses 15% =		32180.90		Unit Rate =	16448.01
						14302.62									

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Description of works:	Providing and laying of Plain/Reinforced Cement Concrete in Foundation complete as per Drawing and Technical Specifications.RCC Grade M25	Unit : 1 m3
Spec. cl. No: 2000		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
20.0.2e	Skilled	md	3.00	1200.00	3600.00	cement	mt	6.050	17187.10	103981.95	mixer (0.28/ 0.20 m^3)	hr	6.00	344.52	2067.12
	Unskilled	md	30.00	900.00	27000.00	aggregate 10-20mm	m3	8.100	4879.44	39523.46	generator	hr	6.00	834.24	5005.44
						aggregate 10mm & down	m3	5.400	4245.21	22924.13					
						coarse sand	m3	6.750	2366.35	15972.86					
						water	lit	3000.000	0.26	780.00					
						Admixer	kg	24.200		0.00					
				Sub total of A =	30600.00				Sub total of B =	183182.40	Sub total of C =				7072.56
											Formwork 3.75% of ABC				8282.06
				Sub total of A +B + C =	229137.02				Contractor's overhead expenses 15% =		34370.55			Unit Rate =	17567.17
					15275.80										

Description of works:	Providing and laying , fitting and placing HYSD bar reinforcement in sub-structure complete as per Drawing and Technical Specifications Providing and laying , fitting and placing HYSD bar reinforcement in sub-structure complete as per Drawing and Technical Specifications	Unit : 1 mt.
Spec. cl. No: 2014		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
20.05	Skilled	md	4.00	1200.00	4800.00	Reinforcement	t	1.100	94187.10	103605.81					
	Unskilled	md	9.00	900.00	8100.00	Binding wire	kg	8.000	109.19	873.52					
				Sub total of A =	12900.00				Sub total of B =	104479.33	Sub total of C =				0.00
				Sub total of A +B + C =	117379.33				Contractor's overhead expenses 15% =		17606.90			Unit Rate =	134986.23

Description of works:	Assembling mechanical woven Gabion boxes /mattresses, placing in position including stretching; forming compartments; tying the sides and diaphragms with binding wire in each mesh; tying with bracing wires and tie wires; and tying down the lid complete as per specification (stone filling not included)	Unit : 1 Sqm
Spec. cl. No: 2402		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
Fabrication of box: Activity no : 24.3															
	Skilled	md	2.00	1200.00	2400.00	Gabion box	sqm	160.00	283.58	45372.80					
	Unskilled	md	10.00	900.00	9000.00										

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				Sub total of A =	11400.00				Sub total of B =	45372.80	Sub total of C =			0.00
				Sub total of A +B + C =	56772.80				Contractor's overhead expenses 15% =		8515.92		Unit Rate =	408.05
Filling of stones : Activity no : 24.4														Unit : 1 cum
	Skilled	md	2.00	1200.00	2400.00	Boulder stone	m3	11.00	1665.15	18316.65				
	Unskilled	md	8.00	900.00	7200.00									
				Sub total of A =	9600.00				Sub total of B =	18316.65	Sub total of C =			
				Sub total of A +B + C =	27916.65				Contractor's overhead expenses 15% =		4187.50		Unit Rate =	3210.42

Description of works:	Providing and laying Gabion structure for retaining earth with diaphragm including rolling, cutting weaving , placing, laying sides and diaphragms with binding wire and filling boulders all													Unit : 1 Cum
Spec. cl. No: 2401	complete as per Drawing and Technical Specification (3x1x1)													
Norms No.	Labour (A)					Material (B)					Equipment (C)			
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
Fabrication of box: Activity no : 24.1.A.i														
	Skilled	md	3.00	1200.00	3600.00	Mesh wire	kg	70.20	115.19	8086.34				
	Unskilled	md	7.00	900.00	6300.00	Selvedge Wire	kg	7.82	109.19	853.87				
						Binding Wire	kg	3.62	109.19	395.27				
						Boulder/stone	Cum	6.60	1665.15	10989.99				
				Sub total of A =	9900.00				Sub total of B =	20325.47	Sub total of C =			0.00
				Sub total of A +B + C =	30225.47				Contractor's overhead expenses 15% =		4533.82		Unit Rate =	5793.22

Description of works:	Providing and laying Gabion structure for retaining earth with diaphragm including rolling, cutting weaving , placing, laying sides and diaphragms with binding wire and filling boulders all													Unit : 1 Cum
Spec. cl. No: 2401	complete as per Drawing and Technical Specification (2x1x1)													
Norms No.	Labour (A)					Material (B)					Equipment (C)			
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
Fabrication of box: Activity no : 24.1.A.ii														
	Skilled	md	3.00	1200.00	3600.00	Mesh wire	kg	72.45	115.19	8345.52				
	Unskilled	md	7.00	900.00	6300.00	Selvedge Wire	kg	8.88	109.19	969.61				
						Binding Wire	kg	3.90	109.19	425.84				
						Boulder/stone	Cum	6.60	1665.15	10989.99				

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				Sub total of A =	9900.00				Sub total of B =	20730.96	Sub total of C =				0.00
				Sub total of A +B + C =	30630.96				Contractor's overhead expenses 15% =		4594.64			Unit Rate =	5870.93

Description of works:	Providing and laying Gabion structure for retaining earth with diaphragm including rolling, cutting weaving , placing, laying sides and diaphragms with binding wire and filling boulders all Providing and laying Gabion structure for retaining earth with diaphragm including rolling, cutting weaving , placing, laying sides and diaphragms with binding wire and filling boulders all														
Spec. cl. No: 2401	complete as per Drawing and Technical Specification (1.5x1x1)														Unit : 1 Cum
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
Fabrication of box: Activity no : 24.1.A.iii															
	Skilled	md	3.00	1200.00	3600.00	Mesh wire	kg	79.00	115.19	9100.01					
	Unskilled	md	8.00	900.00	7200.00	Selvedge Wire	kg	10.80	109.19	1179.25					
						Binding Wire	kg	5.00	109.19	545.95					
						Boulder/stone	Cum	6.60	1665.15	10989.99					
				Sub total of A =	10800.00				Sub total of B =	21815.20	Sub total of C =				0.00
				Sub total of A +B + C =	32615.20				Contractor's overhead expenses 15% =		4892.28			Unit Rate =	6251.25

Description of works:	Providing and laying Gabion structure for retaining earth with diaphragm including rolling, cutting weaving , placing, laying sides and diaphragms with binding wire and filling boulders all														
Spec. cl. No: 2401	complete as per Drawing and Technical Specification (1x1x1)														Unit : 1 Cum
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
Fabrication of box: Activity no : 24.1.A.iv															
	Skilled	md	3.00	1200.00	3600.00	Mesh wire	kg	78.96	115.19	9095.40					
	Unskilled	md	8.00	900.00	7200.00	Selvedge Wire	kg	12.06	109.19	1316.83					
						Binding Wire	kg	4.56	109.19	497.91					
						Boulder/stone	Cum	6.60	1665.15	10989.99					
				Sub total of A =	10800.00				Sub total of B =	21900.13	Sub total of C =				0.00
				Sub total of A +B + C =	32700.13				Contractor's overhead expenses 15% =		4905.02			Unit Rate =	6267.53

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s.n.	gabion type	rate	Average rate
1	3*1*1	5793.22	
2	2*1*1	5870.93	6045.7325
3	1.5*1*1	6251.25	
4	1*1*1	6267.53	

Description of works:	Providing and laying of a geotextile filter between pitching and embankment slopes as per Drawing and Technical tions. Specific	Unit : 1 m2
Spec. cl. No: 2404		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
24.50	Unskilled	md	2.000	900.00	1800.00	Geotextile	m2	360.00	126.00	45360.00					
		md	1.000	1200.00	1200.00										
				Sub total of A =	3000.00				Sub total of B =	45360.00	Sub total of C =				0.00
				Sub total of A +B + C =	48360.00				Contractor's overhead expenses 15% =		7254.00			Unit Rate :	185.38

Description of works:	Providing and laying of hand pack Stone soling with 150 to 200 mm thick stones and packing with smaller stone on prepared surface as per Drawing and Technical Specifications.	Unit : 1 m3
Spec. cl. No: 1006		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
10.80	Skilled	md	6.00	1200.00	7200.00	Blockstone	m3	6.00	1665.15	9990.90					
	Unskilled	md	12.00	900.00	10800.00										
				Sub total of A =	7200.00				Sub total of B =	9990.90	Sub total of C =				0.00
				Sub total of A +B + C =	17190.90				Contractor's overhead expenses 15% =		2578.64			Unit Rate :	3953.91

Description of works:	Providing and laying Stone Masonry work in cement mortar 1:4 in structure complete as per Drawing and Technical Specifications	Unit : 1 m3
Spec. cl. No: 2600,2607		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
26.5.a	Skilled	md	7.00	1200.00	8400.00	Cement	t	0.660	17187.10	11343.48	scaffolding	%	5.00	1320	6600.00
	Unskilled	md	20.00	900.00	18000.00	Sand	m3	1.850	2366.35	4377.74					
						Stone	m3	5.750	1665.15	9574.61					
						water	lit	1000.00	0.26	260.00					
				Sub total of A =	26400.00				Sub total of B =	25555.83	Sub total of C =				6600.00

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				Sub total of A +B + C =	58555.83				Contractor's overhead expenses 15% =				8783.37	Unit Rate =	13467.84
Description of works:						Providing and laying Dry Stone Masonry wall all complete as per the specification.									Unit : 1 m3
Spec. cl. No: 2602,2603,2608															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
26.10	Skilled	md	4.00	1200.00	4800.00	Stone	m_3	5.750	1665.15	9574.61					
	Unskilled	md	8.00	900.00	7200.00										
											Quality Control		1.50%	of T.C.	
				Sub total of A =	12000.00				Sub total of B =	9574.61	Sub total of C =				0.00
				Sub total of A +B + C =	21574.61				Contractor's overhead expenses 15% =		3236.19			Unit Rate =	4962.16
Description of works:						Providing and laying 2mm thick Tartfelt Sheet as directed by engineer all complete.									Unit : 1 m2
Spec. cl. No: Norms 2041(1st ammendment 2050)															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Unskilled	md		900.00	0.00	Tarfelt	m2	1.00	120.00	120.00					
				Sub total of A =	0.00				Sub total of B =	120.00				Sub total of C =	0.00
				Sub total of A +B + C =	120.00				Contractor's overhead expenses 15% =		18.00			Unit Rate :	138.00
Description of works:						Slopes Preparation by clearing grass or trimming uneven surface, levelling the surface and disposal to 10m for Bio-engineering works.									Unit : 1 m2
Specification Clause	Resources														
	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
2807	Unskilled	md	0.023	900.00	20.70						Tools	3 % of Labor ost			0.62
				Sub - Total (A)	20.70				Sub - Total (B)	0.00				Sub Total (C)	0.62

Direct Cost (A+B+C)	NRs	21.32
Contractor's Overhead @ 15 % of A+B+C	NRs	3.20
Total =	NRs	24.52

Say per sq.m 25.00

Description of works:						Planting rooted grass slips on the slopes <45o including preparation of slips on site. a max of 5 cm depth with metal rod or Operation includes digging planting hole to hard-wood peg,									Unit : 1 m2
28.08.e						depending on the nature of the soil. The planting drills should be space									
Specification	Resources														

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Clause	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
2807	Unskilled	md	0.200	900.00	180.00	Grass slips Hassan Jute	no. m2	100.00 0.27	1.50 10.00	150.00 2.70	Other T&P	%	3.00		5.40
			Sub - Total (A)		180.00				Sub - Total (B)	152.70				Sub Total (C)	5.40

Direct Cost (A+B+C)	NRs	338.10
Contractor's Overhead @ 15 % of A+B+C	NRs	50.72
Total =	NRs	388.82

Say per m 389.00

Description of works:		
28.9	Planting containerized tree and shrub seedlings, including pitting, transplanting, composting and placing tree guards, on toe of embankment slopes in plain areas, not less than 8 m from the road center line. Pit size 30 cm diameter x depth. Compost volume 1/4 of the volume of the pit, mixed with original soil.	Unit : 10 nos

Specification Clause	Resources														
	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
2807	Unskilled	md	0.25	900.00	225.00	container seedling compost Tree guard Green mulch	no m3 no m3	10.00 0.05 10.00 0.04	2.00 200.00 125.00 100.00	20.00 10.00 1250.00 4.00	Tools	3 % of Labor cost			6.75
			Sub - Total (A)		225.00				Sub - Total (B)	1284.00				Sub Total (C)	6.75

Direct Cost (A+B+C)	NRs	1515.75
Contractor's Overhead @ 15 % of A+B+C	NRs	227.36
Total =	NRs	1743.11

Say per no 174.00

Description of works:		
	Supply, Preparation and planting of live cuttings of selected species (eg assuro, namdi phul, simali) of minimum 1 m length to 0.5 m into soft debris. Pegs spaced at 5 cm centres within rows, with 5-20 cm between rows, and interwoven with vegetation.	Unit : 1 rm

Specification Clause	Resources														
	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
2807	Unskilled	md	0.12	900.00	108.00	Live pegs	no.	20.00	0.50	10.00	Tools	3 % of Labor cost			3.24
			Sub - Total (A)		108.00				Sub - Total (B)	10.00				Sub Total (C)	3.24

Direct Cost (A+B+C)	NRs	121.24
Contractor's Overhead @ 15 % of A+B+C	NRs	18.19
Total =	NRs	139.43

Say per m 139.00

Description of works:		
	Broadcasting grass seeds on slopes <40o ;including cover with long mulch, seedling rate 25 g per sqm.	Unit : 1 m2

Specification	Resources

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Clause	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
2807	Unskilled	md	5.00	900.00	4500.00	seed	Kg	2.50	380.00	950.00					
				Sub - Total (A)	4500.00				Sub - Total (B)	950.00				Sub Total (C)	0.00

Direct Cost (A+B+C)	NRs	5450.00
Contractor's Overhead @ 15 % of A+B+C	NRs	817.50
Total =	NRs	6267.50

Say per sq.m 63.00

Description of works:	Supply and planting of large bamboo for soil stablization all complete.	Unit : 1 nos

Specification Clause	Resources														
	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
2807	Unskilled	md	0.10	900.00	90.00	Bamboo with roots	m	1.00	170.00	170.00	Tools	3% of Labor Cost Site Preparation cost			2.70
				Sub - Total (A)	90.00				Sub - Total (B)	170.00				Sub Total (C)	2.70

Direct Cost (A+B+C)	NRs	262.70
Contractor's Overhead @ 15 % of A+B+C	NRs	39.41
Total =	NRs	302.11

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Description of works:		Providing, laying, spreading, watering, levelling and compaction of natural gravel for capping layer according to the Standard Specification (capping layer with PI<6).													Unit : 1 m^3
Spec. cl. No: 1004															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
10.3	Skilled	md	1.0000	1200.00	1200.00	Subbase agg.	cu.m.	750.00	3952.44	2964330.00	Grader	hr	6.0000	2997.52	17985.12
	Unskilled	md	6.0000	900.00	5400.00	water	lit	72000.0	0.26	18720.00	Vibrator Rolller	hr	6.0000	1843.68	11062.08
				Sub total of A =	6600.00				Sub total of B =	2983050.00	Sub total of C =				29047.20
				Sub total of A +B + C =	3018697.20				Contractor's overhead expenses 15% =		452804.58			Unit Rate =	5785.84
Description of works:		Transportation by dump truck upto safe disposal site													Unit : 1 m3
Spec. cl. No: 905															
Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount

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	Unskilled	md	0.010	900.00	9.00	Diesel	lit	0.0769	156	11.99	Dump Truck	hr	0.01538	2444.80	37.60
				Sub total of A =	9.00				Sub total of B =	11.99				Sub total of C =	37.60
				Sub total of A +B + C =	58.59				Contractor's overhead expenses 15% =		8.79			Unit Rate =	67.38

Description of works:	Providing and erecting a "W" metal beam crashbarrier comprising of 3mm thick corrugated sheetmetal beam rail, 70cm above road/ground level, fixed on ISMC series channel vertical post,		
Spec.cl.No:1509	150x75x5 mm spaced 2m center to center, 1.8m high, 1.1m below ground/road level metal beam rail to be fixed on the vertical post with a spacer of channel section 150x75x5mm, 330mm long complete as per Drawing and Technical Specifications.		Unit : 1 rm
Norms No.	Labour (A)	Material (B)	Equipment (C)

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	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
15.14.a	Skilled	md	1.00	1200.00	1200.00	Hot dip galvanized Corrugated W beam sheet 3 mm thick	kg	563.610	157.54	88791.11	Tractor trolley	hr.	3.00	344.52	1033.56

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Say per m 302.00

Description of works:	Providing and placing concrete with 60% M 15/40 concrete and 40% boulders/stones as per specification Lead 30m, lift 1.5m , using concrete mixer and vibrator.	Unit : 1 m3
Spec.cl.No: 2421		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
24.21.a.1	Skilled	md	3.00	1200.00	3600.00	cement	t	1.500	17187.10	25780.65	Concrete mixer (0.28 / 0.20 m3)	hr.	6.00	344.52	2067.12
	Unskilled	md	30.00	900.00	27000.00	Aggregates 20-40(mm)	m^3	3.450	3952.44	13635.91	Concrete vibrator	hr.	6.00	100	600.00
						Aggregates 10-20 (mm)	m^3	1.560	4879.44	7611.92					
						Aggregates 5-10(mm)	m^3	0.720	4245.21	3056.55					
						sand	m^3	3.000	2366.35	7099.05					
						Boulder/Stone	m3	4.400	1665.15	7326.66					
				Sub total of A =	30600.00				Sub total of B =	64510.74				Sub total of C =	2667.12
				Sub total of A +B + C =	97777.86				Contractor's overhead expenses 15% =		14666.68			Unit Rate =	11244.45

Description of works:	Clearing landslides, debris from causeways, culverts and side drains including haulage for disposal within 1 km	Unit : 1cumecs
Spec. cl. No: 2900,900		

Specification Clause	Resources														
	Labour (A)					Materials (B)					Equipment (C)				
	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount	Category	Unit	Quantity	Rate	Amount
29.19a	Unskilled Skilled	md md	3.00 1.00	1000.00 1200.00	3000.00 1200.00						Dozer/loader/excavator	hr	6.00	3328.40	19970.40
				Sub - Total (A)	4200.00				Sub - Total (B)	0.00				Sub Total (C)	19970.40

Direct Cost (A+B+C)	NRs	24170.40
Contractor's Overhead @ 15 % of A+B+C	NRs	3625.56
Total =	NRs	55.59

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	Unskilled	md	10.00	900.00	9000.00	Hot dip galvanized Channel post 150 x 75 x 5 mm,	kg	695.520	103.19	71770.70	cost of Material for fabrication, nuts, bolts and washers etc.)	%	25		46629.9025
						Hot dip galvanized Spacer Channel 150 x 75 x 5 mm	kg	127.510	103.19	13157.75					
						M 20 grade concrete	m3	0.990	12664.13	12537.48					
						E/W excavation for post	m3	0.990	265.23	262.57					
				Sub total of A =	10200.00				Sub total of B =	186519.61				Sub total of C =	47663.46
				Sub total of A +B + C =	244383.07				Contractor's overhead expenses 15% =		36657.46			Unit Rate =	8217.60

Description of works:	Clearance of landslides in soil and ordinary rock by machine and disposal of the same on the valley side or designated place as instructed by the Engineer.	Unit : 1 m3
Spec. cl. No: 2900, 900		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
29.19	Unskilled	md	3.0000	900.00	2700.00						Dozer/loader/excavator	hour	6.00	3328.40	19970.40
	Skilled	md	1.0000	1200.00	1200.00										
				Sub total of A =	3900.00				Sub total of B =	0.00				Sub total of C =	19970.40
				Sub total of A +B + C =	23870.40				Contractor's overhead expenses 15% =		3580.56			Rate =	54.90

Description of works:	Installation of soil nailing with semi-flexible 3d galvanised steel mat for slope protection and erosion control. Providing 3D galvanised steel panels from the palette, cutting them if necessary, joining the panels to longer	
Reference to SS. No: 2411 (A)	rows by overlapping and binding as necessary and putting on the slope, insertion of distribution bars or steel ropes , fixing with clamps and marking holes for T-nails or static nails (bored nails) - For 40 m2	Unit : 1 m2

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Skilled	md	1.0000	1200.00	1200.00	3D galvanised steel Profile	Kg	138.00	986.07	136,077.66	Tools and plants	%			included in Overhead
	Unskilled	md	2.0000	900.00	1800.00	12 mm distribution bars (in case of T-nails)	Kg	59.80	94.19	5,632.56					
						Clamps	No	16.00	150.00	2,400.00					
						Binding wire loops	No	200.00	6.00	1,200.00					
				Sub total of A =	3,000.00				Sub total of B =	145,310.22				Sub total of C =	0.00
				Sub total of A +B + C =	148,310.22				Contractor's overhead expenses 15% =		22,246.53			Rate =	170,556.75
														Per M2	4,263.92

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Description of works:	Filling the installed 3D galvanised steel profile with gravel size 32-63 mm, manually) - For 120 m2 i) In slopes (>45 degrees slope angle)	Unit : 1 m2
Reference to SS. No: **2411 (A)**		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Skilled	md	2.0000	1200.00	2400.00	Gravel (32-63)	M3	6.00	3025.44	18,152.64	Tools and plants	%			included in Overhead
	Unskilled	md	7.0000	900.00	6300.00										
			Sub total of A =		8,700.00				Sub total of B =	18,152.64				Sub total of C =	0.00
			Sub total of A +B + C =		26,852.64				Contractor's overhead expenses 15% =		4,027.90			Rate =	30,880.54
														Per M2	**257.34**

Description of works:	Spraying of humus on the on the top of gravel (on the top surface of 3D profile) manually - For 120 m2 i) In slopes (>45 degrees slope angle)	Unit : 1 m2
Reference to SS. No: **2411 (A)**		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Skilled	md	1.0000	1200.00	1200.00	Humus material	M3	7.20	342.90	2,468.88	Humus Spraying Machine	hr	6.00	2785.44	16712.64
	Unskilled	md	1.0000	900.00	900.00										

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					Sub total of A =	2,100.00				Sub total of B =	2,468.88		Sub total of C =	16712.64
					Sub total of A +B + C =	21,281.52				Contractor's overhead expenses 15% =	3,192.23		Rate =	24,473.75
													Per M2	203.95

Description of works:	Providing and driving the equal angle T-section galvanized steel nails with curved head (16 mm dia steel hook) and tapered at tail size T-25 x 25 x 3 mm (equivalent to Indian Steel ISA 2525) by using handheld or pneumatic hammer (nail length between 0.6 m -3.5 m), driving the nails to fix the semi-flexible 3-D galvanized steel panel on the slopes or embankments, max spacing of nails is 1.5 m. for 100 m	Unit : 1 m
Reference to SS. No: 2411 (A)		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Skilled	md	4.0000	1200.00	4800.00	Galvanised t-steel profile 25*25*3 mm	Kg	129.00	104.19	13,440.51	Supporting equipments	20 % of labor cost			1680
	Unskilled	md	4.0000	900.00	3600.00						Pneumatic air compressor	hr	12.00	1199.88	14398.56
					Sub total of A =	8,400.00				Sub total of B =	13,440.51		Sub total of C =	16078.56
					Sub total of A +B + C =	37,919.07				Contractor's overhead expenses 15% =	5,687.86		Rate =	43,606.93
													Per M	436.07

Description of works:	Carryout Routine (regular maintenance) of Black top/ Gravel road in Hilly area as per Technical Specifications and direction of the Engineer for km-day	Unit : 1 km-month
Reference to SS. No: 2902		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
	Skilled	md	0.0500	1200.00	60.00	Fuel		5 % of labor cost		17.85	Tools and plants	9 % of labor cost			32.13
	Unskilled	md	0.3300	900.00	297.00	Training ARMP		1.7 % of labor cost		6.06	Maintenance of Tools	3% of labor cost			10.71
						Insurance		1% of labor cost		3.57					
						First Aid		3 % of labor cost		10.71					
					Sub total of A =	357.00				Sub total of B =	34.62		Sub total of C =		42.84
					Sub total of A +B + C =	434.46				Contractor's overhead expenses 15% =	65.17		Rate =		499.63
													Per kmmonth		14,988.90

Description of works:	Providing and mixing of Bitumen cutter as per design / direction of Engineer	Unit : 1 ltr
Spec. cl. No: 1300		

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Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.17	Skilled	md	0.0100	1200.00	12.00	Kerosene or Diesel	lit	210.0000	156.00	32760.00	Tools and plants 3% of				27.36
	Unskilled	md	1.0000	900.00	900.00						labour costs				
				Sub total of A =	912.00				Sub total of B =	32760.00	Sub total of C =				27.36
				Sub total of A +B + C =	33699.36				Contractor's overhead expenses 15% =		5054.90			Unit Rate =	193.77

Description of works:	Providing and mixing of Anti stripping agent as per Design/ direction of Engineer	Unit : 1 kg
Spec. cl. No: 1300		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.16	Skilled	md	0.0100	1200.00	12.00	Additive material	lit	210.0000	351.55	73825.50	Tools and plants 3% of				27.36
	Unskilled	md	1.0000	900.00	900.00						labour costs				
				Sub total of A =	912.00				Sub total of B =	73825.50	Sub total of C =				27.36
				Sub total of A +B + C =	74764.86				Contractor's overhead expenses 15% =		11214.73			Unit Rate =	429.90

Description of works:	Anti- Stripping agent Providing and mixing of Anti stripping agent as per Design/ direction of Engineer	Unit : 200kg
Spec. cl. No: 1300		

Norms No.	Labour (A)					Material (B)					Equipment (C)				
	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount	Type	Unit	Qty.	Rate	Amount
13.16	Skilled	md	0.01	Rate	1200.00	Additive materials	KG	210.00	351.55	73825.50	3% of labour cost				63
	Unskilled	md	1.00	1200.00	900.00										
				Sub total of A =	2100.00				Sub total of B =	73825.50	Sub total of C =				63.00
				Sub total of A +B + C =	75988.50					0	11398.28			Rate (200 Kg) =	87386.78
														Unit Rate (1 kg) =	436.93

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1) District rate : Materials

S.N.	Description	Unit	District Rate (D)	Collection Rate (C)	Royalty (R)	Transportation Rate (Tp)	Total Rate (C + R + Tp)	Remarks
1	Gravel							
1.a	(6 - 10 mm)	m3	3443.89	1854.00	70.65	1100.79	3025.44	Bhaktapur
1.b	(10 - 20 mm)	m3	3705.92	2781.00	70.65	1100.79	3952.44	Bhaktapur
1.c	(20 - 40 mm)	m3	6771.94	3708.00	70.65	1100.79	4879.44	Bhaktapur
1.d	(0 - 6 mm)	m3	3144.42	5562.00	70.65	1100.79	4245.21	Bhaktapur
2	Broken Aggregates							
2.a	(70 - 100 mm)	m3	1350.00	1390.50	70.65	1100.79	2450.79	Bhaktapur
2.b	(40 - 70 mm)	m3	1350.00	1854.00	70.65	1100.79	2450.79	Bhaktapur
2.c	(20 - 40 mm)	m3	3602.00	2781.00	70.65	1100.79	3952.44	Bhaktapur
2.d	(10 - 20 mm)	m3	3567.00	3708.00	70.65	562.93	4129.93	Bhaktapur
2.e	(5 - 10 mm)	m3	3426.00	5562.00	70.65	562.93	3988.93	Bhaktapur
2.f	For Base 40 mm Down	m3	3178.00		70.65	1100.79	4278.79	Bhaktapur
3	Sand	m3	3130.00	1390.50	70.65	905.20	2366.35	Bhaktapur
5	Wood							
5.a	wood Local	m3	70640.00			841.30	71481.30	Bhaktapur
5.b	Sal wood	m3	207650.00			841.30	208491.30	Bhaktapur
6	Stone dust	m3	1535.00			1100.79	2635.79	Bhaktapur
7	Rubble	m3	2546.19	1297.80		367.35	1665.15	Bhaktapur
8	Cement	mt.	14000.00			3187.10	17187.10	Bhaktapur
9	Water	Ltr		0.26		0.00	0.26	
10	Bitumen 80/100	Ltr	90.00			1.14	91.14	Bhaktapur
11	Reinforcement (Tor Steel)							
11.a	8 mm dia	mt.	94000.00			3187.10	97187.10	Bhaktapur
11.b	10 - 22 mm dia	mt.	91000.00			3187.10	94187.10	Bhaktapur
11.c	25 - 32 mm dia	mt.	91000.00			3187.10	94187.10	Bhaktapur
11.d	4.75 - 7 mm dia	mt.	101000.00			3187.10	104187.10	Bhaktapur

12	Binding Wire	Kg	106.00			3.19	109.19	Bhaktapur
13	G.I Wire heavy coated	m2						
13.a	8 gauge	Kg	112.00			3.19	115.19	Bhaktapur
13.b	10 gauge	Kg	112.00			3.19	115.19	Bhaktapur
13.c	12 gauge	Kg	114.00			3.19	117.19	Bhaktapur
14	RCC Hume Pipes							
14.a	300mm diameter	m	3140.00			1480.33	4620.33	Bhaktapur
14.b	450mm diameter	m	4500.00			1480.33	5980.33	Bhaktapur
14.c	600 mm diameter	m	6200.00			1480.33	7680.33	Bhaktapur
14.d	750 mm diameter	m	8600.00			1480.33	10080.33	Bhaktapur
14.e	900 mm diameter	m	12172.00			2568.37	14740.37	Bhaktapur
14.f	1200 mm diameter	m	16000.00			2568.37	18568.37	Bhaktapur
15	Jute	Kg	330.00			8.61	338.61	Bhaktapur
16	Nails	Kg	130.00			8.61	138.61	Bhaktapur
17	Ply wood							
17.a	plywood 3 mm	m2	387.50			3.37	390.87	Bhaktapur
17.c	plywood 6 mm	m2	570.50			6.75	577.25	Bhaktapur
17.f	plywood 12 mm	m2	861.00			13.50	874.50	Bhaktapur
18	Road Paint	Ltr	599.00			8.61	607.61	Bhaktapur

S.N.	Description	Unit	District Rate (D)	Collection Rate (C)	Royalty (R)	Transportation Rate (Tp)	Total Rate (C + R + Tp)	Remarks
	Glass Beads	kg	165.00				165.00	
19	Enamel Paint	Ltr	542.00			8.61	550.61	Bhaktapur
20	Lime	Kg	37.10			8.61	45.71	Bhaktapur
21	Gum/Fevicol	Kg	210.00			8.61	218.61	Bhaktapur
22	Snow cem	Kg	74.00			8.61	82.61	Bhaktapur

23	Primer	Ltr	389.00			8.61	397.61	Bhaktapur
24	Steel Plate(2 mm)	m^2	2245.10				2245.10	1 sq=15.7 kg, rate =94 per kg
25	Steel tube(50 mm dia GI)	Rm	560.52			8.61	569.13	
26	GI Pipe Medium Class							
26.a	40mm	m	514.00			8.61	522.61	1m= 5 to 8 kg
26.b	50 mm	m	705.00			9.33	714.33	Bhaktapur
26.c	80 mm	m	1122.00			10.05	1132.05	Bhaktapur
26.d	100 mm	m	1650.00			10.77	1660.77	Bhaktapur

S.N.	Description	Unit	District Rate (D)	Collection Rate (C)	Royalty (R)	Transportation Rate (Tp)	Total Rate (C + R + Tp)	Remarks
27.a	HDPE 110mm (4 kg/cm2, 1.703 kg/m)	m	556.00			8.61	564.61	Bhaktapur
27.b	HDPE 200mm	m	1668.00			8.61	1676.61	Bhaktapur
28	Bearing pad		50993.28				50993.28	Bhaktapur
29	Geotextile	m^2	126.00				126.00	Bhaktapur
30	Expansion joint		20000.00				20000.00	Bhaktapur
31	Round Aggregates							
	70 to 100 mm	m^3	1350.00	850.00	70.56	562.93	1483.49	
	40 to 70mm	m^3	1350.00	850.00	70.56	562.93	1483.49	
	20 to 40 mm	m^3	3602.00	850.00	70.56	562.93	1483.49	
	10 to 20 mm	m^3	3567.00	850.00	70.56	562.93	1483.49	
	10 mm and down	m^3	3426.00	850.00	70.56	562.93	1483.49	
32	Steel Structure	mt.				1124.61	1124.61	
33	Earth	m^3		60.08		342.90	402.98	
34	Tarfelt	m^2	170.00				170.00	Bhaktapur
35	Bond stone	m^3	2184.00	1545.00			1545.00	
36	machine made gabions	Sqm	275.00			8.58	283.58	Bhaktapur
	3x1x1	Box	4016.00			50.99		Bhaktapur
	2x1x1	Box	2761.00			35.06		Bhaktapur
	1.5x1x1	Box	2008.00			28.68		Bhaktapur
37	Antistripping agent Additives	Kg	350.00			1.55	351.55	Bhaktapur
38	Gelatine	Kg	330.00			1.55	331.55	Bhaktapur

2) District Rate : Labour

S.N.	Description	Unit	District Rate	Remarks

1	Skilled	md	1200.00	
2	Semiskilled	md	1000.00	
3	Unskilled (Labour)	md	900.00	
4	Blaster	md	815.00	
5	Light driver	md	815.00	
6	Heavy driver	md	950.00	
7	Supervisor	md	815.00	
8	Road Length Worker	md	815.00	

3) District Rate : Fuel and Lubricant

S.N.	Description	Unit	District Rate	Lead	Total
1	Diesel	Ltr	156.00		156.00
2	Kerosene	Ltr	156.00		156.00
3	Petrol	Ltr	166.00		166.00

4) DOR's Equipment Hire Rate

S.N.	Description	Unit	Operator's Allowance	DOR Hire rate	Fuel	Maintenance	Total rate
1	Excavator (upto 150 HP)	Hr					3328.40
2	Loader Wheel (upto	Hr					2455.24
3	Truck (3 tonnes)	Hr					2444.80
4	Truck (5 tonnes)	Hr					2444.80
5	Truck (8 tonnes)	Hr					2444.80
6	Grader (75 HP)	Hr					2997.52
7	Pump 10cm dia	Hr					0.00
8	Vibrating Roller (8 - 10	Hr					1843.68
9	3 Wheel roller	Hr					1090.40
10	Water bowser	Hr					1113.92
11	Boiler	Hr					1136.76

12	Sprayer Emulsion	Hr					2785.44
13	Air compressor	Hr					1199.88
14	Hand Sprayer	Hr					-
15	Aggregate Spreader	Hr					1429.36
16	Pneumatic Tyred Roller	Hr					2191.64
17	mixer	Hr					344.52
18	Vibrating needle	Hr					100.00
19	Blasting machine	Hr					-
20	Generator	Hr					834.24
21	Bitumen Distributor	Hr					2785.44
22	Chip Spreader	Hr					1429.36
23	Tractor	Hr					869.00
24	Asphalt plant	Hr					33455.96
25	Asphalt mixer	Hr					33455.96
26	Asphalt paver	Hr					2312.64
27	Compressor & Rock Drill	Hr					426.80
28	Dozer	Hr					4407.84
29	Tractor with ripper	Hr					869.00
30	Mechanical Broom	Hr					1419.40
31	Batch mix HEMP	Hr					33455.96

32	Road Marking Machine	Hr					323.80
33	Crane	hr					2921.28
34	Stone Crusher	hr					1866.00

Tribhuvan University
Instiute of Engineering
Thapathali Campus
Thapathali, Kathmandu

Transportation Analysis of Construction Materials :

Material Type	Unit	Mountainous Region			Terai region			Total Travel Time (T)	Labour Loading		Labour unLoading		Load time			unload time		Total Transportation Cost per unit	Remarks
		Earthen	Gravel	Blacktop	Earthen	Gravel	Blacktop		Unskilled	Skilled	Unskilled	Skilled	Truck /tipper	Crane	Loader hr	Truck/tipper	Crane		
1) Excavated earth work																			
a) Soil Material	m3	0.50	0.00	0.00				0.02					0.06		0.06	0.00	0.00	342.90	
b) Rock Material	m3	0.50	10.00	0.00				0.23					0.06		0.06	0.00	0.00	856.31	
2) Sand	m3	1.00	10.00	0.00				0.25					0.06		0.06	0.00	0.00	905.20	
3) Gravel, river shingle, broken stone aggregates, and bats.								0.00					0.06		0.06	0.00	0.00	294.00	
a) Gravel	m3	1.00	10.00	5.00				0.33					0.06		0.06	0.00	0.00	1100.79	
Aggregate for concrete								0.00					0.06		0.06	0.00	0.00	294.00	
b) River shingle	m3	1.00	10.00	0.00				0.25					0.06		0.06	0.00	0.00	905.20	
c) Broken stone aggregates	m3	1.00	0.00	5.00				0.11					0.06		0.06	0.00	0.00	562.93	
d) Brick bats	m3	1.00	0.00	5.00				0.11					0.06		0.06	0.00	0.00	562.93	
4) Boulder, Cobbles, quarry stone	m3	1.00	0.00	0.00				0.03					0.06		0.06	0.00	0.00	367.35	
5) Dressed Stone	m3	1.00	0.00	5.00				0.11					0.06		0.06	0.00	0.00	562.93	
6) Bricks	1000 nos	2.00	10.00	300.00				5.19	0.19				0.38					13788.54	
7) Cement	t	2.00	10.00	97.00				1.03	0.20	0.00			0.20		0.00			3187.10	
8) Reinforcement Steel and gabion wire	t	2.00	10.00	97.00				1.03	0.20	0.00			0.20		0.00			3187.10	
9) Bitumen	1000 lit	2.00	10.00	97.00				0.26	0.15	0.00			0.15		0.00			1137.37	
10) GI, CI, Pipe and fittings	t	2.00	10.00	7.00				0.40										977.92	
11) Timber for temporary works	m3	2.00	5.00	0.00				0.03	0.27	0.03			0.20		0.00			841.30	

15) Equiptment & accessoriesetc. requiring careful handling	truck	2.00	10.00	97.00				0.34										831.23	
16) RCC hume pipe				97.00				0.29										708.99	
a) 900/1200/1000 mm dia	m	2.00	10.00	97.00				0.69	0.13	0.03	0.07	0.01	0.07	0.07	0.00	0.03	0.07	2568.37	
b) 600 mm dia	m	2.00	10.00	97.00				0.41	0.08	0.02	0.04	0.02	0.04	0.04	0.00	0.02	0.02	1480.33	
c) 450mm dia	m	2.00	10.00	97.00				0.27	0.05	0.01	0.03	0.00	0.03	0.03	0.00	0.01	0.01	958.74	
c) 300mm dia	m	2.00	10.00	97.00				0.27	0.05	0.01	0.03	0.00	0.03	0.03	1.00	0.01	0.01	3413.98	
																		0.00	
17) Water	1000 lit	0.30																0.00	

Fuel =Total Travel Time (T)*Fuel Coefficient

Truck, Hr.=Truck Coefficient *(Total Travel Time (T)+Load / Unload Time)

Total Transportation Cost per unit = Labour, md. * Labour Rate + Fuel, Ltr.* Fuel Rate + Truck, Hr.* Truck Rate

Prepared By

Checked By

Recommended By

Approved By

Government of Nepal

Ministry of Physical Infrastructure and Transportation

Department of Roads

Thapathali Campus

Chart for collection of materials

S.N.	Description	Unit	Activity no	Labour				Amount	Remarks
				Type	Unit	Qty.	Rate		
1	Collection and seiving gravel including stacking within 10m. Hauling distance.		8.1						
a	(5 - 70 mm size)	m^3		Unskilled	md	2	900	1854.00	
b	(5 - 40 mm size)	m^3		Unskilled	md	3	900	2781.00	
c	(5 - 20 mm size)	m^3		Unskilled	md	4	900	3708.00	
d	(5 - 08 mm size)	m^3		Unskilled	md	6	900	5562.00	
	(40 - 70 mm size)	m3		Unskilled	md	4	900	3708.00	
	(70 - 100 mm size)	m3		Unskilled	md	3	900	2781.00	
2	Collection of rubble of required size, hauling distance10m. and stacking.	m^3	8.2	Unskilled	md	1.4	900	1297.80	
3	Collection and seiving sand within 10m. hauling distance.		8.3						
a	(Quarry output less than 33%)	m^3		Unskilled	md	4	900	3708.00	
b	(Quarry output 33 - 66 %)	m^3		Unskilled	md	3	900	2781.00	
c	(Quarry output more than 66%)	m^3		Unskilled	md	1.5	900	1390.50	
4	Collection, quarring and seiving sand in local river.	m^3	8.3.D	Unskilled	md	1.5	900	1390.50	

5	Washing broken stone, gravel and sand.	m3	8.4.A	Unskilled	md	0.5	900	463.50	
6	Washing rubble	m3	8.4.B	Unskilled	md	0.2	900	185.40	
7	Breaking stones including Collection, seiving and stacking within 10m.		8.5						
a	(70 - 100 mm size)	m3		Unskilled	md	1.5	900	1390.50	
b	(40 - 70 mm size)	m3		Unskilled	md	2	900	1854.00	
c	(20 - 40 mm size)	m3		Unskilled	md	3	900	2781.00	
d	(10 - 20 mm size)	m3		Unskilled	md	4	900	3708.00	
e	(5 - 10 mm size)	m3		Unskilled	md	6	900	5562.00	
8	Making rubbles of required size including breaking with distance 10m. and stacking.	m3	8.02.03	Unskilled	md	2.5	900	2317.50	
9	Transportation of water by manpower including loading, hauling, unloading and stacking.	1000 lit	8.03.17	Unskilled	md	0.47	900	435.69	

4) DOR's Equipment Hire Rate

Fuel/Electricity Rate		
Fuel (L/hr)	Electricity (Units/hr)	Fuel C (Heatir (L/hr
156.0	10	

Skilled	1200
Unskilled	900
diesel	156

SN	Equipments	Activity/ Usages	Ownership Cost (NRs/Hr)	Servicing (NRs/Hr)	Maintenance (NRs/Hr)	Fuel/Electricity Demand			Fuel/Electricity (NRs/Hr)	Crew, per day	Assistant,per day	Crew, per hr	Assistant,per hr	Crew, hr	Assistant,hr	Crew & Assistant (NRs/Hr)	Total Hire rate (NRs/Hr)
						Fuel (L/hr)	Electricity (Units/hr)	Fuel Oil (Heating) (L/hr)		Skilled	Helper/Unskille d	Skilled	Helper/Unskille d	Skilled	Helper/Unskille d		
1	Air compressor /compressor with pneumatic breaker	General	192	42	50	5.73			893.88	1,200.00	900.00	173.08	129.81	0.125		22	1,199.88
2	Asphalt Plant (Batch mix HMP/Drum mix plant/Hot Mix Plant)	Asphalt/DBM Production	693	108	173	6.91	15.00	200.00	32,427.96	1,200.00	900.00	173.08	129.81	0.125	0.250	54	33,455.96
3	Batching Plant	Concrete Production	352	44	88	6.14	25.00		1,207.84	1,200.00	900.00	173.08	129.81	0.125	0.250	54	1,745.84
4	Bentonite pump	Drilled Hole Stabilization	26	3	8		2.00		20.00			0.00	0.00			0	57.00
5	Bitumen boiler	Bitumen Heating	40	3	8	1.96		5.00	1,085.76			0.00	0.00			0	1,136.76
6	Bitumen pressure distributor/Bitumen Distributor/ Bitumen Sprayer	Bitumen Spray	443	63	176	10.24		3.00	2,065.44	1,200.00	900.00	173.08	129.81	0.125	0.125	38	2,785.44
7	Chip spreader	Surface Dressing/Chips Seal/Otta	196	30	64	7.06			1,101.36	1,200.00	900.00	173.08	129.81	0.125	0.125	38	1,429.36
8	Cold mix plant	Cold Mix Asphalt/Premix	375	50	75	3.89	20.00		806.84	1,200.00	900.00	173.08	129.81	0.125		22	1,328.84
9	Concrete Pump	Concreting	80	5	10	3.06			477.36	1,200.00	900.00	173.08	129.81	0.125	0.125	38	610.36
10	Crane	Lifting	820	145	338	10.13			1,580.28	1,200.00	900.00	173.08	129.81	0.125	0.125	38	2,921.28
11	Crane (3 T)	Lifting	599	106	170	6.75			1,053.00	1,200.00	900.00	173.08	129.81	0.125	0.125	38	1,966.00
12	Crane 15 t capacity	Lifting	1,147	163	431	14.63			2,282.28	1,200.00	900.00	173.08	129.81	0.125	0.125	38	4,061.28
13	Crane with grab bucket/dredger crane	Dredging	1,000	120	200	8.96			1,397.76	1,200.00	900.00	173.08	129.81	0.125	0.125	38	2,755.76
14	Dozer	Earthwork	1,300	330	550	14.14			2,205.84	1,200.00		173.08	0.00	0.125		22	4,407.84
15	Drilling machine with bit and accessories	Earth Hole Drilling	126	24	36	1.30			202.80	1,200.00	900.00	173.08	129.81	0.125	0.125	38	426.80
16	Electric generator	Electricity	77	10	17	4.54			708.24	1,200.00		173.08	0.00	0.125		22	834.24
17	Electric hand driller (HDEP work)	Hole Drilling	105	0	10		1.00		10.00			0.00	0.00			0	125.00
18	Electric heating plate	Connection work	63	6	12		1.00		10.00			0.00	0.00			0	91.00
19	Emulsion pressure distributor	Emulsion distribution	46	4	8	1.15			179.40	1,200.00		173.08	0.00	0.125		22	259.40
20	Excavator	Excavation/Earthwork	620	165	275	14.40			2,246.40	1,200.00		173.08	0.00	0.125		22	3,328.40
21	Grout Injection Equipment	Crack Repair	68	12	24		1.00		10.00	1,200.00		173.08	0.00	0.125		22	136.00
22	Grouting pump with agitator	PSC Bridge construction related	147	28	56		2.00		20.00	1,200.00		173.08	0.00	0.125		22	273.00
23	Hacking Machine	Jacketing prupose	42	8	16	1.30			202.80	1,200.00		173.08	0.00	0.125		22	290.80
24	Hydraulic Jack (40 tonne capacity)	Bearing Installation/Repair	105	20	40	0.00			0.00			0.00	0.00			0	165.00

25	Hydraulic Jack (required capacity normally 200 tonne)	Bearing Installation/Repair	256	33	56		5.00		50.00			0.00	0.00			0	395.00
26	Jack hammer /Rock drill / Portable rock driller	Earthwork	22	3	5	1.62			252.72			0.00	0.00			0	282.72
27	Loader	Material Loading	543	136	227	9.79			1,527.24	1,200.00		173.08	0.00	0.125		22	2,455.24
28	Mastic cooker	Mastic Asphalt Production	69	5	16		1.00	2.88	459.28	1,200.00	900.00	173.08	129.81	0.125	0.125	38	587.28
29	Mixture machine/Concrete Mixture	Concrete Production	31	3	11	1.92			299.52	1,200.00		173.08	0.00			0	344.52
30	Mobile slurry seal equipment	Maintenance	211	32	86	6.07			946.92	1,200.00	900.00	173.08	129.81	0.125	0.125	38	1,313.92
31	Motor grader	Laying	1,016	256	351	8.67			1,352.52	1,200.00		173.08	0.00	0.125		22	2,997.52
32	Paver finisher	Asphalt	775	119	298	6.94			1,082.64	1,200.00	900.00	173.08	129.81	0.125	0.125	38	2,312.64
33	Piling rig (with all accessories)	Pile Construction upto 1.2m	1,600	267	267	7.84			1,223.04	1,200.00	900.00	173.08	129.81	0.125	0.125	38	3,395.04
34	Plate compactor/power rammer	Light Compaction	54	9	19	1.46			227.76	1,200.00		173.08	0.00	0.125		22	331.76
35	Pneumatic roller/Pneumatic tired roller	Compaction	539	57	296	8.19			1,277.64	1,200.00		173.08	0.00	0.125		22	2,191.64
36	Premix Mixer	Premix Production	115	25	25	4.25		20.00	3,783.00	1,200.00	900.00	173.08	129.81	0.125	0.125	38	3,986.00
37	Road marking machine	Thermoplastic Painting	92	8	21	1.30			202.80			0.00	0.00			0	323.80
38	Road sweeper/Mechanical broom	Sweeping	297	34	68	6.40			998.40	1,200.00		173.08	0.00	0.125		22	1,419.40
39	Screw Jack	Pipe Connection	53	0	0		0.00		0.00			0.00	0.00			0	53.00
40	Smooth wheeled roller/Smooth 3 wheeled steel roller	Compaction	173	13	40	5.40			842.40	1,200.00		173.08	0.00	0.125		22	1,090.40
41	Stressing jack with pump	Prestressing	104	8	20		1.00		10.00			0.00	0.00			0	142.00
42	Tipper	Transportation/Carry	148	23	55	6.76			1,054.56	1,200.00	900.00	173.08	129.81	0.125	0.125	38	1,318.56
43	Tractor with ripper attachment/Tractor	Ripping/Carry	83	13	33	4.50			702.00	1,200.00	900.00	173.08	129.81	0.125	0.125	38	869.00
44	Truck flat body/Trailer	Carry	532	37	153	10.80			1,684.80	1,200.00	900.00	173.08	129.81	0.125	0.125	38	2,444.80
45	Vibratory roller	Compaction	461	66	159	7.28			1,135.68	1,200.00		173.08	0.00	0.125		22	1,843.68
46	Water Tanker	Watering	270	38	110	4.32			673.92	1,200.00		173.08	0.00	0.125		22	1,113.92
47	Wet mix plant	Base Production	433	67	100		30.00		300.00	1,200.00	900.00	173.08	129.81	0.125	0.125	38	938.00
48	Cutter(Bitumen Pavement/RCC Cutter)	Cutting	168	8	12	1.22			190.32			0.00	0.00			0	378.32

Sr.N.	Description of machine	Unit	Capacity/ Output	Output	Activity/Usages	Rate (Rs/hr)	Ownership Charge (Rs/hr)	Operation Charge (Rs/hr)				Fuel (L/hr)	Electricity (Unit/hr)	Fuel Oil (Heating) (	Remarks
								Fuel/ Electricity	Operetors (	Servicing (FOG)	Maintenance				
P&M-029	Integrated Stone Crusher	hr.	ton/hr	100		1886.00	977	=	Crew) 240	85	327	3.06			

District Rate Assistant/hr =30x Daily Rate/(8*26)

Fuel Cost = Fuel Demand x Fuel Cost per liter at site / 1.13

Electricity Cost = Electricity Demand x Electricity Unit Cost

Crew/Assistant Cost = (Crew,hr x District Rate of Crew/hr) + (Assistant, hr x District Rate of Assistant/hr

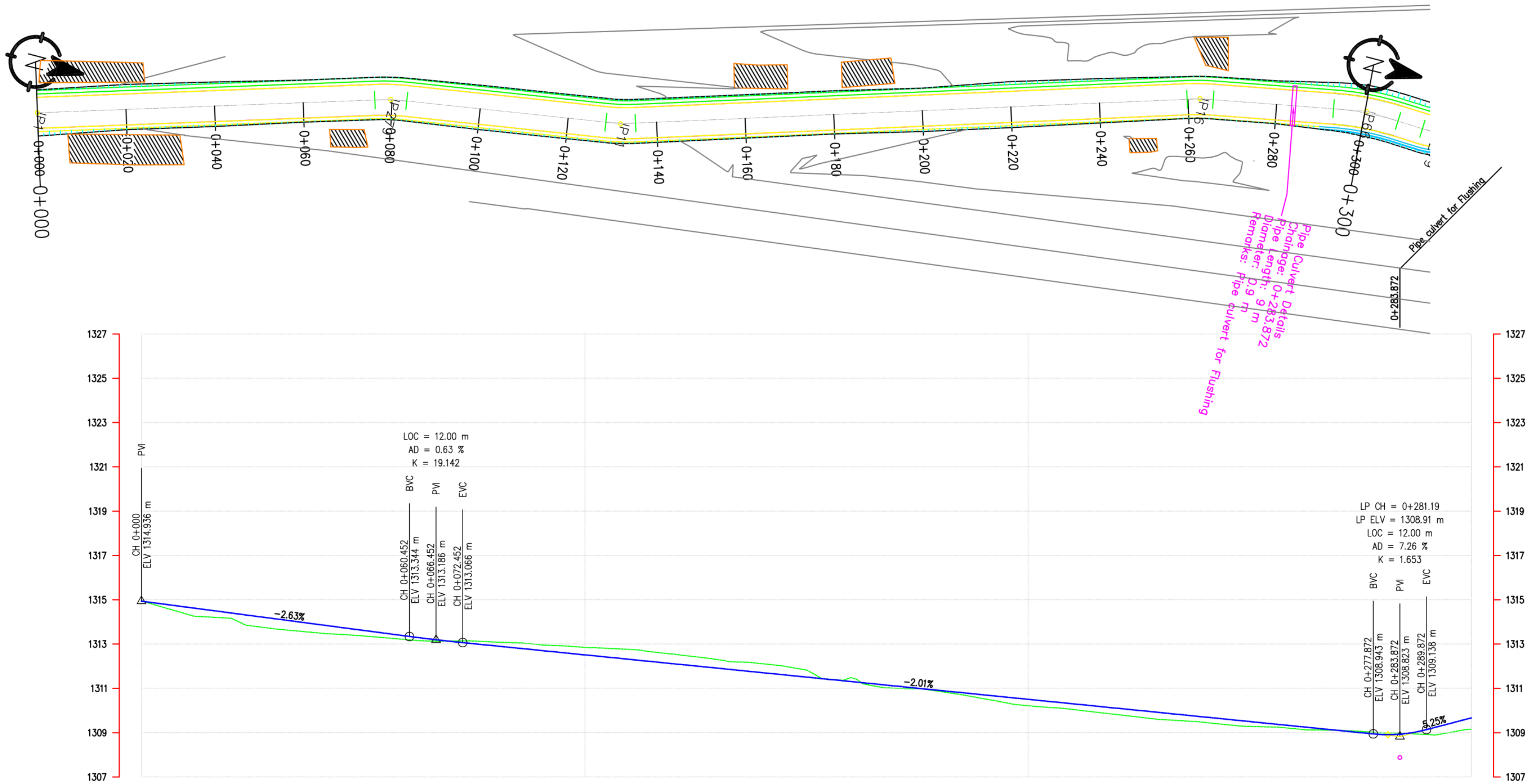
Rate of Plant & Machinery = Ownership Cost + Operational Cost (Servicing Cost + Maintenance Cost + Crew/Assistant Cost + Fuel/Electricity Cost)

Tribhuvan University
Instiute of Engineering
Thapathali Campus
Thapathali, Kathmandu

Estimated cost =	205,285,330.72	
Location =	Bhaktapur	
Geographical Coefficient=	1	
Work intensity Coefficient =	1.03	
Work Complexity coefficient =	1.05	
Basic Duration =	491.19	
=	492	Days
Actual Duration =	532.10	days
	2.22	yrs

Geography	Coefficient
plain kathmandu	1
Hill	1.05
mountain	1.15
Work extent	Coefficient
<1km, bridges	1
1-25km	1.01 - 1.05
26-50km	1.06- 1.10
>50km	1.11 - 1.15
Work Complexity	Coefficient
Easy work (involving only upto 3 types of major construction materials for production	1
Complex Works (involving more than 3 types of major construction materials for production using simple equipments	1.05
Very complex (special equipments, new technology being introduced	1.1

ANNEX II: PLAN, PROFILE AND CROSS SECTIONS



DESIGN LEVEL(m)	1314.936	1314.409	1313.883	1313.356	1312.914	1312.513	1312.111	1311.710	1311.309	1310.907	1310.506	1310.105	1309.703	1309.302	1308.914	1309.670
EXISTING LEVEL(m)	1315.011	1314.166	1313.503	1313.197	1313.089	1312.850	1312.548	1312.114	1311.482	1310.863	1310.218	1309.819	1309.459	1309.180	1308.987	1309.156
CHAINAGE(Km)	0+000	0+020	0+040	0+060	0+080	0+100	0+120	0+140	0+160	0+180	0+200	0+220	0+240	0+260	0+280	0+300
HORIZONTAL ALIGNMENT (RIGHT / LEFT)	IP-1 R=0.00				IP-IP279 R=50.00			IP-11 R=45.00						IP-16 R=50.00		IP-IP66 R=65.00
CUT/FILL (m)	-0.075	0.243	0.380	0.159	-0.175	-0.337	-0.436	-0.404	-0.173	0.045	0.288	0.286	0.244	0.123	-0.073	0.514

CHAINAGE : 0+000 – 0+300

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS
THAPATHALI, KATHMANDU
DEPARTMENT OF CIVIL ENGINEERING

GROUP MEMBERS

ABINA TAMANG	THA076BCE004
BIPIN DHEDI	THA076BCE027
BIGYAN KARKI	THA076BCE028
SAMUNDRA SAPKOTA	THA076BCE097
DIWAKAR TIMILSINA	THA076BCE041
JEEVAN BHATTARAI	THA076BCE047

DATE REVISION SIGNATURE

KALOPATI TO MANDEV MARG ROADSECTION

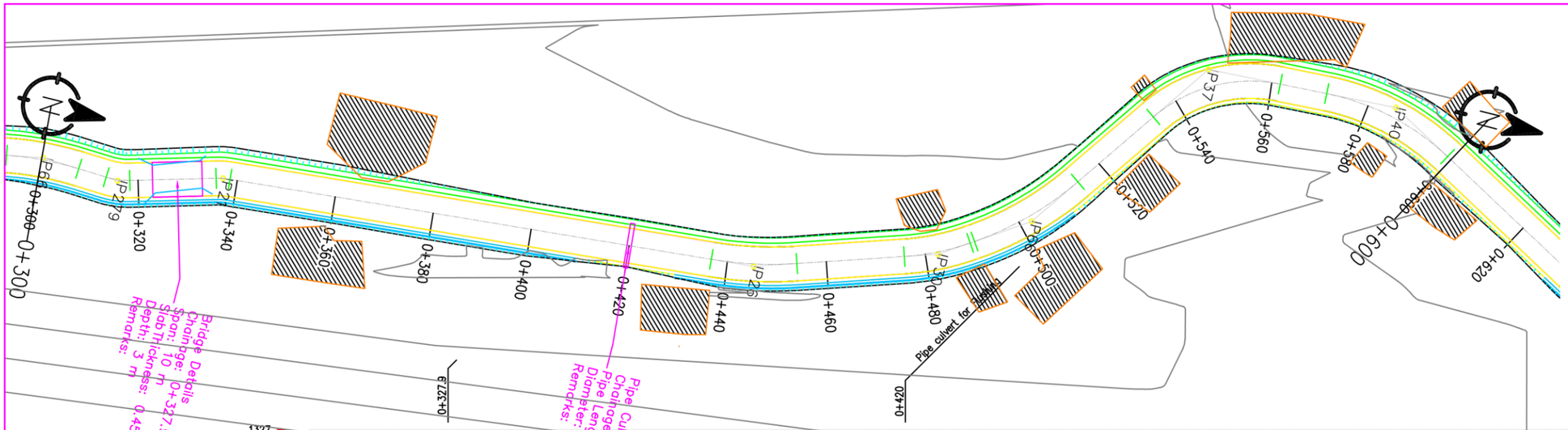
DESIGNED BY :
DRAWN BY :
CHECKED BY :
APPROVED BY :

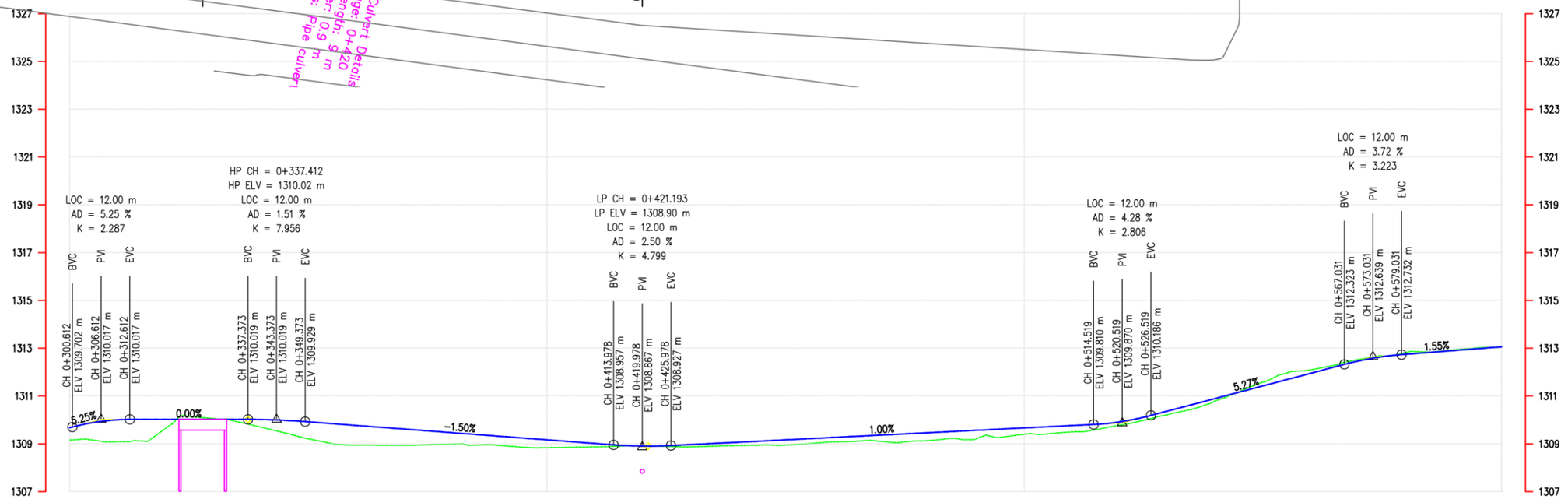
SCALE
HORIZONTAL 1:1000
VERTICAL 1:1000

Plan & Profile

0+000-0+300

DATE:
DRG NO : 1
SHEET NO : 1





DESIGN LEVEL(m)	1309.670	1310.018	1310.014	1309.769	1309.468	1309.168	1308.905	1309.067	1309.266	1309.466	1309.665	1309.918	1310.897	1311.952	1312.747	1313.057
EXISTING LEVEL(m)	1309.156	1309.628	1309.701	1308.945	1308.990	1308.838	1308.909	1308.928	1309.079	1309.138	1309.403	1309.781	1310.795	1312.098	1312.820	1313.065
CHAINAGE(Km)	0+300	0+320	0+340	0+360	0+380	0+400	0+420	0+440	0+460	0+480	0+500	0+520	0+540	0+560	0+580	0+600
HORIZONTAL ALIGNMENT RIGHT	IP-IP66 R=65.00		IP-21 R=15.00					IP-26 R=75.00		IP-30 R=50.00	IP-IP66 R=65.00		IP-37 R=30.00		IP-40 R=50.00	
HORIZONTAL ALIGNMENT LEFT		IP-IP279 R=15.00														
CUT/FILL (m)	0.514	0.390	0.313	0.824	0.479	0.330	-0.004	0.139	0.188	0.328	0.263	0.137	0.102	-0.146	-0.073	.514 -0.008

CHAINAGE : 0 +300+30 +600

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS

GROUP MEMBERS:

ABHYA TAMRAKAR	THA076BCE004
BIBUDH SUBEDI	THA076BCE027
BIGYAN KARKI	THA076BCE028
SAMUNDRA SAPKOTA	THA076BCE097
DIWAKAR TIMILSINA	THA076BCE041
JEEVAN BHATTARAI	THA076BCE047

THAPATHALI, KATHMANDU
DEPARTMENT OF CIVIL ENGINEERING

DATE REVISION SIGNATURE

KALOPATI TO MANDEV MARG ROADSECTION

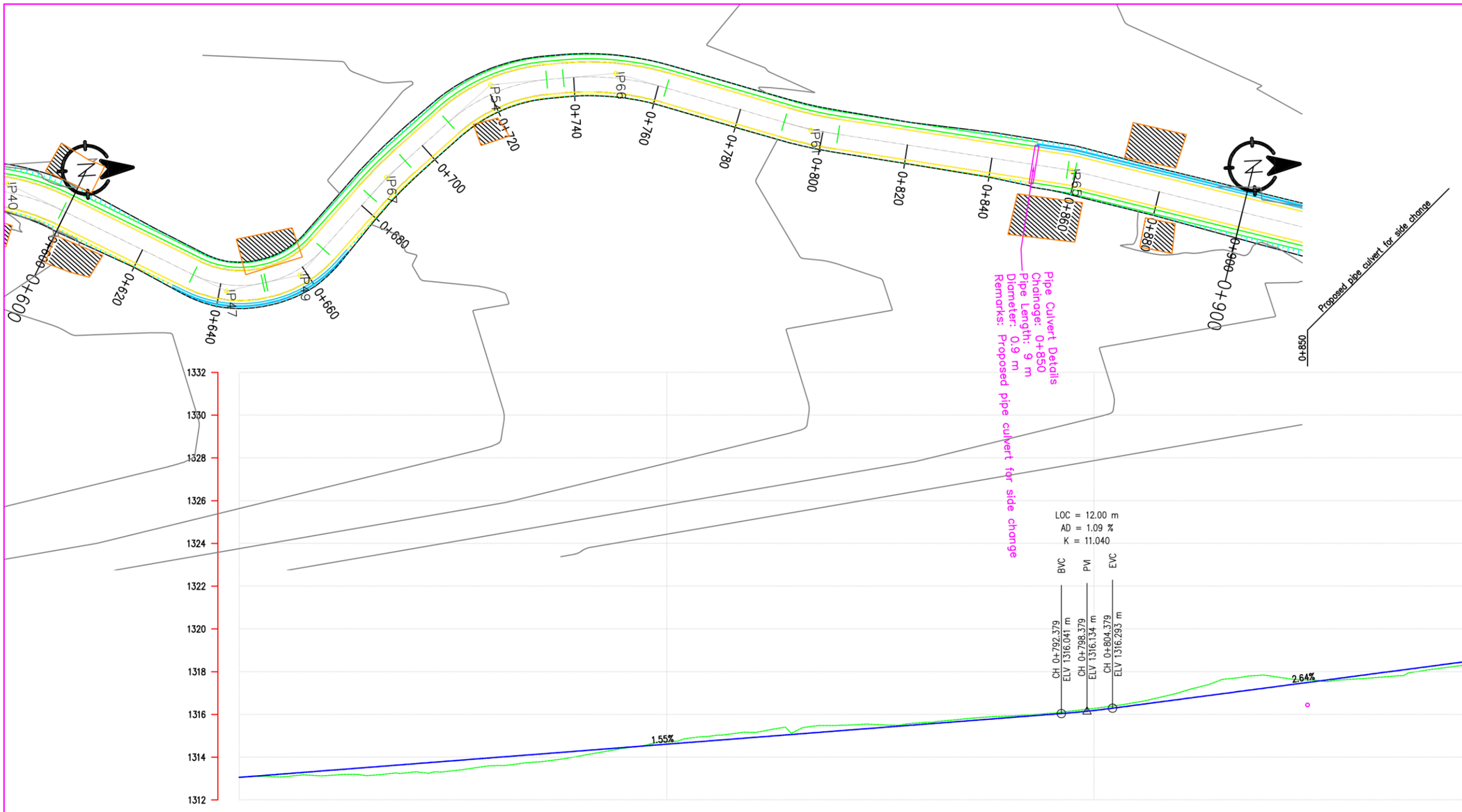
DESIGNED BY :
DRAWN BY :
CHECKED BY :
APPROVED BY :

SCALE
HORIZONTAL 1:1000 (10 m 0 20 m)
VERTICAL 1: 1000 (10 m 0 20 m)

Plan & Profile

0+300-0+600

DATE:
DRG NO : 1
SHEET NO : 1



DESIGN LEVEL(m)	1313.057	1313.368	1313.678	1313.988	1314.298	1314.609	1314.919	1315.229	1315.539	1315.849	1316.186	1316.705	1317.232	1317.760	1318.288	1318.815
EXISTING LEVEL(m)	1313.065	1313.134	1313.288	1313.606	1314.069	1314.731	1315.163	1315.487	1315.625	1315.926	1316.283	1317.025	1317.837	1317.643	1318.135	1318.691
CHAINAGE(Km)	0+600	0+620	0+640	0+660	0+680	0+700	0+720	0+740	0+760	0+780	0+800	0+820	0+840	0+860	0+880	0+900
HORIZONTAL ALIGNMENT RIGHT			IP–47 R=25.00	IP–49 R=25.00	IP–IP67 R=100.00		IP–54 R=40.00	IP–IP66 R=65.00			IP–61 R=100.00			IP–65 R=20.00		
HORIZONTAL ALIGNMENT LEFT																
CUT/FILL (m)	-0.008	0.234	0.390	0.382	0.230	-0.123	-0.244	-0.258	-0.086	-0.077	-0.097	-0.320	-0.605	0.117	0.153	-0.124

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS

HORIZONTAL ALIGNMENT

GROUP MEMBERS:

		DATE	REVISION	SIGNATURE
ABINA TAMANG	THA076BCE004			
BIBIDH SUBEDI	THA076BCE027			
BIGYAN KARKI	THA076BCE028			

CHAINAGE : 0+600 – 0+900

THAPATHALI, KATHMANDU
DEPARTMENT OF CIVIL ENGINEERING

SAMUNDRA SAPKOTA	THA076BCE097
DIWAKAR TIMILSINA	THA076BCE041
JEEVAN BHATTARAI	THA076BCE047

KALOPATI TO MANDEV MARG ROADSECTION

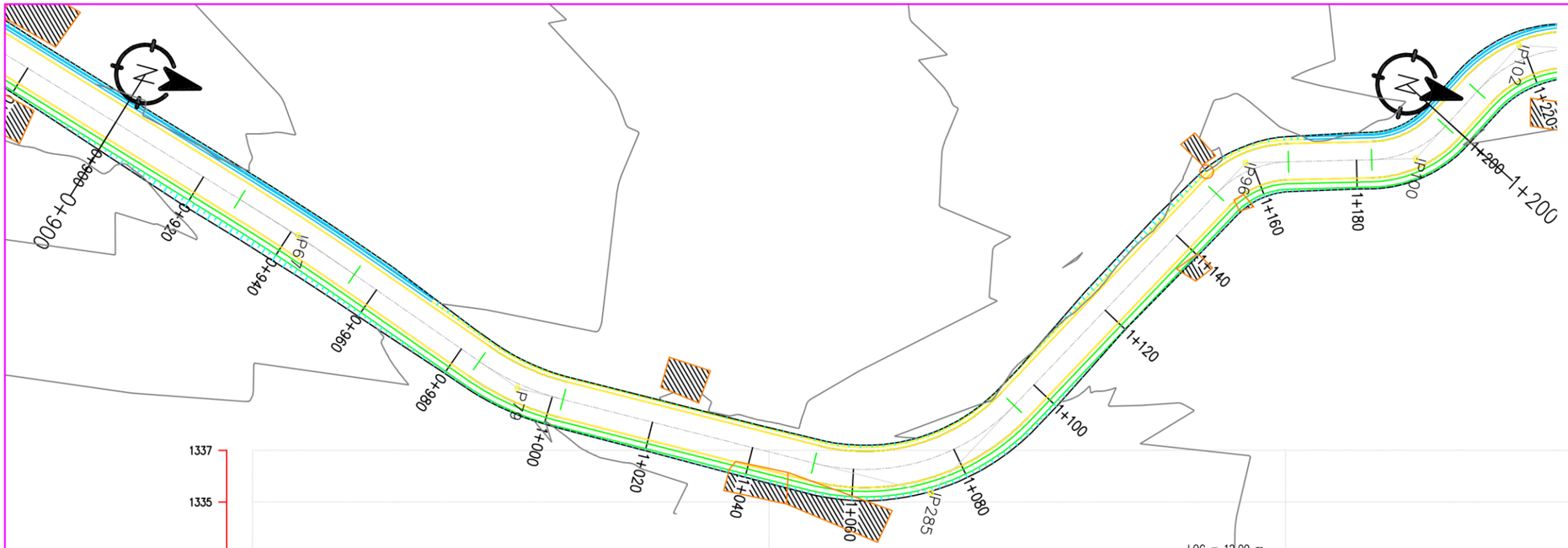
DESIGNED BY :
DRAWN BY :
CHECKED BY :
APPROVED BY :

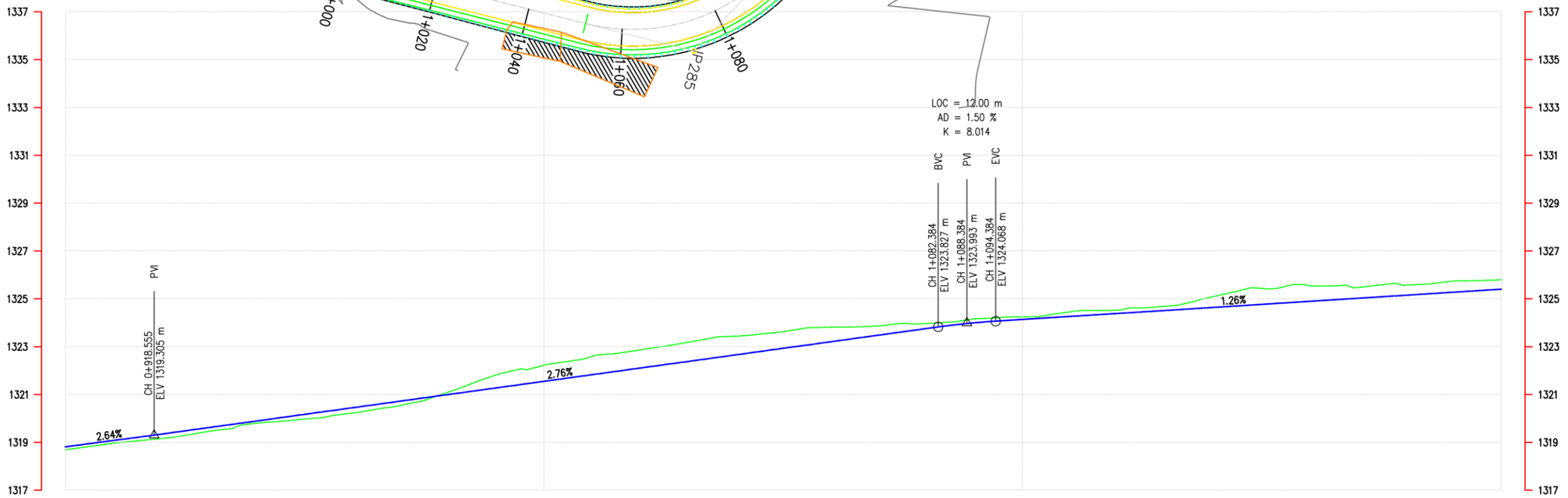
SCALE
HORIZONTAL 1:1000
10 m 0 20 m
VERTICAL 1: 1000
10 m 0 20 m

Plan & Profile

0+600-0+900

DATE:
DRG NO : 1
SHEET NO : 1





DESIGN LEVEL(m)		1318.815	1319.345	1319.897	1320.449	1321.001	1321.553	1322.105	1322.657	1323.209	1323.761	1324.139	1324.392	1324.645	1324.897	1325.150	1325.402
EXISTING LEVEL(m)		1318.691	1319.160	1319.803	1320.228	1321.103	1322.228	1322.864	1323.438	1323.819	1323.971	1324.251	1324.531	1325.102	1325.554	1325.572	1325.800
CHAINAGE(Km)		0+900	0+920	0+940	0+960	0+980	1+000	1+020	1+040	1+060	1+080	1+100	1+120	1+140	1+160	1+180	1+200
HORIZONTAL ALIGNMENT	RIGHT / LEFT			IP–IP67 R=500.00			IP–79 R=50.00				IP–IP285 R=40.00				IP–96 R=20.00		IP–100 R=20.00
CUT/FILL (m)		0.124	0.184	1.094	0.220	−0.102	−0.675	−0.759	−0.781	−0.609	−0.210	−0.111	−0.139	−0.457	−0.657	−0.422	−0.398

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
THAPATHALI CAMPUS
DEPARTMENT OF CIVIL ENGINEERING

GROUP MEMBERS | DATE | REVISION | SIGNATURE

ABINA TAMANG THA076BCE004
BIBIDH SUBEDI THA076BCE017
BIGYAN KARKI THA076BCE028
DIWAKAR TIMILSINA THA076BCE041
JEEVAN BHATTARAI THA076BCE047
SAMUNDRA SAPKOTA THA076BCE097

THAPATHALI, KATHMANDU

CHAINAGE : 0+900 – 1+200

KALOPATI TO MANDEV MARG ROADSECTION

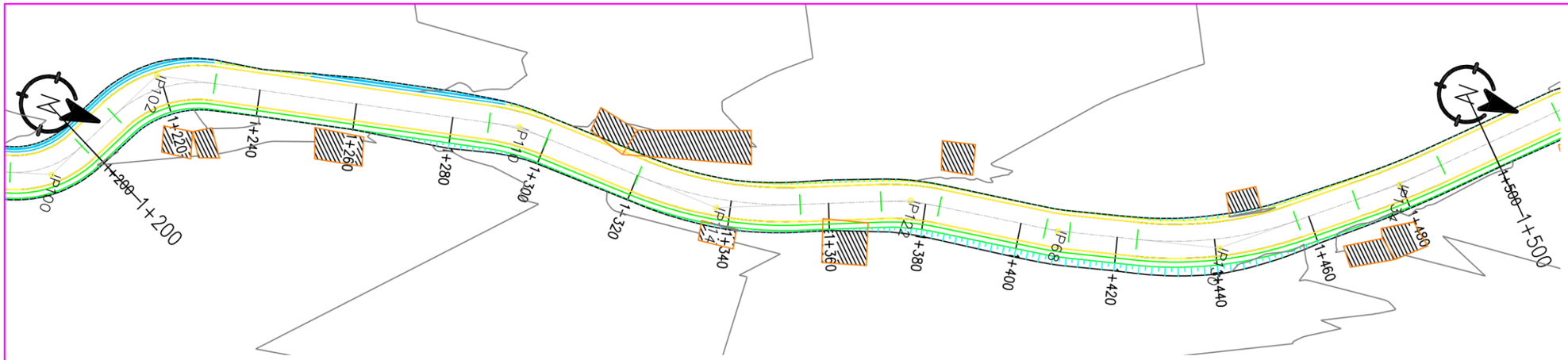
DESIGNED BY :
DRAWN BY :
CHECKED BY :
APPROVED BY :

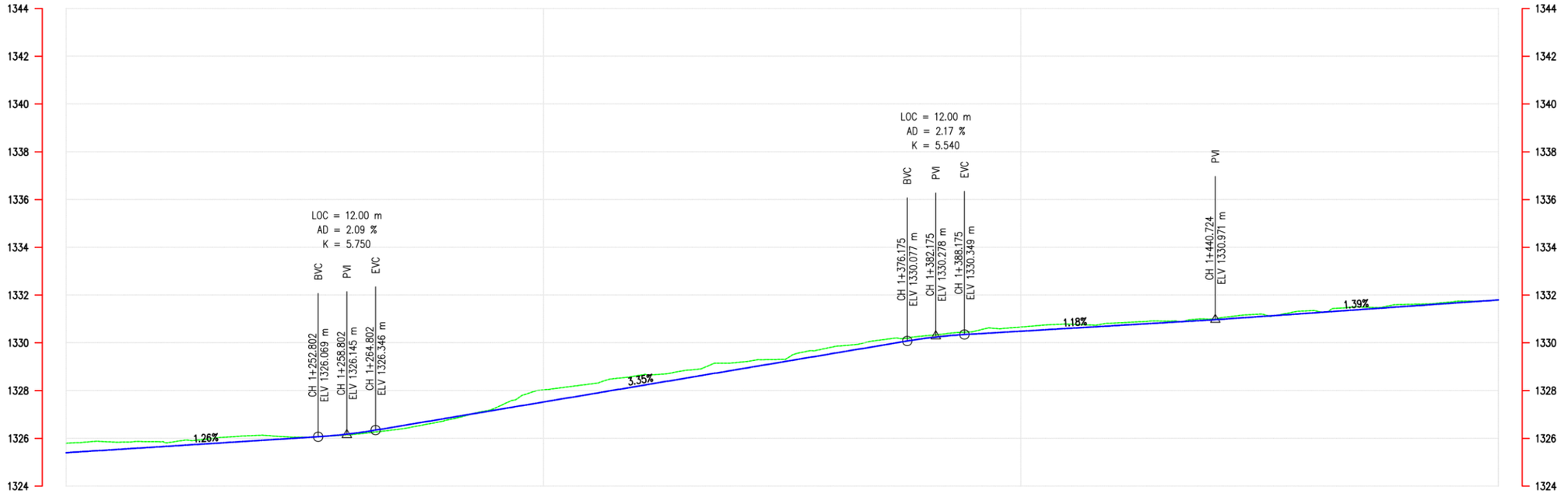
SCALE
HORIZONTAL 1:1000
10 m 0 20 m
VERTICAL 1:1000
10 m 0 20 m

Plan & Profile

0+900-1+200

DATE:
DRG NO : 1
SHEET NO : 4



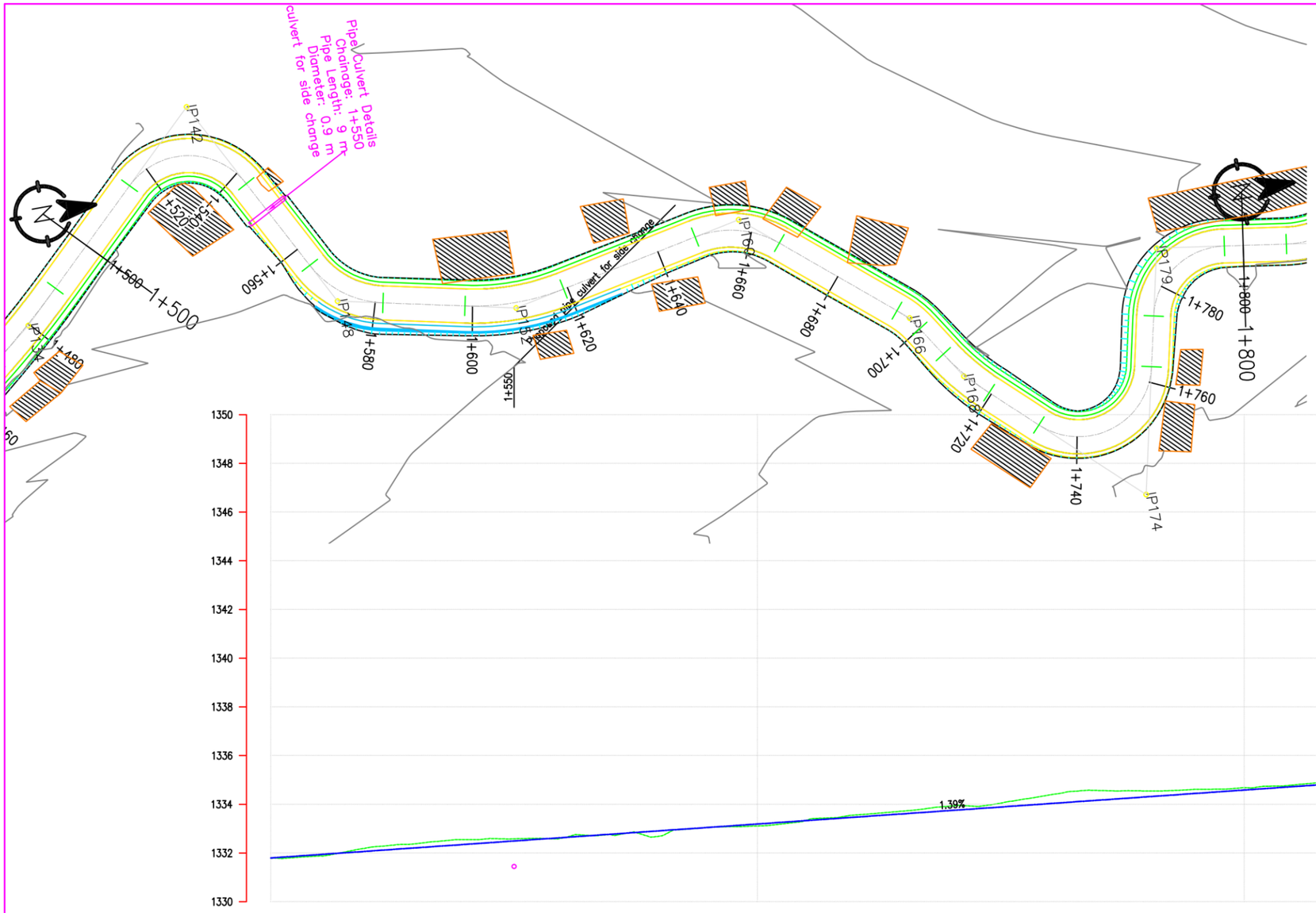


DESIGN LEVEL(m)		1325.402	1325.655	1325.908	1326.205	1326.855	1327.525	1328.195	1328.865	1329.535	1330.192	1330.489	1330.725	1330.962	1331.240	1331.518	1331.797
EXISTING LEVEL(m)		1325.800	1325.859	1326.123	1326.162	1326.778	1328.032	1328.639	1329.168	1329.807	1330.297	1330.662	1330.834	1330.991	1331.342	1331.605	1331.787
CHAINAGE(Km)		1+200	1+220	1+240	1+260	1+280	1+300	1+320	1+340	1+360	1+380	1+400	1+420	1+440	1+460	1+480	1+500
HORIZONTAL ALIGNMENT	RIGHT		IP-102 R=25.00				IP-110 R=50.00		IP-114 R=80.00		IP-122 R=50.00	IP-IP68 R=50.00		IP-130 R=75.00		IP-134 R=200.00	
	LEFT																
CUT/FILL (m)		-0.398	-0.204	-0.216	0.043	0.078	-0.507	-0.444	-0.303	-0.272	-0.105	-0.174	-0.108	-0.028	-0.103	-0.087	0.010

CHAINAGE : 1+200 – 1+500

THAPATHALI, KATHMANDU TRIBHUVAN UNIVERSITY	SAMUNDRA SAPKOTA THA076BCE097 GROUP MEMBERS: ABINA TAMANG THA076BCE004	KALOPATI TO MANDEV MARG ROADSECTION	DATE	REVISION	SIGNATURE	DESIGNED BY : DRAWN BY : CHECKED BY : APPROVED BY :	SCALE HORIZONTAL 1:1000 10 m 0 20 m VERTICAL 1:1000 10 m 0 20 m

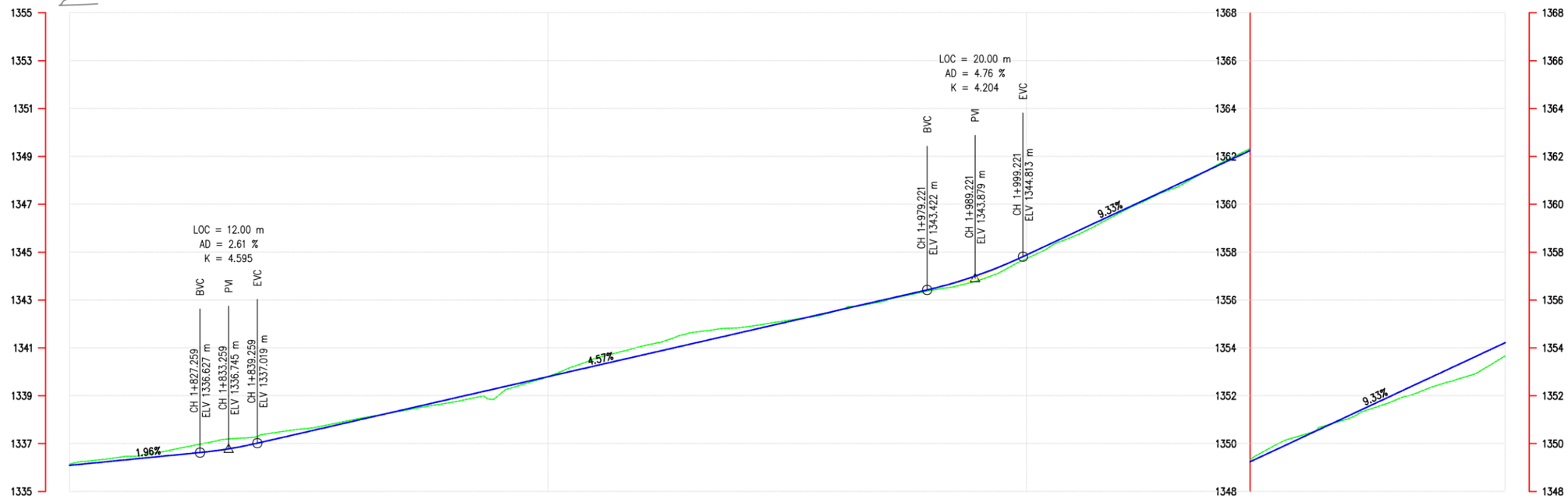
Plan & Profile 1+200-1+500	DATE: DRG NO : 1 SHEET NO : 6



DESIGN LEVEL(m)	1331.797	1332.076	1332.355	1332.634	1332.913	1333.191	1333.470	1333.749	1334.028	1334.307	1334.585	1334.864	1335.143	1335.422	1335.709	1336.092
EXISTING LEVEL(m)	1331.787	1332.219	1332.550	1332.619	1332.695	1333.111	1333.560	1333.935	1334.383	1334.547	1334.681	1334.923	1335.374	1335.570	1335.684	1336.148
CHAINAGE(Km)	1+500	1+520	1+540	1+560	1+580	1+600	1+620	1+640	1+660	1+680	1+700	1+720	1+740	1+760	1+780	1+800
HORIZONTAL ALIGNMENT RIGHT		IP–142 R=15.00			IP–148 R=20.00		IP–152 R=50.00		IP–160 R=20.00		IP–166 R=20.00	IP–168 R=50.00	IP–174 R=15.00		IP–179 R=15.00	
HORIZONTAL ALIGNMENT LEFT																
CUT/FILL (m)	0.010	−0.143	−0.195	0.014	0.218	0.081	−0.090	−0.186	−0.355	−0.240	−0.096	−0.059	−0.231	−0.148	0.024	−0.057

CHAINAGE : 1+500 – 1+800

THAPATHALI, KATHMANDU TRIBHUVAN UNIVERSITY	SAMUNDRA SAPKOTA THA076BCE097 GROUP MEMBERS: ABINA TAMANG THA076BCE004	KALOPATI TO MANDEV MARG ROADSECTION	DATE	REVISION	SIGNATURE	DESIGNED BY : DRAWN BY : CHECKED BY : APPROVED BY :	SCALE HORIZONTAL 1:1000 10 m 0 20 m VERTICAL 1: 1000 10 m 0 20 m	Plan & Profile 1+500-1+800	DATE: DRG NO : 1 SHEET NO : 6

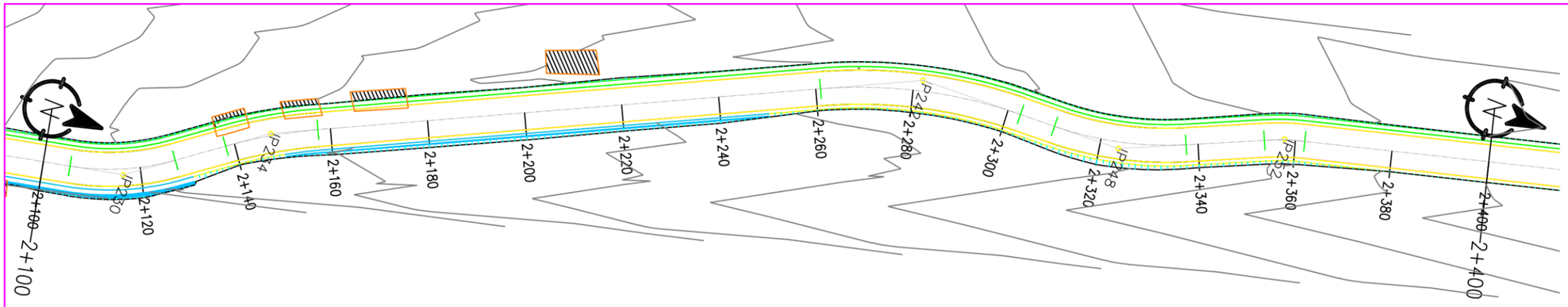


DESIGN LEVEL(m)		1336.092	1336.484	1337.053	1337.968	1338.883	1339.798	1340.713	1341.628	1342.543	1343.458	1344.885	1346.752	1348.618	1350.485	1352.351	1354.218
EXISTING LEVEL(m)		1336.148	1336.682	1337.372	1338.031	1338.731	1339.799	1341.088	1341.841	1342.531	1343.405	1344.732	1346.697	1348.664	1350.500	1352.008	1353.679
CHAINAGE(Km)		1+800	1+820	1+840	1+860	1+880	1+900	1+920	1+940	1+960	1+980	2+000	2+020	2+040	2+060	2+080	2+100
HORIZONTAL ALIGNMENT	RIGHT							IP-199 R=30.00				IP-210 R=20.00					
	LEFT		IP-184 R=20.00				IP-193 R=35.00						IP-211 R=15.00		IP-220 R=50.00		
CUT/FILL (m)		-0.057	-0.198	-0.319	-0.063	0.152	-0.002	-0.375	-0.213	0.012	0.054	0.153	0.054	-0.046	-0.015	0.343	0.538

CHAINAGE : 1+800 – 2+100

THAPATHALI, KATHMANDU TRIBHUVAN UNIVERSITY	SAMUNDRA SAPKOTA THA076BCE097 GROUP MEMBERS: ABINA TAMANG THA076BCE004	KALOPATI TO MANDEV MARG ROADSECTION	DATE	REVISION	SIGNATURE	DESIGNED BY : DRAWN BY : CHECKED BY : APPROVED BY :	SCALE HORIZONTAL 1:1000 10 m 0 20 m VERTICAL 1:1000 10 m 0 20 m

Plan & Profile	DATE:
1+800-2+100	DRG NO : 1
	SHEET NO : 6

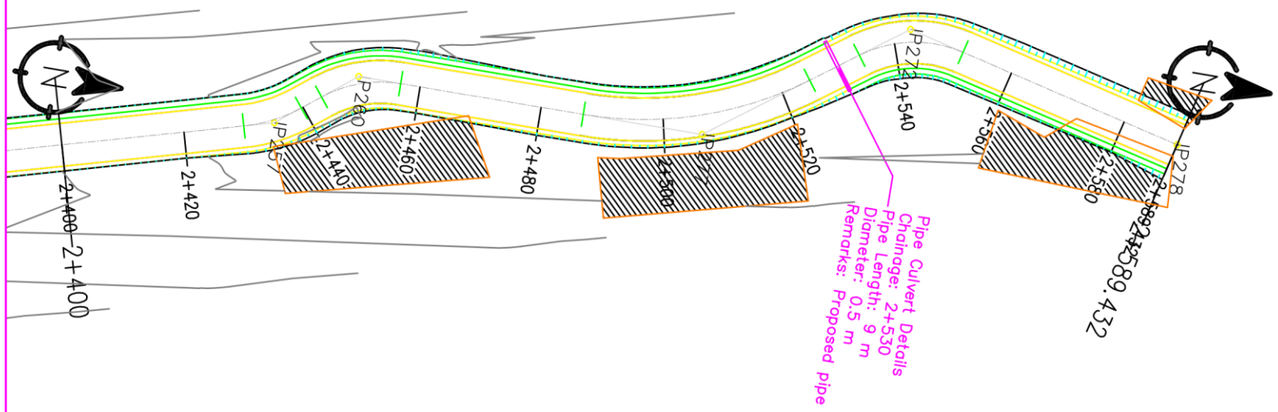


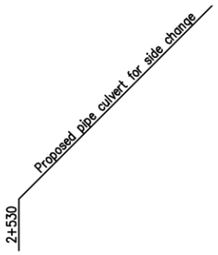
DESIGN LEVEL(m)		1354.218	1356.084	1357.460	1358.207	1358.954	1359.700	1360.447	1361.194	1361.941	1362.688	1363.435	1364.181	1364.931	1366.461	1368.241	1370.020
EXISTING LEVEL(m)		1353.679	1355.947	1357.383	1358.075	1358.379	1358.954	1359.722	1360.712	1361.919	1362.912	1363.610	1363.971	1364.751	1366.330	1368.567	1370.199
CHAINAGE(Km)		2+100	2+120	2+140	2+160	2+180	2+200	2+220	2+240	2+260	2+280	2+300	2+320	2+340	2+360	2+380	2+400
HORIZONTAL ALIGNMENT	RIGHT			IP-234 R=100.00							IP-242 R=100.00				IP-252 R=50.00		
	LEFT		IP-230 R=50.00										IP-248 R=70.00				
CUT/FILL (m)		0.538	0.137	0.077	0.132	0.575	0.747	0.726	0.482	0.022	−0.224	−0.175	0.210	0.180	0.131	−0.327	−0.179

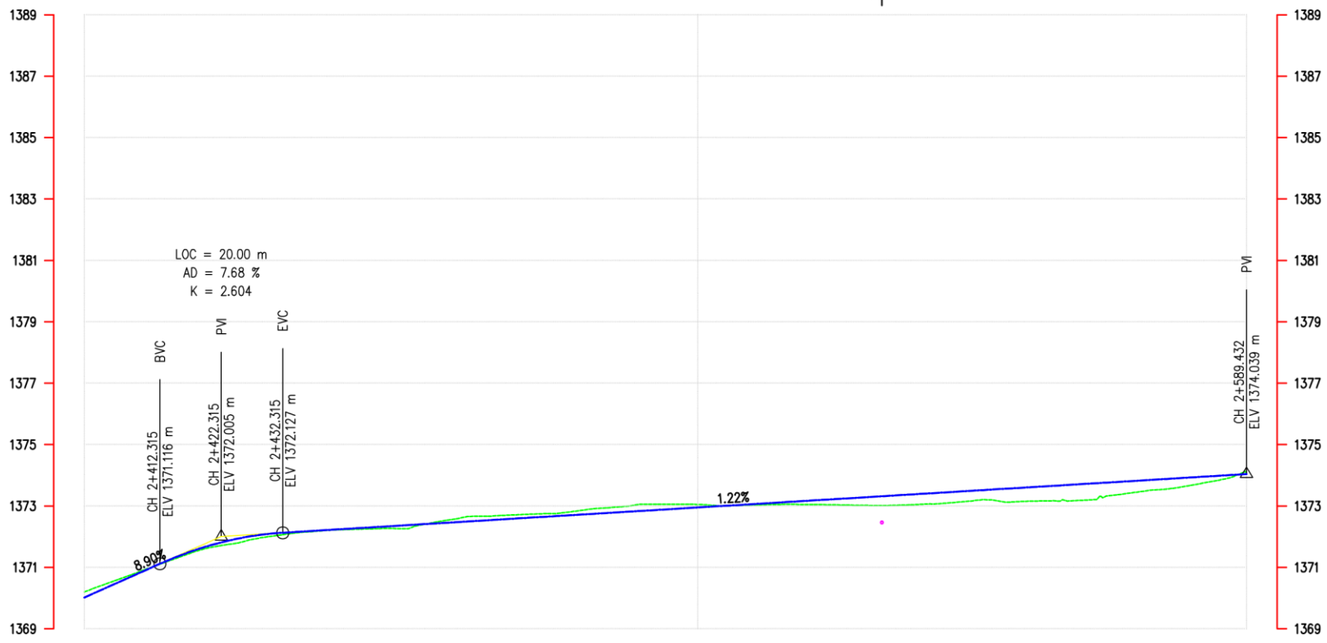
CHAINAGE : 2+100 – 2+400

THAPATHALI, KATHMANDU TRIBHUVAN UNIVERSITY	SAMUNDRA SAPKOTA THA076BCE097 GROUP MEMBERS: ABINA TAMANG THA076BCE004	KALOPATI TO MANDEV MARG ROADSECTION	DATE	REVISION	SIGNATURE	DESIGNED BY : DRAWN BY : CHECKED BY : APPROVED BY :	SCALE HORIZONTAL 1:1000 10 m 0 20 m VERTICAL 1:1000 10 m 0 20 m

Plan & Profile	DATE:
2+100-2+400	DRG NO : 1
	SHEET NO : 6







DESIGN LEVEL(m)		1370.020	1371.686	1372.221	1372.464	1372.707	1372.951	1373.194	1373.437	1373.681	1373.924	1374.039
EXISTING LEVEL(m)		1370.199	1371.628	1372.210	1372.562	1372.829	1373.049	1373.045	1373.085	1373.172	1373.660	1374.069
CHAINAGE(Km)		2+400	2+420	2+440	2+460	2+480	2+500	2+520	2+540	2+560	2+580	2+589.43
HORIZONTAL ALIGNMENT	RIGHT / LEFT			IP-257 R=25.00	IP-260 R=20.00		IP-IP277 R=60.00		IP-272 R=20.00			IP-278 R=0.00
CUT/FILL (m)		-0.179	0.058	0.010	-0.098	-0.122	-0.099	0.149	0.352	0.509	0.264	-0.030

CHAINAGE : 2+400 – 2+589.432

THAPATHALI, KATHMANDU TRIBHUVAN UNIVERSITY	SAMUNDRA SAPKOTA THA076BCE097 GROUP MEMBERS: ARINA TAMANG THA076BCE004	KALOPATI TO MANDEV MARG ROADSECTION	DATE	REVISION	SIGNATURE	DESIGNED BY : DRAWN BY : CHECKED BY : APPROVED BY :	SCALE HORIZONTAL 1:1000 10 m 0 20 m VERTICAL 1:1000 10 m 0 20 m	Plan & Profile 2+400-2+589.432	DATE: DRG NO : 1 SHEET NO : 9

IP No.	CO-ORDINATES(m)		WCB (D-M-S)	DIST. (m)	DEF. ANG. (D-M-S)	TAN. LEN. (m)	SIMPLE CURVE DATA			CHAINAGE			
	EASTING	NORTHING					R (m)	E (m)	LC (m)	BC	MC	EC	IP
1	344458.565	3062256.583	343-24-54.72	0.000	00-00-0.00	0.000	0.000	0.000	0.000	0+000.000	0+000.000	0+000.000	0+000.000
IP279	344435.795	3062333.036	351-39-26.62	79.772	08-14-31.90	3.603	50.000	0.130	7.193	0+076.170	0+079.766	0+083.363	0+079.772
11	344428.233	3062384.605	343-07-27.14	52.121	08-31-59.48	3.357	45.000	0.125	6.702	0+128.523	0+131.874	0+135.225	0+131.881
16	344390.248	3062509.819	349-54-0.43	130.849	06-46-33.28	2.960	50.000	0.088	5.913	0+259.757	0+262.713	0+265.670	0+262.717
IP66	344383.648	3062546.873	02-58-5.64	37.637	13-04-5.22	7.445	65.000	0.425	14.825	0+292.902	0+300.314	0+307.727	0+300.347
IP279	344384.458	3062562.504	344-30-18.55	15.653	18-27-47.10	2.438	15.000	0.197	4.834	0+313.497	0+315.914	0+318.330	0+315.935
21	344378.784	3062582.971	355-20-34.85	21.238	10-50-16.31	1.423	15.000	0.067	2.837	0+335.708	0+337.126	0+338.545	0+337.131
26	344369.990	3062690.927	342-08-12.23	108.313	13-12-22.62	8.682	75.000	0.501	17.287	0+436.754	0+445.397	0+454.041	0+445.436
30	344358.579	3062726.335	326-35-10.60	37.202	15-33-1.63	6.827	50.000	0.464	13.570	0+475.734	0+482.519	0+489.304	0+482.561
IP66	344347.579	3062743.009	305-17-26.77	19.976	21-17-43.83	12.221	65.000	1.139	24.159	0+490.232	0+502.312	0+514.391	0+502.453
37	344309.268	3062770.125	357-28-6.41	46.935	52-10-39.65	14.690	30.000	3.403	27.320	0+534.417	0+548.077	0+561.737	0+549.106
40	344307.567	3062808.599	29-20-7.54	38.512	31-52-1.13	14.274	50.000	1.998	27.809	0+571.284	0+585.189	0+599.093	0+585.559
47	344335.536	3062858.367	350-54-35.00	57.088	38-25-32.54	8.712	25.000	1.475	16.766	0+633.195	0+641.578	0+649.961	0+641.907
49	344332.757	3062875.736	314-50-47.01	17.590	36-03-47.99	8.138	25.000	1.291	15.736	0+650.701	0+658.568	0+666.436	0+658.839
IP67	344311.104	3062897.273	321-29-57.65	30.540	06-39-10.63	5.812	100.000	0.169	11.612	0+683.026	0+688.832	0+694.638	0+688.838
54	344290.841	3062922.747	357-58-14.46	32.551	36-28-16.81	13.179	40.000	2.115	25.462	0+708.197	0+720.928	0+733.659	0+721.376
IP66	344289.798	3062952.158	19-27-19.86	29.430	21-29-5.40	12.332	65.000	1.159	24.374	0+737.578	0+749.765	0+761.951	0+749.909
61	344305.633	3062996.984	12-01-37.73	47.540	07-25-42.13	6.492	100.000	0.210	12.965	0+790.669	0+797.151	0+803.634	0+797.160
65	344318.486	3063057.312	16-58-33.25	61.681	04-56-55.52	0.864	20.000	0.019	1.727	0+857.959	0+858.823	0+859.687	0+858.823
IP67	344342.628	3063136.397	20-00-57.45	82.689	03-02-24.20	13.268	500.000	0.176	26.529	0+928.243	0+941.508	0+954.773	0+941.511
79	344360.345	3063185.030	359-27-54.70	51.759	20-33-2.75	9.064	50.000	0.815	17.934	0+984.199	0+993.166	1+002.133	0+993.264
IP285	344359.574	3063267.537	298-54-12.68	82.511	60-33-42.02	23.356	40.000	6.320	42.280	1+052.224	1+073.364	1+094.504	1+075.580
96	344282.301	3063310.201	343-51-38.73	88.269	44-57-26.05	8.276	20.000	1.644	15.693	1+151.141	1+158.988	1+166.834	1+159.417
100	344273.153	3063341.812	297-38-24.38	32.908	46-13-14.35	8.535	20.000	1.745	16.134	1+182.932	1+190.999	1+199.066	1+191.467
102	344246.833	3063355.595	349-00-36.85	29.711	51-22-12.47	12.024	25.000	2.741	22.414	1+208.218	1+219.425	1+230.632	1+220.241
110	344232.510	3063429.351	03-11-17.69	75.133	14-10-40.84	6.218	50.000	0.385	12.373	1+287.524	1+293.710	1+299.896	1+293.742
114	344234.942	3063473.004	338-47-1.86	43.721	24-24-15.83	17.300	80.000	1.849	34.075	1+320.099	1+337.137	1+354.174	1+337.399
122	344220.468	3063510.289	352-39-41.02	39.996	13-52-39.16	6.085	50.000	0.369	12.110	1+370.785	1+376.841	1+382.896	1+376.870
IP68	344216.531	3063540.858	346-56-43.92	30.822	05-42-57.09	2.496	50.000	0.062	4.988	1+405.136	1+407.630	1+410.124	1+407.632
130	344208.993	3063573.369	321-30-37.05	33.373	25-26-6.88	16.926	75.000	1.886	33.295	1+424.075	1+440.722	1+457.370	1+441.001
134	344184.573	3063604.080	316-04-50.89	39.237	05-25-46.15	9.483	200.000	0.225	18.952	1+470.197	1+479.674	1+489.150	1+479.681
142	344146.130	3063644.002	62-13-58.70	55.422	106-09-7.81	19.961	15.000	9.969	27.791	1+515.128	1+529.023	1+542.918	1+535.088
148	344190.825	3063667.534	12-16-44.60	50.512	49-57-14.10	9.316	20.000	2.063	17.437	1+564.153	1+572.872	1+581.590	1+573.470
152	344198.629	3063703.388	348-32-30.27	36.693	23-44-14.33	10.508	50.000	1.092	20.715	1+598.459	1+608.816	1+619.174	1+608.967
160	344188.857	3063751.599	40-00-54.77	49.192	51-28-24.50	9.641	20.000	2.203	17.968	1+648.216	1+657.200	1+666.184	1+657.857
166	344214.910	3063782.631	57-12-38.03	40.519	17-11-43.25	3.024	20.000	0.227	6.002	1+694.037	1+697.039	1+700.040	1+697.061
168	344228.646	3063791.480	43-05-11.01	16.339	14-07-27.01	6.194	50.000	0.382	12.326	1+707.161	1+713.324	1+719.487	1+713.355
174	344259.143	3063824.085	282-32-34.85	44.644	120-32-36.16	26.268	15.000	15.249	31.558	1+731.669	1+747.448	1+763.227	1+757.937
179	344209.699	3063835.085	08-21-57.19	50.652	85-49-22.34	13.944	15.000	5.480	22.468	1+773.667	1+784.901	1+796.136	1+787.612
184	344214.331	3063866.580	339-23-3.04	31.834	28-58-54.15	5.169	20.000	0.657	10.117	1+808.856	1+813.915	1+818.973	1+814.025
193	344186.888	3063939.529	302-06-22.52	77.940	37-16-40.52	11.805	35.000	1.937	22.772	1+879.938	1+891.324	1+902.710	1+891.744
199	344151.456	3063961.761	351-17-4.34	41.830	49-10-41.82	13.728	30.000	2.992	25.750	1+919.006	1+931.881	1+944.756	1+932.734
210	344141.498	3064026.721	69-24-55.97	65.718	78-07-51.63	16.234	20.000	5.759	27.273	1+980.512	1+994.149	2+007.785	1+996.746
211	344167.088	3064036.331	358-58-57.26	27.335	70-25-58.72	10.588	15.000	3.360	18.439	2+008.299	2+017.519	2+026.738	2+018.887
220	344166.283	3064081.656	347-56-35.34	45.332	11-02-21.92	4.832	50.000	0.233	9.634	2+056.651	2+061.468	2+066.285	2+061.483
230	344154.756	3064135.623	322-55-10.05	55.184	25-01-25.30	11.096	50.000	1.216	21.837	2+105.541	2+116.460	2+127.378	2+116.636
234	344135.766	3064160.750	333-57-16.18	31.496	11-02-6.14	9.660	100.000	0.465	19.260	2+138.118	2+147.748	2+157.378	2+147.778
242	344076.751	3064281.506	357-51-16.11	134.406	23-53-59.93	21.164	100.000	2.215	41.713	2+260.960	2+281.817	2+302.674	2+282.125
248	344075.160	3064323.966	335-21-39.25	42.489	22-29-36.86	13.920	70.000	1.371	27.481	2+310.079	2+323.819	2+337.560	2+323.999
252	344060.905	3064355.046	344-53-33.44	34.193	09-31-54.19	4.169	50.000	0.173	8.318	2+353.665	2+357.824	2+361.983	2+357.833
257	344040.837	3064429.380	322-09-14.68	76.996	22-44-18.76	5.027	25.000	0.500	9.922	2+429.783	2+434.744	2+439.704	2+434.810
260	344031.206	3064441.776	00-21-2.83	15.697	38-11-48.15	6.925	20.000	1.165	13.333	2+443.450	2+450.116	2+456.783	2+450.375
IP277	344031.554	3064498.514	324-06-26.40	56.739	36-14-36.43	19.636	60.000	3.131	37.954	2+486.961	2+505.938	2+524.915	2+506.597
272	344009.264	3064529.315	14-10-15.12	38.020	50-03-48.72	9.340	20.000	2.073	17.475	2+533.959	2+542.697	2+551.435	2+543.299
278	344020.853	3064575.211	00-00-0.00	47.337	00-00-0.00	0.000	0.000	0.000	0.000	2+589.432	2+589.432	2+589.432	2+589.432

THAPATHALI, KATHMANDU

TRIBHUVAN UNIVERSITY

SAMUNDRA SAPKOTA THA076BCE097

GROUP MEMBERS:

ABINA TAMANG THA076BCE004

KALOPATI TO MANDEV MARG ROADSECTION

DATE REVISION SIGNATURE

DESIGNED BY :

DRAWN BY :

CHECKED BY :

APPROVED BY :

SCALE

HORIZONTAL 1:1000

10 m 0 20 m

VERTICAL 1:1000

10 m 0 20 m

CURVE DATA

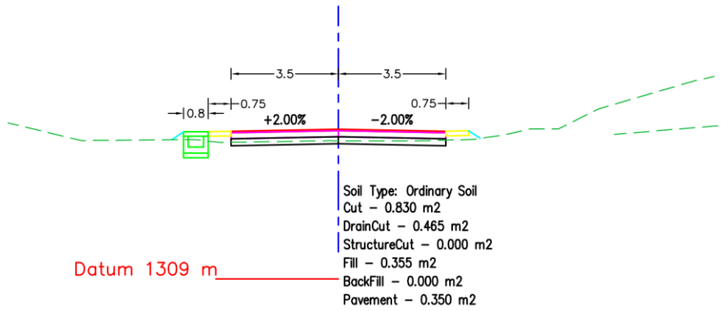
0+000-2+589.432

DATE:

DRG NO : 1

SHEET NO : 10

Ch: 0+040
GL: 1313.503
DL: 1313.883



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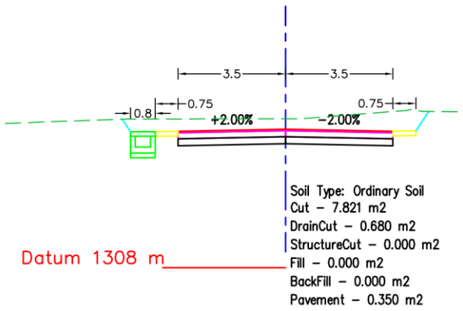

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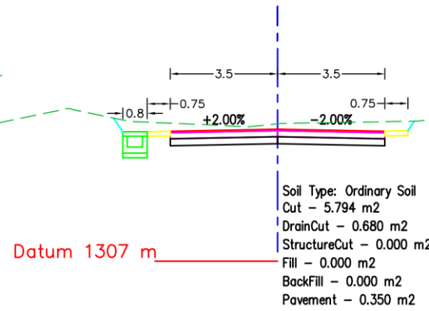

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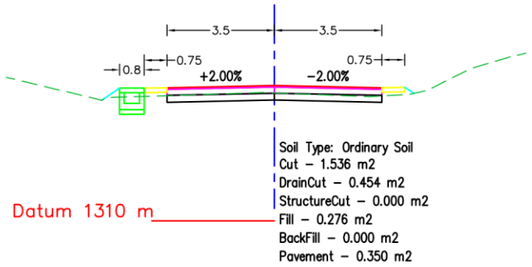
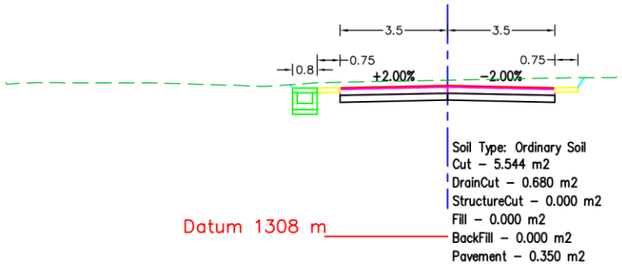
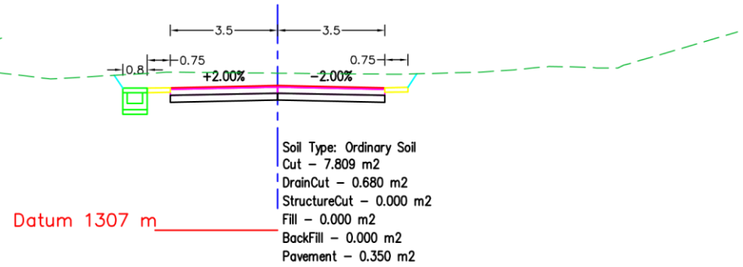


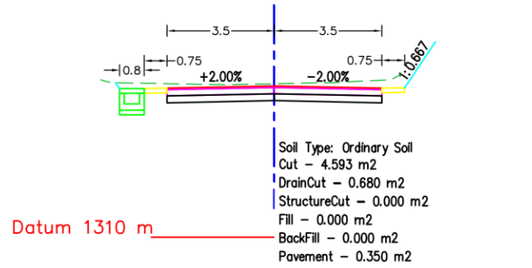
Ch: 0+080
GL: 1313.089
DL: 1312.914



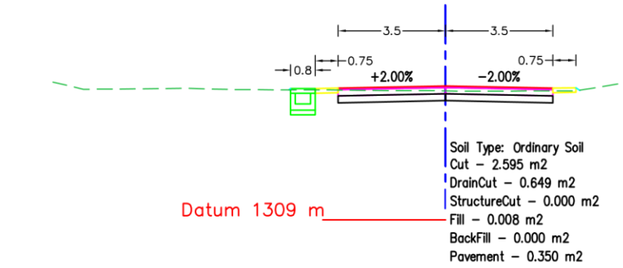
Ch: 0+140
GL: 1312.114
DL: 1311.710



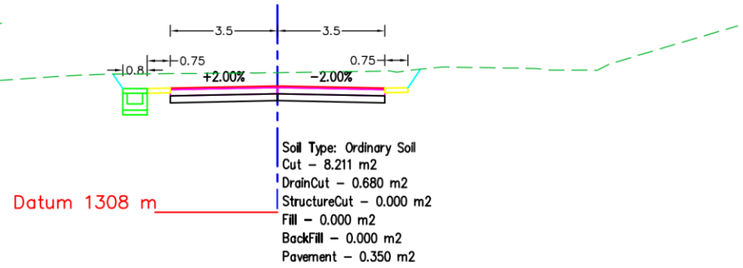
Ch: 0+000
GL: 1315.011
DL: 1314.936



Ch: 0+060
GL: 1313.197
DL: 1313.356



Ch: 0+120
GL: 1312.548
DL: 1312.111



	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION				DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		0+000-0+160	SHEET NO : 1
						APPROVED BY :			

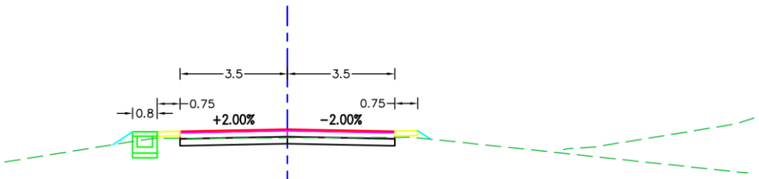
TRIBHUVAN UNIVERSITY

GROUP MEMBERS:

ABINA TAMANG THA076BCE004

DATE REVISION SIGNATURE

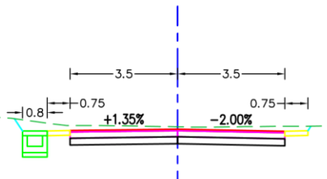
Ch: 0+220
GL:1309.819
DL:1310.105



Soil Type: Ordinary Soil
Cut – 1.568 m2
DrainCut – 0.471 m2
StructureCut – 0.000 m2
Fill – 0.250 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1306 m

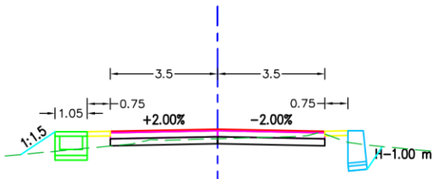
Ch: 0+280
GL:1308.987
DL:1308.914



Soil Type: Ordinary Soil
Cut – 4.933 m2
DrainCut – 0.680 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1304 m

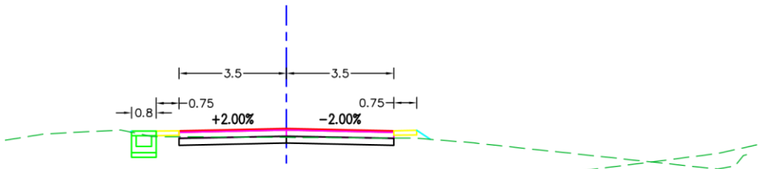
Ch: 0+340
GL:1309.701
DL:1310.014



Soil Type: Ordinary Soil
Cut – 1.527 m2
DrainCut – 0.354 m2
StructureCut – 0.531 m2
Fill – 0.695 m2
BackFill – 0.031 m2
Pavement – 0.350 m2

Datum 1306 m

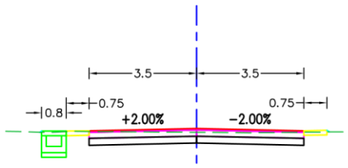
Ch: 0+200
GL:1310.218
DL:1310.506



Soil Type: Ordinary Soil
Cut – 1.551 m2
DrainCut – 0.586 m2
StructureCut – 0.000 m2
Fill – 0.161 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1306 m

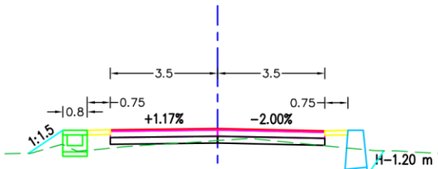
Ch: 0+260
GL:1309.180
DL:1309.302



Soil Type: Ordinary Soil
Cut – 2.915 m2
DrainCut – 0.655 m2
StructureCut – 0.000 m2
Fill – 0.003 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1305 m

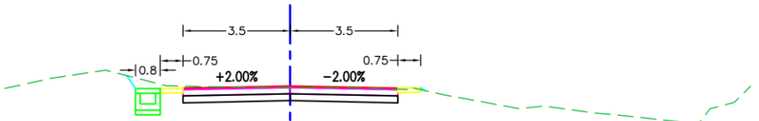
Ch: 0+320
GL:1309.628
DL:1310.018



Soil Type: Ordinary Soil
Cut – 0.606 m2
DrainCut – 0.191 m2
StructureCut – 0.650 m2
Fill – 1.005 m2
BackFill – 0.052 m2
Pavement – 0.350 m2

Datum 1306 m

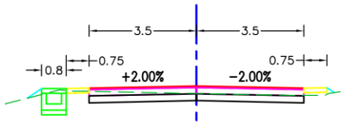
Ch: 0+180
GL:1310.863
DL:1310.907



Soil Type: Ordinary Soil
Cut – 3.770 m2
DrainCut – 0.680 m2
StructureCut – 0.000 m2
Fill – 0.004 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1306 m

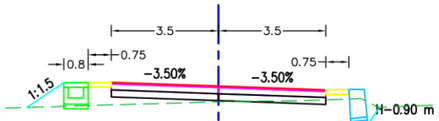
Ch: 0+240
GL:1309.459
DL:1309.703



Soil Type: Ordinary Soil
Cut – 1.909 m2
DrainCut – 0.603 m2
StructureCut – 0.000 m2
Fill – 0.134 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1305 m

Ch: 0+300
GL:1309.156
DL:1309.670



Soil Type: Ordinary Soil
Cut – 0.323 m2
DrainCut – 0.075 m2
StructureCut – 0.487 m2
Fill – 1.584 m2
BackFill – 0.029 m2
Pavement – 0.350 m2

Datum 1305 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION				DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section
						DRAWN BY :		DATE:
						CHECKED BY :		DRG NO : 1
						APPROVED BY :	0+180-0+340	SHEET NO : 2

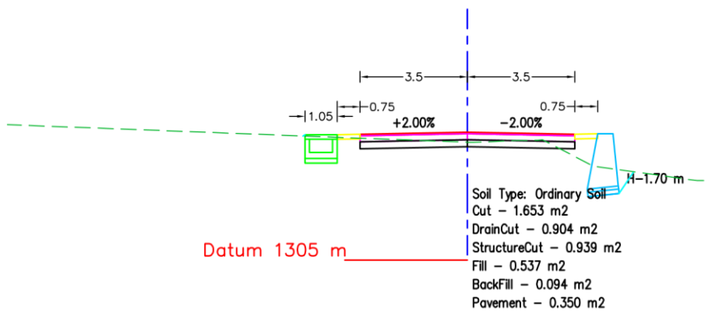
TRIBHUVAN UNIVERSITY
GROUP MEMBERS:
ABINA TAMANG THA076BCE004

DATE REVISION SIGNATURE

Ch: 0+400

GL: 1308.838

DL: 1309.168

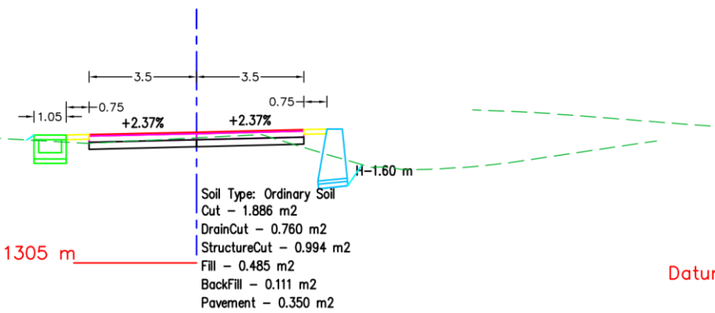


Soil Type: Ordinary Soil
Cut – 1.653 m2
DrainCut – 0.904 m2
StructureCut – 0.939 m2
Fill – 0.537 m2
BackFill – 0.094 m2
Pavement – 0.350 m2

Ch: 0+460

GL: 1309.079

DL: 1309.266

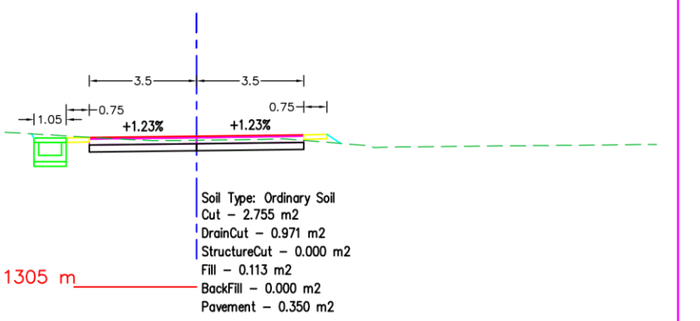


Soil Type: Ordinary Soil
Cut – 1.886 m2
DrainCut – 0.760 m2
StructureCut – 0.994 m2
Fill – 0.485 m2
BackFill – 0.111 m2
Pavement – 0.350 m2

Ch: 0+520

GL: 1309.781

DL: 1309.918

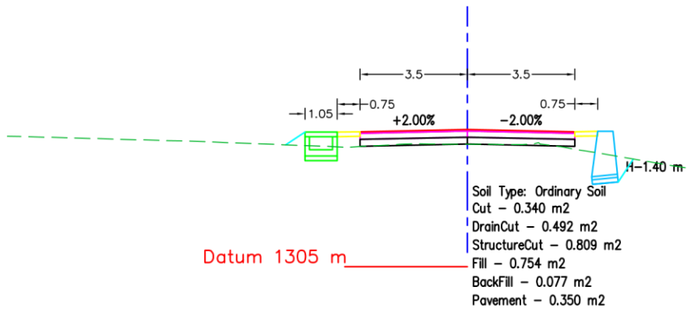


Soil Type: Ordinary Soil
Cut – 2.755 m2
DrainCut – 0.971 m2
StructureCut – 0.000 m2
Fill – 0.113 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 0+380

GL: 1308.990

DL: 1309.468

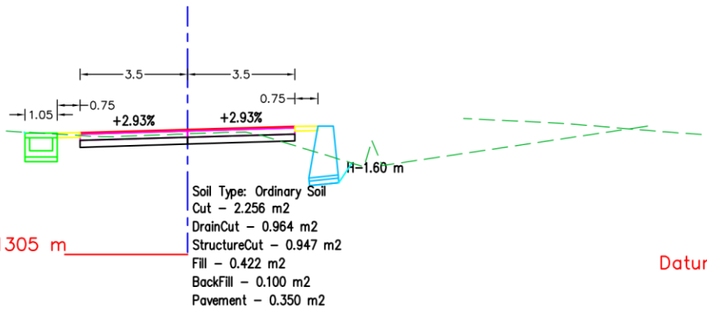


Soil Type: Ordinary Soil
Cut – 0.340 m2
DrainCut – 0.492 m2
StructureCut – 0.809 m2
Fill – 0.754 m2
BackFill – 0.077 m2
Pavement – 0.350 m2

Ch: 0+440

GL: 1308.928

DL: 1309.067

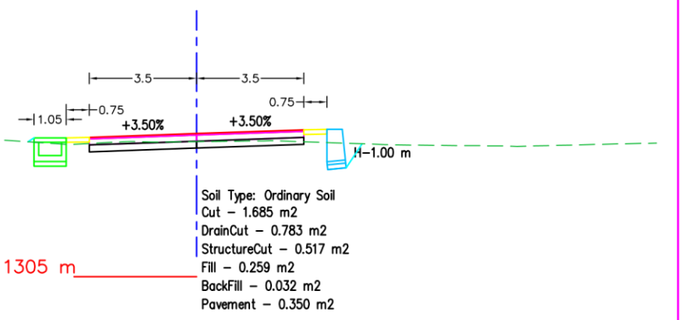


Soil Type: Ordinary Soil
Cut – 2.256 m2
DrainCut – 0.964 m2
StructureCut – 0.947 m2
Fill – 0.422 m2
BackFill – 0.100 m2
Pavement – 0.350 m2

Ch: 0+500

GL: 1309.403

DL: 1309.665

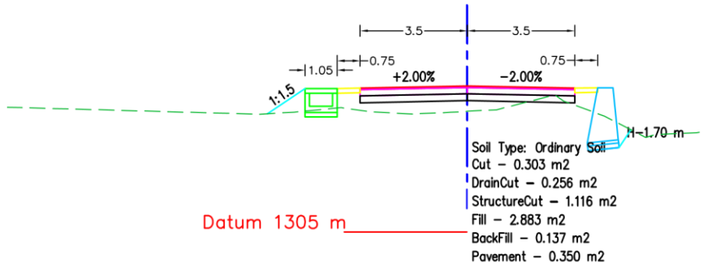


Soil Type: Ordinary Soil
Cut – 1.685 m2
DrainCut – 0.783 m2
StructureCut – 0.517 m2
Fill – 0.259 m2
BackFill – 0.032 m2
Pavement – 0.350 m2

Ch: 0+360

GL: 1308.945

DL: 1309.769

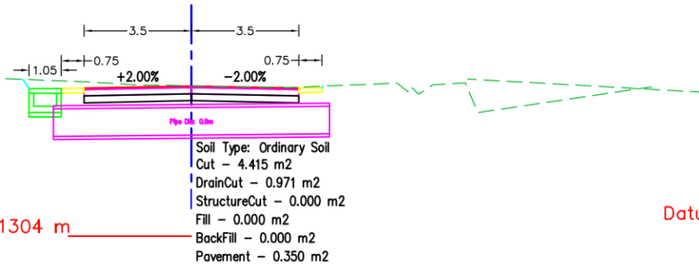


Soil Type: Ordinary Soil
Cut – 0.303 m2
DrainCut – 0.256 m2
StructureCut – 1.116 m2
Fill – 2.883 m2
BackFill – 0.137 m2
Pavement – 0.350 m2

Ch: 0+420

GL: 1308.909

DL: 1308.905

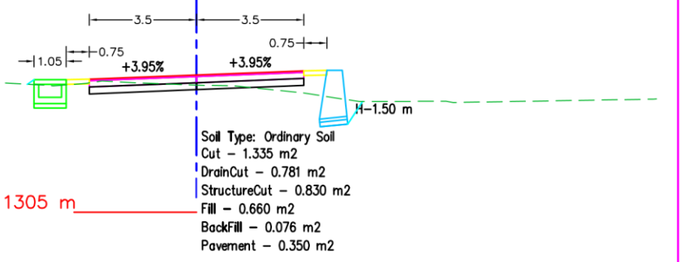


Soil Type: Ordinary Soil
Cut – 4.415 m2
DrainCut – 0.971 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 0+480

GL: 1309.138

DL: 1309.466



Soil Type: Ordinary Soil
Cut – 1.335 m2
DrainCut – 0.781 m2
StructureCut – 0.830 m2
Fill – 0.660 m2
BackFill – 0.076 m2
Pavement – 0.350 m2

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		0+360-0+520	SHEET NO : 3
						APPROVED BY :			

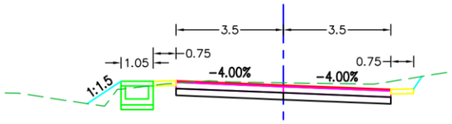
TRIBHUVAN UNIVERSITY

GROUP MEMBERS:

ABINA TAMANG THA076BCE004

DATE REVISION

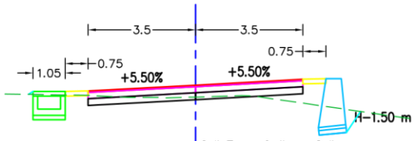
Ch: 0+580
GL: 1312.820
DL: 1312.747



Soil Type: Ordinary Soil
Cut – 4.290 m2
DrainCut – 0.764 m2
StructureCut – 0.000 m2
Fill – 0.290 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1308 m

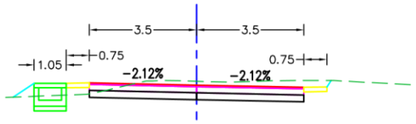
Ch: 0+640
GL: 1313.288
DL: 1313.678



Soil Type: Ordinary Soil
Cut – 0.939 m2
DrainCut – 0.860 m2
StructureCut – 0.789 m2
Fill – 0.701 m2
BackFill – 0.068 m2
Pavement – 0.350 m2

Datum 1309 m

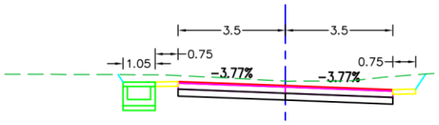
Ch: 0+700
GL: 1314.731
DL: 1314.609



Soil Type: Ordinary Soil
Cut – 4.125 m2
DrainCut – 0.521 m2
StructureCut – 0.000 m2
Fill – 0.313 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1310 m

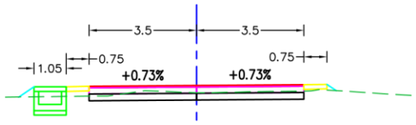
Ch: 0+560
GL: 1312.098
DL: 1311.952



Soil Type: Ordinary Soil
Cut – 5.849 m2
DrainCut – 0.971 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1307 m

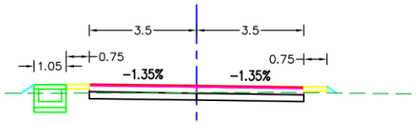
Ch: 0+620
GL: 1313.134
DL: 1313.368



Soil Type: Ordinary Soil
Cut – 1.750 m2
DrainCut – 0.633 m2
StructureCut – 0.000 m2
Fill – 0.269 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1309 m

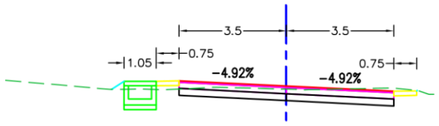
Ch: 0+680
GL: 1314.069
DL: 1314.298



Soil Type: Ordinary Soil
Cut – 1.701 m2
DrainCut – 0.650 m2
StructureCut – 0.000 m2
Fill – 0.230 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1310 m

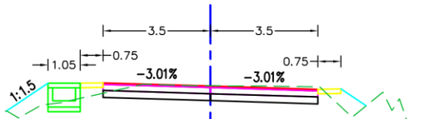
Ch: 0+540
GL: 1310.795
DL: 1310.897



Soil Type: Ordinary Soil
Cut – 2.898 m2
DrainCut – 0.699 m2
StructureCut – 0.000 m2
Fill – 0.149 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1306 m

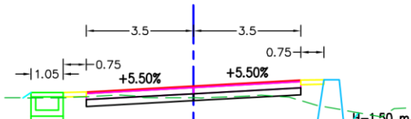
Ch: 0+600
GL: 1313.065
DL: 1313.057



Soil Type: Ordinary Soil
Cut – 3.297 m2
DrainCut – 0.340 m2
StructureCut – 0.000 m2
Fill – 1.311 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1309 m

Ch: 0+660
GL: 1313.606
DL: 1313.988



Soil Type: Ordinary Soil
Cut – 1.102 m2
DrainCut – 0.782 m2
StructureCut – 0.806 m2
Fill – 0.514 m2
BackFill – 0.072 m2
Pavement – 0.350 m2

Datum 1309 m

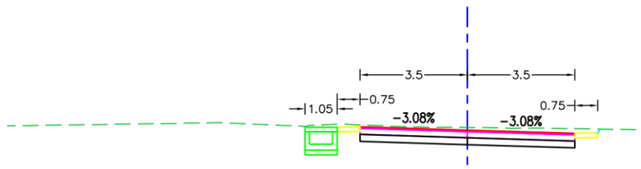
	SAMUNDRA SAPKOTA THA076BCE097 GROUP MEMBERS: ABINA TAMANG THA076BCE004 TRIBHUVAN UNIVERSITY	KALOPATI TO MANDEV MARG ROADSECTION	DATE	REVISION	SIGNATURE	DESIGNED BY : DRAWN BY : CHECKED BY : APPROVED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section 0+540-0+700	DATE: DRG NO : 1 SHEET NO : 4

Design & Drawing by SW Road V2

Ch: 0+760

GL: 1315.625

DL: 1315.539



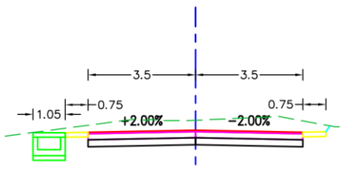
Soil Type: Ordinary Soil
Cut – 4.426 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1311 m

Ch: 0+820

GL: 1317.025

DL: 1316.705



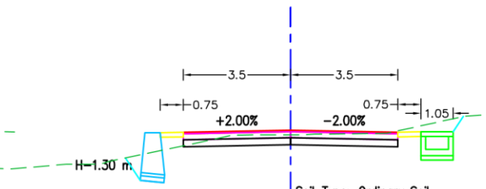
Soil Type: Ordinary Soil
Cut – 6.601 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1312 m

Ch: 0+880

GL: 1318.135

DL: 1318.288



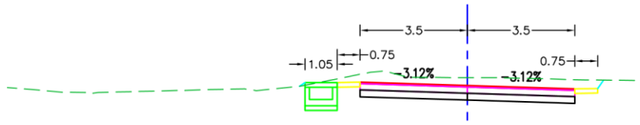
Soil Type: Ordinary Soil
Cut – 3.099 m2
DrainCut – 0.971 m2
StructureCut – 0.758 m2
Fill – 0.258 m2
BackFill – 0.070 m2
Pavement – 0.350 m2

Datum 1314 m

Ch: 0+740

GL: 1315.487

DL: 1315.229



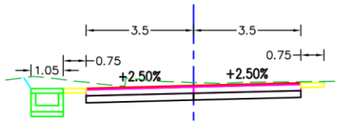
Soil Type: Ordinary Soil
Cut – 5.929 m2
DrainCut – 0.927 m2
StructureCut – 0.000 m2
Fill – 0.007 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1311 m

Ch: 0+800

GL: 1316.283

DL: 1316.186



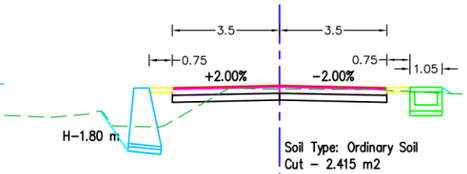
Soil Type: Ordinary Soil
Cut – 4.915 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1312 m

Ch: 0+860

GL: 1317.643

DL: 1317.760



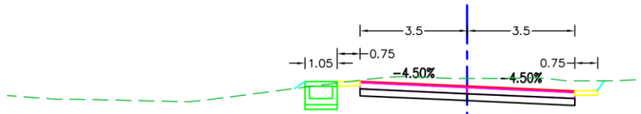
Soil Type: Ordinary Soil
Cut – 2.415 m2
DrainCut – 0.798 m2
StructureCut – 0.931 m2
Fill – 1.009 m2
BackFill – 0.076 m2
Pavement – 0.350 m2

Datum 1313 m

Ch: 0+720

GL: 1315.163

DL: 1314.919



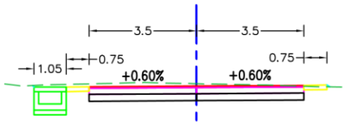
Soil Type: Ordinary Soil
Cut – 5.599 m2
DrainCut – 0.826 m2
StructureCut – 0.000 m2
Fill – 0.031 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1310 m

Ch: 0+780

GL: 1315.926

DL: 1315.849



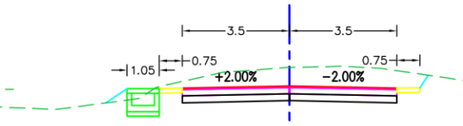
Soil Type: Ordinary Soil
Cut – 4.128 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.003 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1311 m

Ch: 0+840

GL: 1317.837

DL: 1317.232



Soil Type: Ordinary Soil
Cut – 8.016 m2
DrainCut – 0.729 m2
StructureCut – 0.000 m2
Fill – 0.130 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1313 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		0+720-0+880	SHEET NO : 5
						APPROVED BY :			

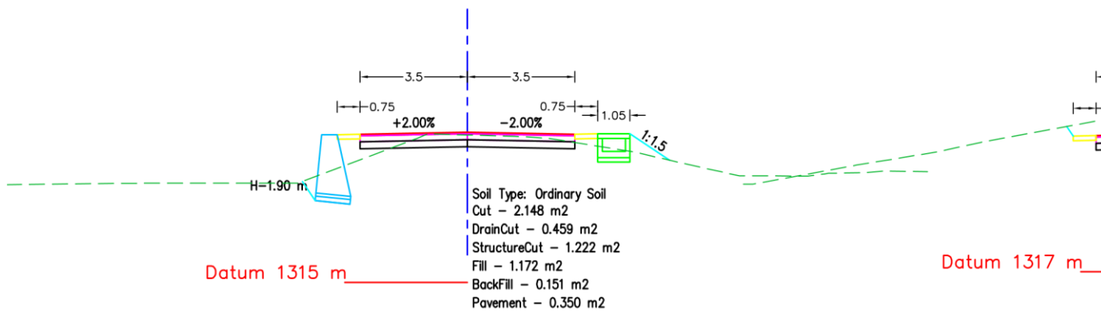
TRIBHUVAN UNIVERSITY

GROUP MEMBERS:

ABINA TAMANG THA076BCE004

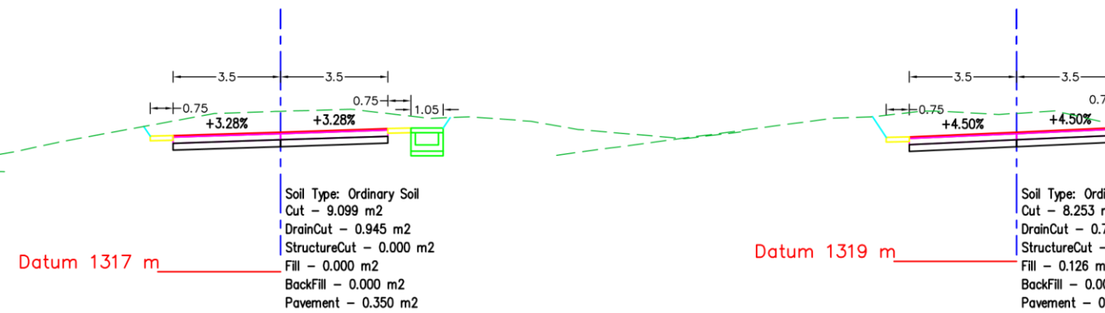
DATE REVISION

Ch: 0+940
GL: 1319.803
DL: 1319.897



Soil Type: Ordinary Soil
Cut – 2.148 m2
DrainCut – 0.459 m2
StructureCut – 1.222 m2
Fill – 1.172 m2
BackFill – 0.151 m2
Pavement – 0.350 m2

Ch: 1+000
GL: 1322.228
DL: 1321.553

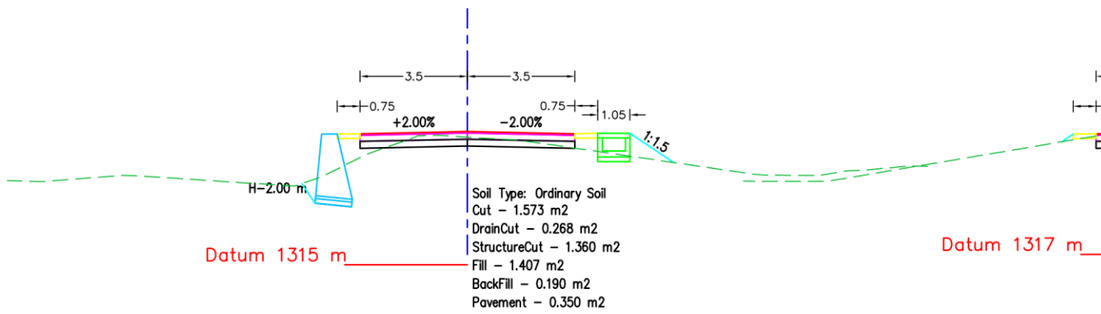


Soil Type: Ordinary Soil
Cut – 9.099 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+060
GL: 1323.818
DL: 1323.209

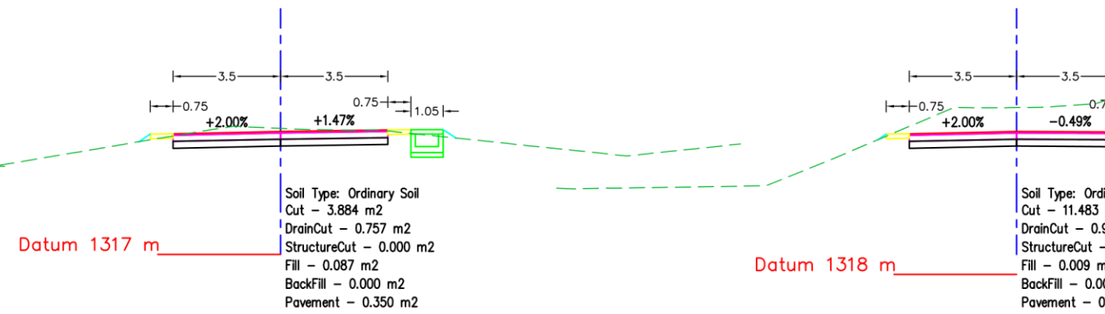
Soil Type: Ordinary Soil
Cut – 8.253 m2
DrainCut – 0.701 m2
StructureCut – 0.000 m2
Fill – 0.126 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 0+920
GL: 1319.160
DL: 1319.345



Soil Type: Ordinary Soil
Cut – 1.573 m2
DrainCut – 0.268 m2
StructureCut – 1.360 m2
Fill – 1.407 m2
BackFill – 0.190 m2
Pavement – 0.350 m2

Ch: 0+980
GL: 1321.103
DL: 1321.001

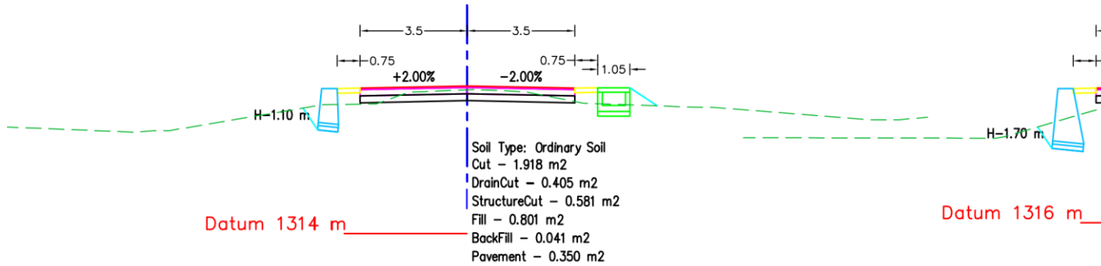


Soil Type: Ordinary Soil
Cut – 3.884 m2
DrainCut – 0.757 m2
StructureCut – 0.000 m2
Fill – 0.087 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+040
GL: 1323.438
DL: 1322.657

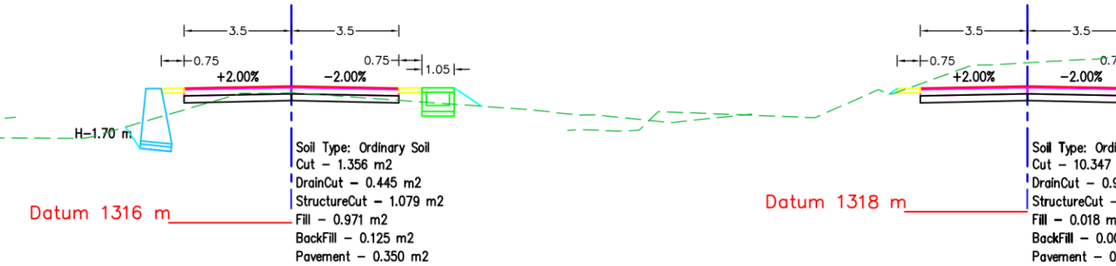
Soil Type: Ordinary Soil
Cut – 11.483 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.009 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 0+900
GL: 1318.691
DL: 1318.815



Soil Type: Ordinary Soil
Cut – 1.918 m2
DrainCut – 0.405 m2
StructureCut – 0.581 m2
Fill – 0.801 m2
BackFill – 0.041 m2
Pavement – 0.350 m2

Ch: 0+960
GL: 1320.228
DL: 1320.449



Soil Type: Ordinary Soil
Cut – 1.356 m2
DrainCut – 0.445 m2
StructureCut – 1.079 m2
Fill – 0.971 m2
BackFill – 0.125 m2
Pavement – 0.350 m2

Ch: 1+020
GL: 1322.864
DL: 1322.105

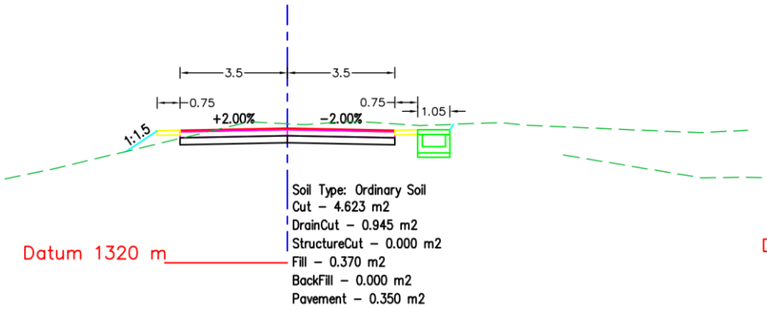
Soil Type: Ordinary Soil
Cut – 10.347 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.018 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION				DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		0+900-1+060	SHEET NO : 6
	GROUP MEMBERS:		DATE	REVISION	SIGNATURE	APPROVED BY :			
TRIBHUVAN UNIVERSITY	ABINA TAMANG THA076BCE004								

Ch: 1+120

GL: 1324.531

DL: 1324.392

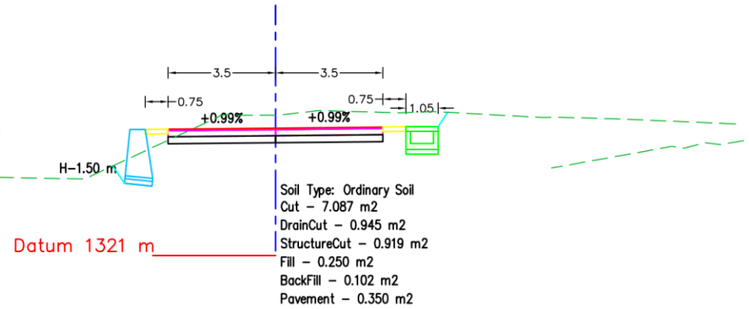


Soil Type: Ordinary Soil
Cut – 4.623 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.370 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+180

GL: 1325.572

DL: 1325.150

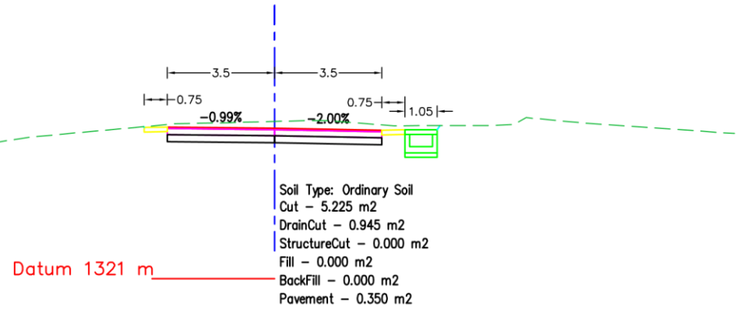


Soil Type: Ordinary Soil
Cut – 7.087 m2
DrainCut – 0.945 m2
StructureCut – 0.919 m2
Fill – 0.250 m2
BackFill – 0.102 m2
Pavement – 0.350 m2

Ch: 1+240

GL: 1326.123

DL: 1325.907

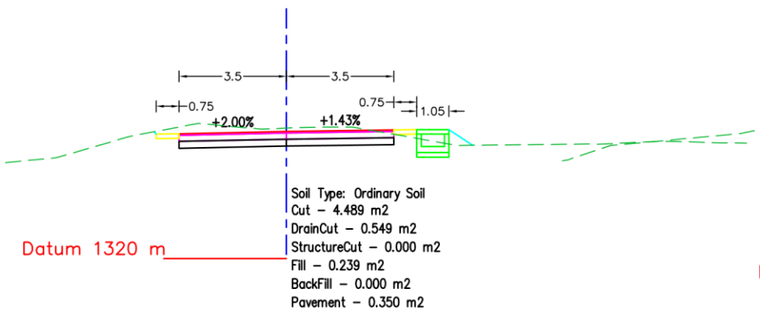


Soil Type: Ordinary Soil
Cut – 5.225 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+100

GL: 1324.251

DL: 1324.139

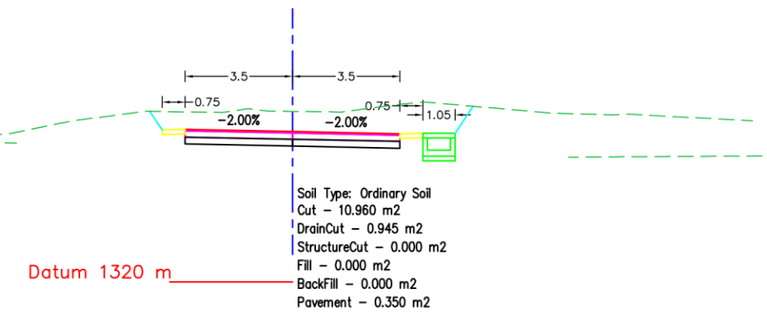


Soil Type: Ordinary Soil
Cut – 4.489 m2
DrainCut – 0.549 m2
StructureCut – 0.000 m2
Fill – 0.239 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+160

GL: 1325.554

DL: 1324.897

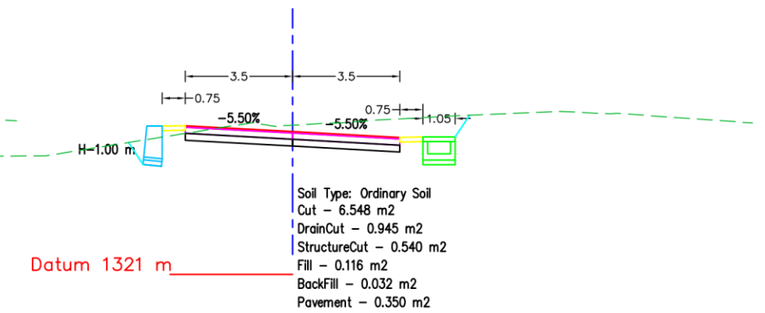


Soil Type: Ordinary Soil
Cut – 10.960 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+220

GL: 1325.859

DL: 1325.655

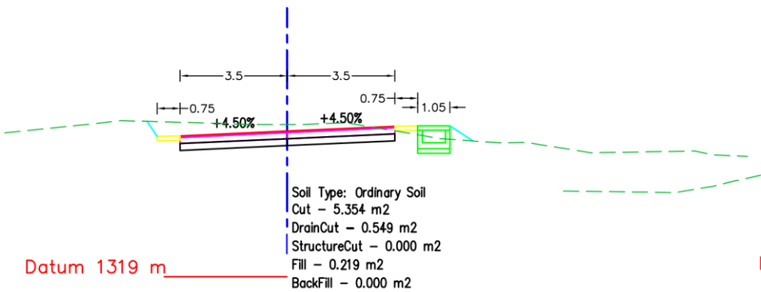


Soil Type: Ordinary Soil
Cut – 6.548 m2
DrainCut – 0.945 m2
StructureCut – 0.540 m2
Fill – 0.116 m2
BackFill – 0.032 m2
Pavement – 0.350 m2

Ch: 1+080

GL: 1323.971

DL: 1323.761

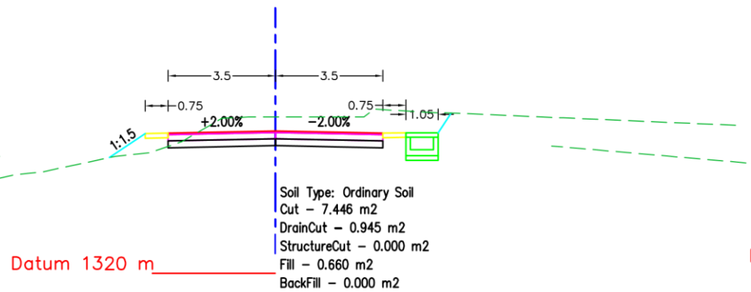


Soil Type: Ordinary Soil
Cut – 5.354 m2
DrainCut – 0.549 m2
StructureCut – 0.000 m2
Fill – 0.219 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+140

GL: 1325.102

DL: 1324.645

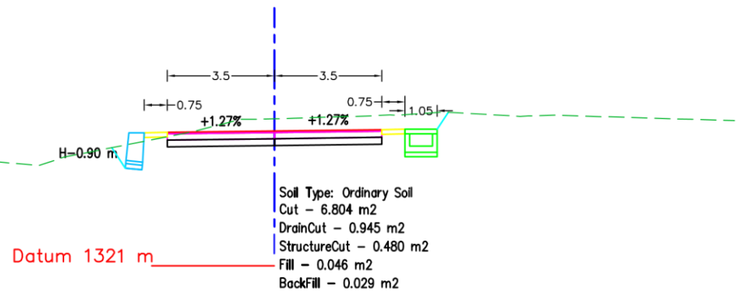


Soil Type: Ordinary Soil
Cut – 7.446 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.660 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+200

GL: 1325.800

DL: 1325.402



Soil Type: Ordinary Soil
Cut – 6.804 m2
DrainCut – 0.945 m2
StructureCut – 0.480 m2
Fill – 0.046 m2
BackFill – 0.029 m2
Pavement – 0.350 m2

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		1+080-1+240	SHEET NO : 7
						APPROVED BY :			

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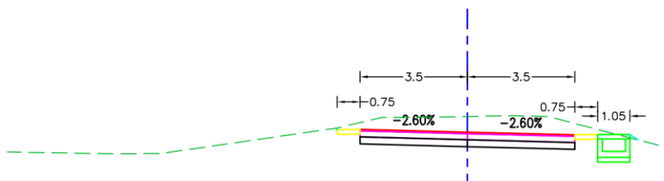
GROUP MEMBERS:

ABINA TAMANG THA076BCE004

DATE REVISION

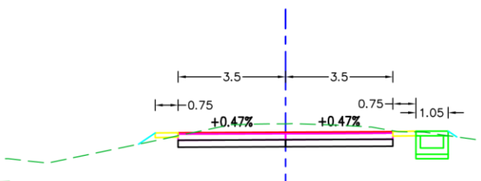
Ch: 1+300
GL: 1328.032
DL: 1327.525



Soil Type: Ordinary Soil
Cut – 7.249 m2
DrainCut – 0.922 m2
StructureCut – 0.000 m2
Fill – 0.015 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1323 m

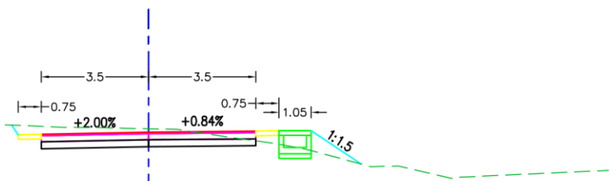
Ch: 1+360
GL: 1329.807
DL: 1329.535



Soil Type: Ordinary Soil
Cut – 4.726 m2
DrainCut – 0.865 m2
StructureCut – 0.000 m2
Fill – 0.111 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1325 m

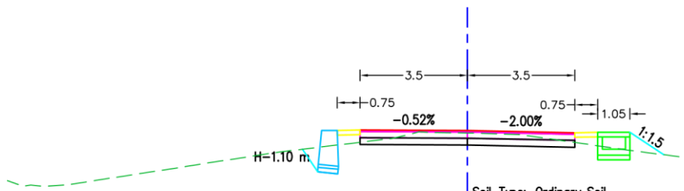
Ch: 1+420
GL: 1330.834
DL: 1330.725



Soil Type: Ordinary Soil
Cut – 4.084 m2
DrainCut – 0.380 m2
StructureCut – 0.000 m2
Fill – 0.695 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1326 m

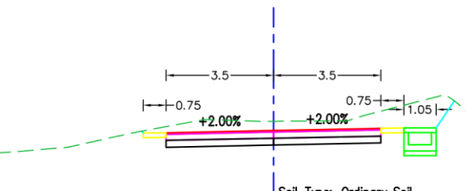
Ch: 1+280
GL: 1326.777
DL: 1326.855



Soil Type: Ordinary Soil
Cut – 2.412 m2
DrainCut – 0.402 m2
StructureCut – 0.592 m2
Fill – 0.707 m2
BackFill – 0.042 m2
Pavement – 0.350 m2

Datum 1322 m

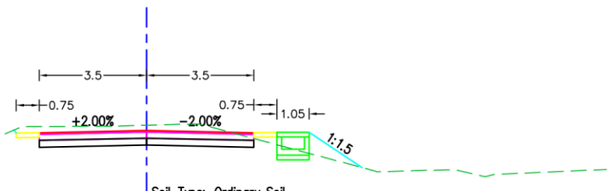
Ch: 1+340
GL: 1329.168
DL: 1328.865



Soil Type: Ordinary Soil
Cut – 7.708 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1324 m

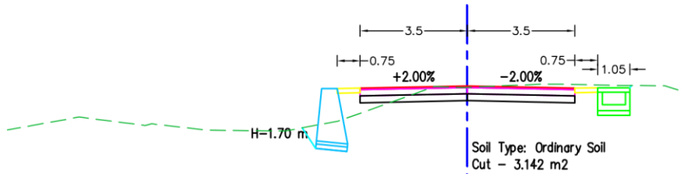
Ch: 1+400
GL: 1330.662
DL: 1330.489



Soil Type: Ordinary Soil
Cut – 4.637 m2
DrainCut – 0.372 m2
StructureCut – 0.000 m2
Fill – 0.703 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1326 m

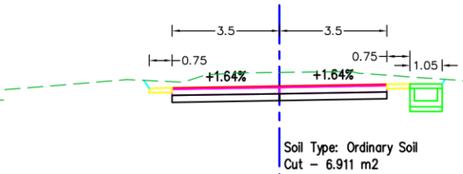
Ch: 1+260
GL: 1326.162
DL: 1326.205



Soil Type: Ordinary Soil
Cut – 3.142 m2
DrainCut – 0.945 m2
StructureCut – 0.944 m2
Fill – 0.668 m2
BackFill – 0.094 m2
Pavement – 0.350 m2

Datum 1322 m

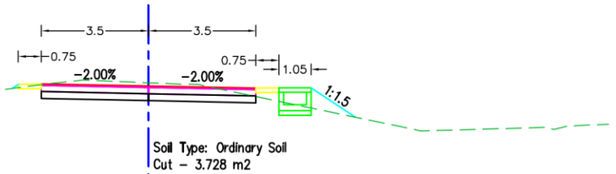
Ch: 1+320
GL: 1328.639
DL: 1328.195



Soil Type: Ordinary Soil
Cut – 6.911 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1324 m

Ch: 1+380
GL: 1330.297
DL: 1330.192



Soil Type: Ordinary Soil
Cut – 3.728 m2
DrainCut – 0.367 m2
StructureCut – 0.000 m2
Fill – 0.640 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1326 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION				DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		1+260-1+420	SHEET NO : 8
						APPROVED BY :			

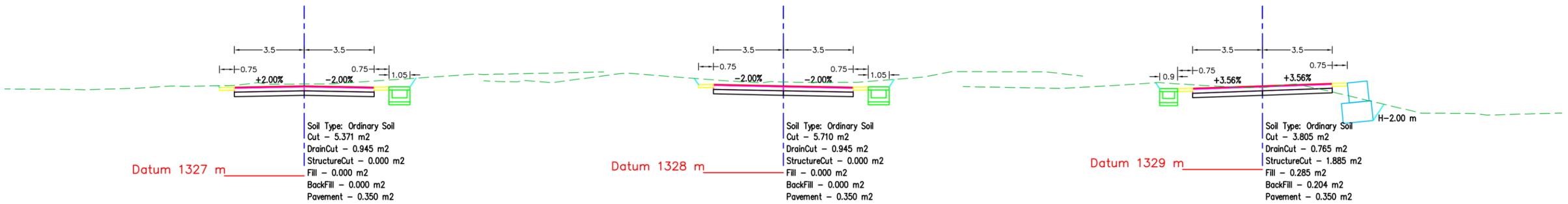
TRIBHUVAN UNIVERSITY

GROUP MEMBERS:

ABINA TAMANG THA076BCE004

DATE REVISION SIGNATURE

Ch: 1+480
GL: 1331.605
DL: 1331.518



Soil Type: Ordinary Soil
Cut – 5.371 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

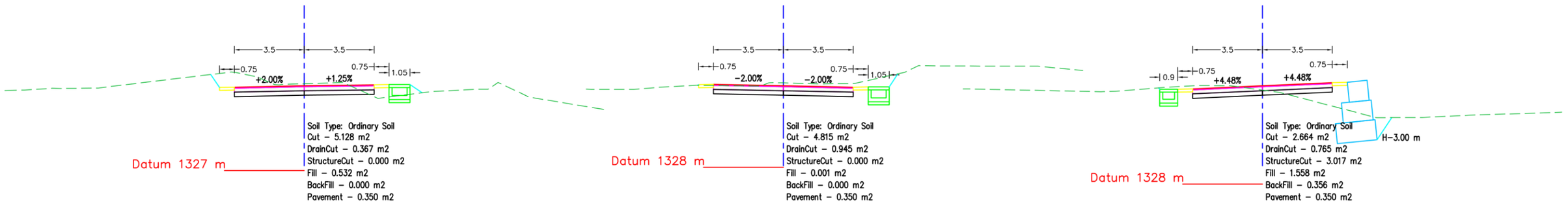
Ch: 1+540
GL: 1332.550
DL: 1332.355

Soil Type: Ordinary Soil
Cut – 5.710 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+600
GL: 1333.111
DL: 1333.191

Soil Type: Ordinary Soil
Cut – 3.805 m2
DrainCut – 0.765 m2
StructureCut – 1.885 m2
Fill – 0.285 m2
BackFill – 0.204 m2
Pavement – 0.350 m2

Ch: 1+460
GL: 1331.342
DL: 1331.240



Soil Type: Ordinary Soil
Cut – 5.128 m2
DrainCut – 0.367 m2
StructureCut – 0.000 m2
Fill – 0.532 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

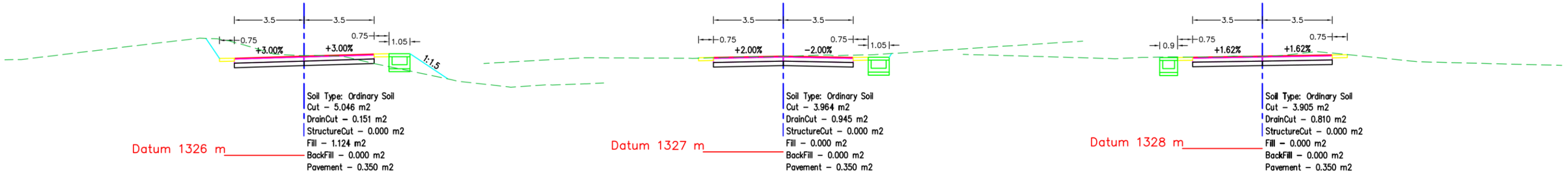
Ch: 1+520
GL: 1332.219
DL: 1332.076

Soil Type: Ordinary Soil
Cut – 4.815 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.001 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+580
GL: 1332.695
DL: 1332.912

Soil Type: Ordinary Soil
Cut – 2.664 m2
DrainCut – 0.765 m2
StructureCut – 3.017 m2
Fill – 1.558 m2
BackFill – 0.356 m2
Pavement – 0.350 m2

Ch: 1+440
GL: 1330.991
DL: 1330.962



Soil Type: Ordinary Soil
Cut – 5.046 m2
DrainCut – 0.151 m2
StructureCut – 0.000 m2
Fill – 1.124 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+500
GL: 1331.787
DL: 1331.797

Soil Type: Ordinary Soil
Cut – 3.964 m2
DrainCut – 0.945 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 1+560
GL: 1332.619
DL: 1332.634

Soil Type: Ordinary Soil
Cut – 3.905 m2
DrainCut – 0.810 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		1+440-1+600	SHEET NO : 9
						APPROVED BY :			

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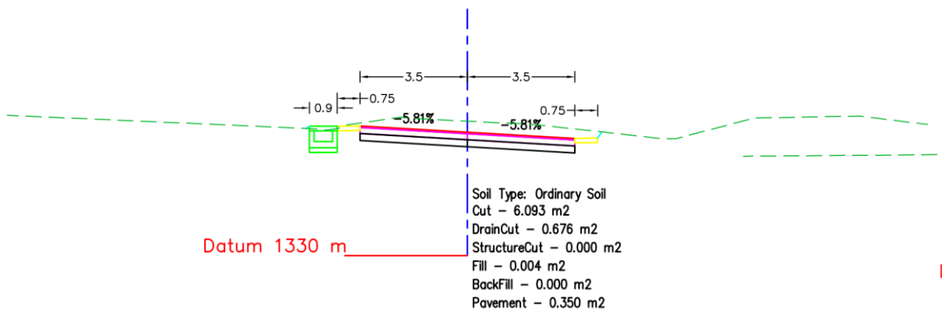
Ch: 1+660

GL: 1334.383

DL: 1334.028



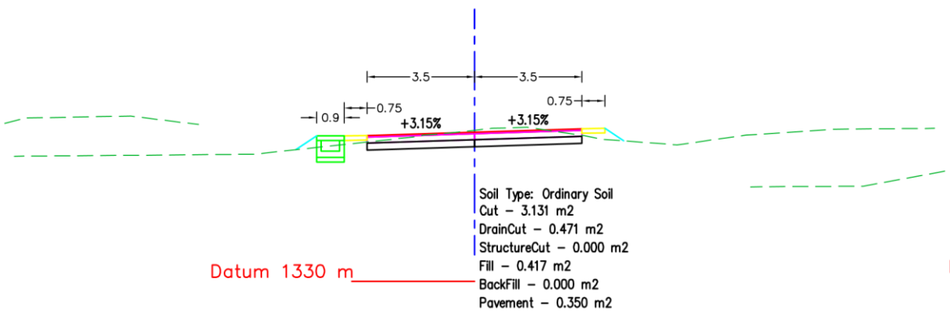
Soil Type: Ordinary Soil
Cut – 6.093 m2
DrainCut – 0.676 m2
StructureCut – 0.000 m2
Fill – 0.004 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1330 m

Ch: 1+720

GL: 1334.923

DL: 1334.864



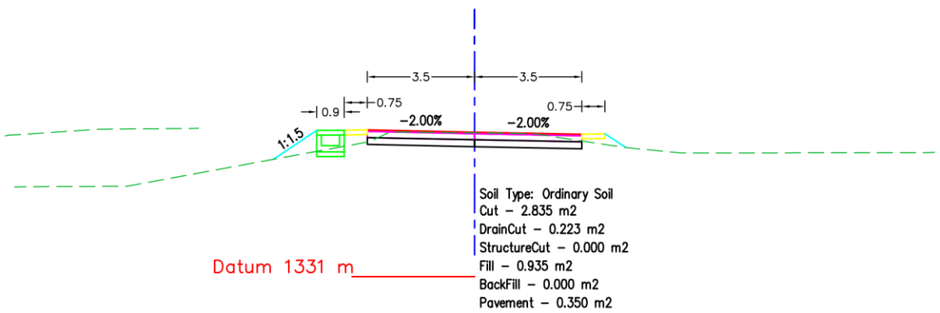
Soil Type: Ordinary Soil
Cut – 3.131 m2
DrainCut – 0.471 m2
StructureCut – 0.000 m2
Fill – 0.417 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1330 m

Ch: 1+780

GL: 1335.684

DL: 1335.708



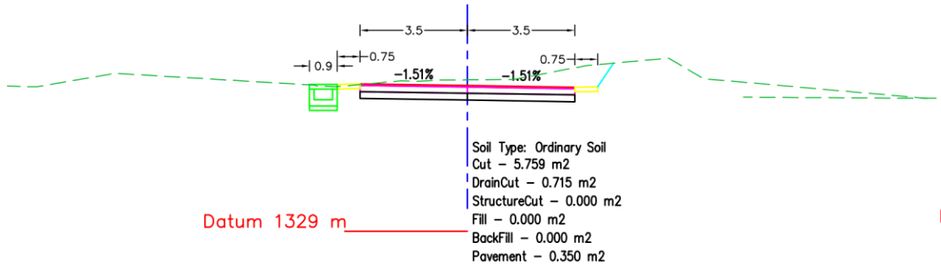
Soil Type: Ordinary Soil
Cut – 2.835 m2
DrainCut – 0.223 m2
StructureCut – 0.000 m2
Fill – 0.935 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1331 m

Ch: 1+640

GL: 1333.935

DL: 1333.749



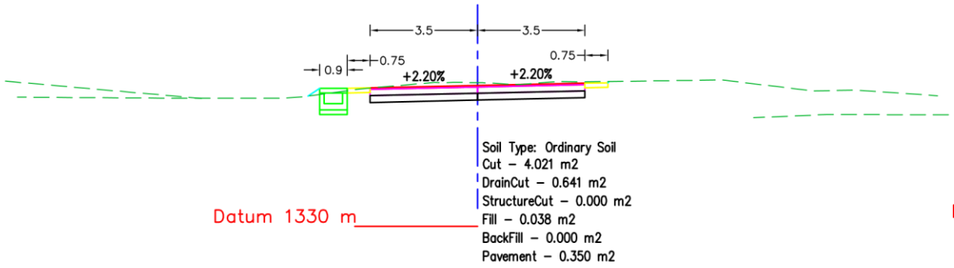
Soil Type: Ordinary Soil
Cut – 5.759 m2
DrainCut – 0.715 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1329 m

Ch: 1+700

GL: 1334.681

DL: 1334.585



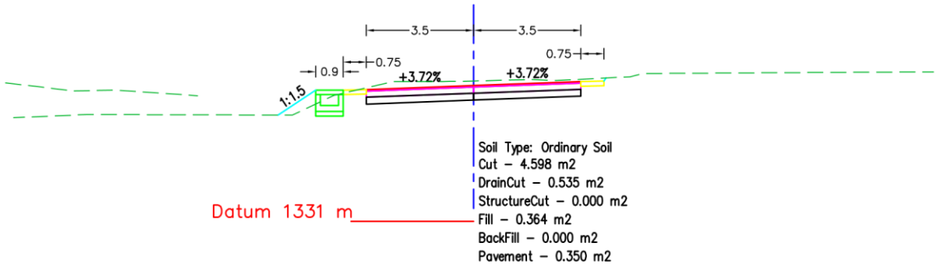
Soil Type: Ordinary Soil
Cut – 4.021 m2
DrainCut – 0.641 m2
StructureCut – 0.000 m2
Fill – 0.038 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1330 m

Ch: 1+760

GL: 1335.570

DL: 1335.422



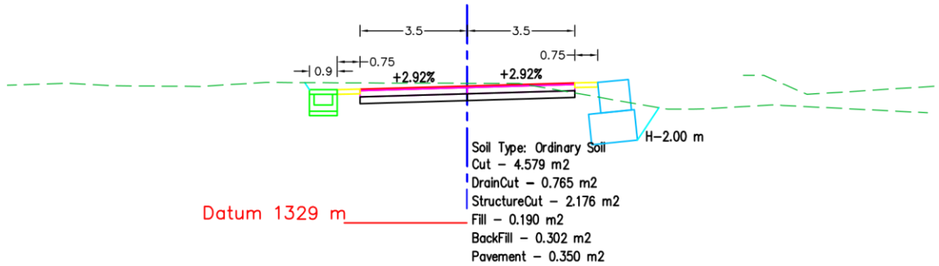
Soil Type: Ordinary Soil
Cut – 4.598 m2
DrainCut – 0.535 m2
StructureCut – 0.000 m2
Fill – 0.364 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1331 m

Ch: 1+620

GL: 1333.560

DL: 1333.470



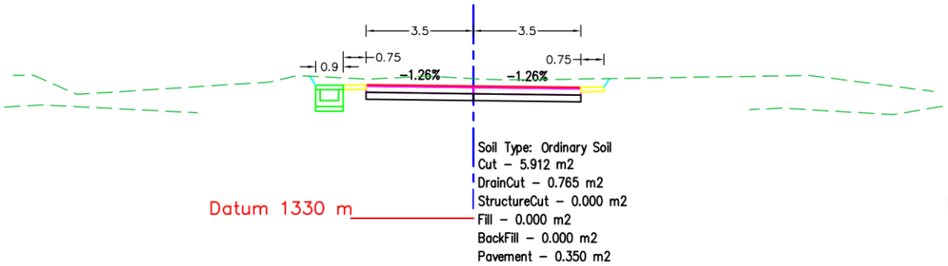
Soil Type: Ordinary Soil
Cut – 4.579 m2
DrainCut – 0.765 m2
StructureCut – 2.176 m2
Fill – 0.190 m2
BackFill – 0.302 m2
Pavement – 0.350 m2

Datum 1329 m

Ch: 1+680

GL: 1334.547

DL: 1334.307



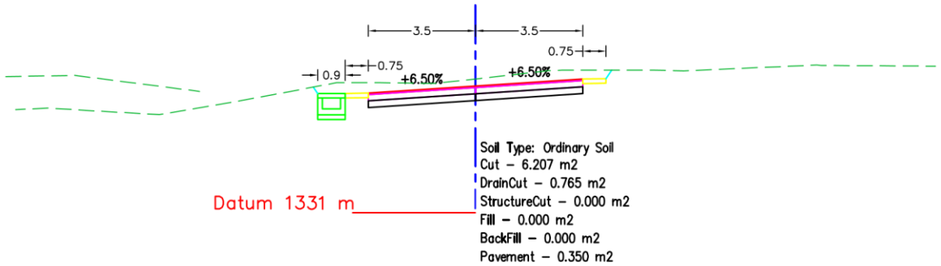
Soil Type: Ordinary Soil
Cut – 5.912 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1330 m

Ch: 1+740

GL: 1335.374

DL: 1335.143



Soil Type: Ordinary Soil
Cut – 6.207 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1331 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION				DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		1+620-1+780	SHEET NO : 10
						APPROVED BY :			

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ABINA TAMANG THA076BCE004

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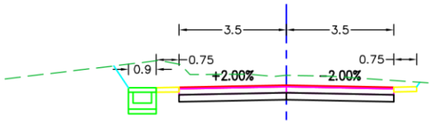
Design & Drawing by SW Road V2

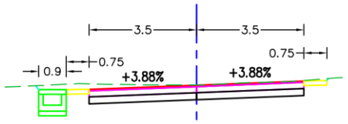
Ch: 1+840
GL: 1337.372
DL: 1337.053



Soil Type: Ordinary Soil
Cut – 7.612 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1333 m

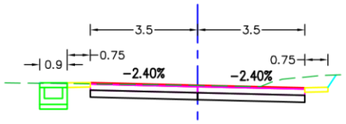
Ch: 1+900
GL: 1339.799
DL: 1339.798



Soil Type: Ordinary Soil
Cut – 4.160 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1335 m

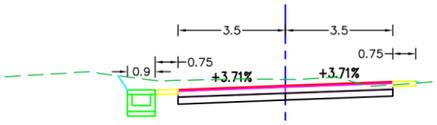
Ch: 1+960
GL: 1342.531
DL: 1342.543



Soil Type: Ordinary Soil
Cut – 4.071 m2
DrainCut – 0.750 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1338 m

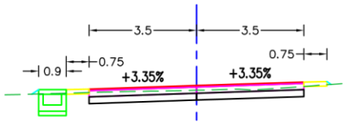
Ch: 1+820
GL: 1336.682
DL: 1336.484



Soil Type: Ordinary Soil
Cut – 5.311 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.003 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1332 m

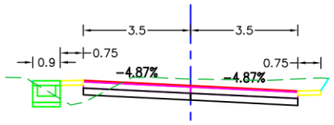
Ch: 1+880
GL: 1338.731
DL: 1338.883



Soil Type: Ordinary Soil
Cut – 2.326 m2
DrainCut – 0.649 m2
StructureCut – 0.000 m2
Fill – 0.023 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1334 m

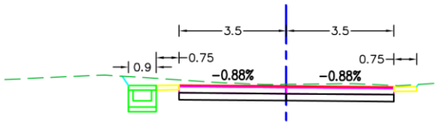
Ch: 1+940
GL: 1341.841
DL: 1341.628



Soil Type: Ordinary Soil
Cut – 4.750 m2
DrainCut – 0.482 m2
StructureCut – 0.000 m2
Fill – 0.489 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1337 m

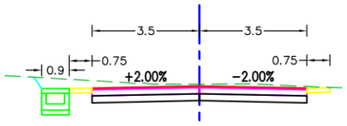
Ch: 1+800
GL: 1336.148
DL: 1336.092



Soil Type: Ordinary Soil
Cut – 4.585 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1332 m

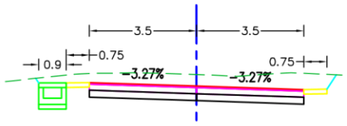
Ch: 1+860
GL: 1338.031
DL: 1337.968



Soil Type: Ordinary Soil
Cut – 4.860 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1333 m

Ch: 1+920
GL: 1341.088
DL: 1340.713



Soil Type: Ordinary Soil
Cut – 7.153 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1336 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		1+800-1+960	SHEET NO : 11
						APPROVED BY :			

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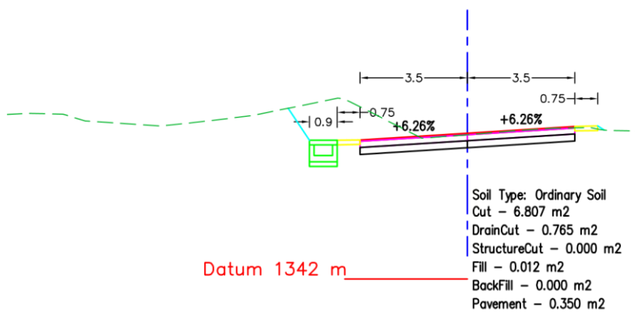
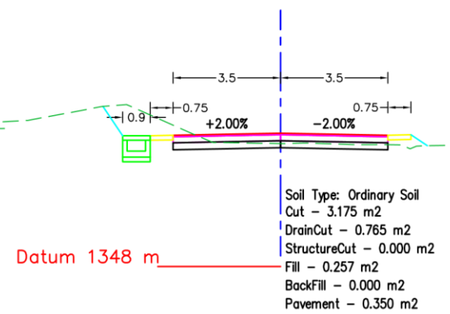
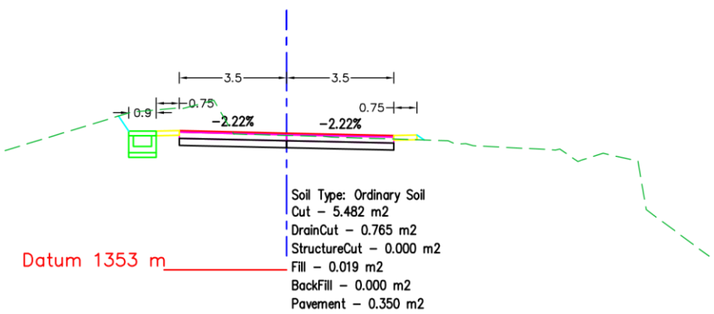
Ch: 2+020
GL:1346.698
DL:1346.752



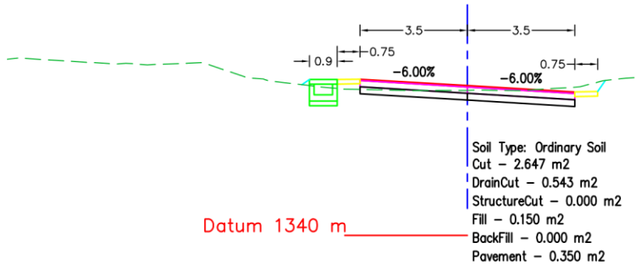
Ch: 2+080
GL:1352.008
DL:1352.351



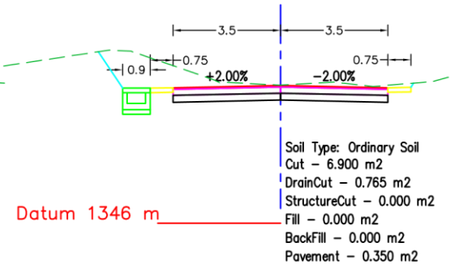
Ch: 2+140
GL:1357.383
DL:1357.460



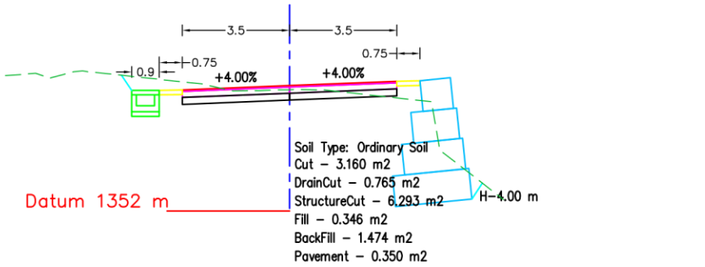
Ch: 2+000
GL:1344.732
DL:1344.885



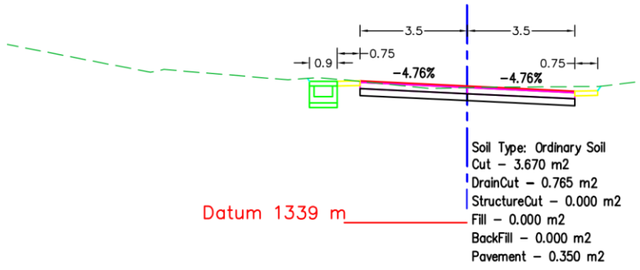
Ch: 2+060
GL:1350.500
DL:1350.485



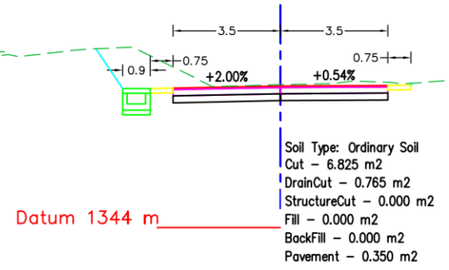
Ch: 2+120
GL:1355.948
DL:1356.084



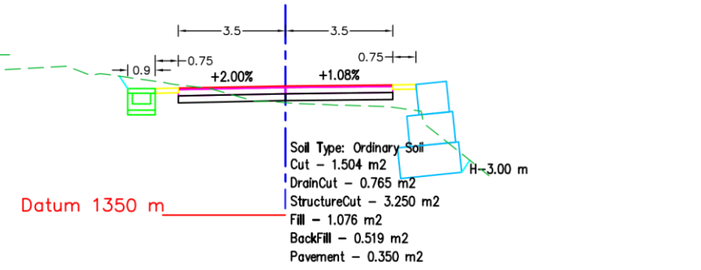
Ch: 1+980
GL:1343.405
DL:1343.458



Ch: 2+040
GL:1348.664
DL:1348.618



Ch: 2+100
GL:1353.679
DL:1354.218



	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		1+980-2+140	SHEET NO : 12
						APPROVED BY :			

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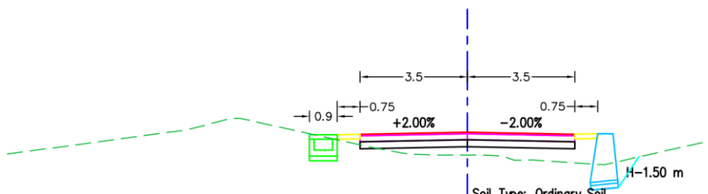
DATE REVISION

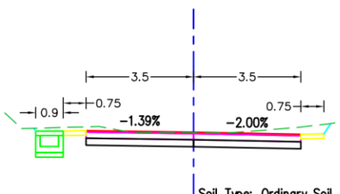
Ch: 2+200
GL: 1358.953
DL: 1359.700



Soil Type: Ordinary Soil
Cut – 0.318 m2
DrainCut – 0.704 m2
StructureCut – 0.751 m2
Fill – 2.456 m2
BackFill – 0.063 m2
Pavement – 0.350 m2

Datum 1355 m

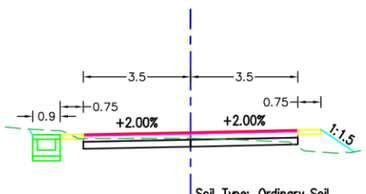
Ch: 2+260
GL: 1361.919
DL: 1361.941



Soil Type: Ordinary Soil
Cut – 4.271 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1357 m

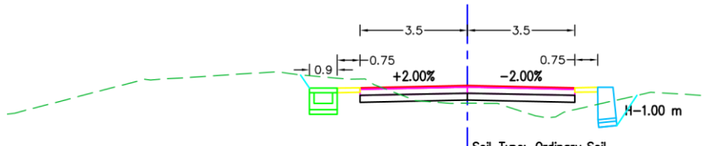
Ch: 2+320
GL: 1363.971
DL: 1364.181



Soil Type: Ordinary Soil
Cut – 1.901 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.829 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1360 m

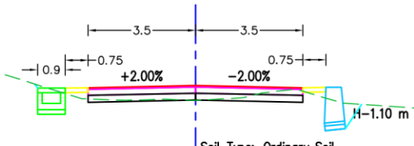
Ch: 2+180
GL: 1358.379
DL: 1358.954



Soil Type: Ordinary Soil
Cut – 1.706 m2
DrainCut – 0.765 m2
StructureCut – 0.491 m2
Fill – 1.438 m2
BackFill – 0.034 m2
Pavement – 0.350 m2

Datum 1354 m

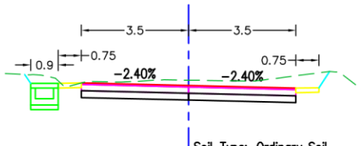
Ch: 2+240
GL: 1360.712
DL: 1361.194



Soil Type: Ordinary Soil
Cut – 1.093 m2
DrainCut – 0.717 m2
StructureCut – 0.639 m2
Fill – 0.169 m2
BackFill – 0.048 m2
Pavement – 0.350 m2

Datum 1357 m

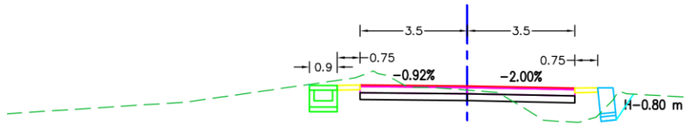
Ch: 2+300
GL: 1363.610
DL: 1363.435



Soil Type: Ordinary Soil
Cut – 5.332 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1359 m

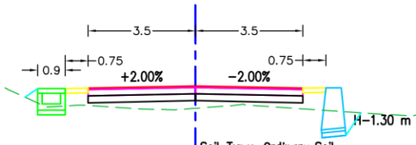
Ch: 2+160
GL: 1358.075
DL: 1358.207



Soil Type: Ordinary Soil
Cut – 2.926 m2
DrainCut – 0.765 m2
StructureCut – 0.271 m2
Fill – 1.620 m2
BackFill – 0.029 m2
Pavement – 0.350 m2

Datum 1354 m

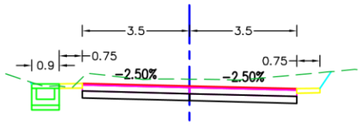
Ch: 2+220
GL: 1359.722
DL: 1360.447



Soil Type: Ordinary Soil
Cut – 0.188 m2
DrainCut – 0.254 m2
StructureCut – 0.665 m2
Fill – 2.114 m2
BackFill – 0.052 m2
Pavement – 0.350 m2

Datum 1356 m

Ch: 2+280
GL: 1362.912
DL: 1362.688



Soil Type: Ordinary Soil
Cut – 5.823 m2
DrainCut – 0.716 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1358 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		2+160-2+320	SHEET NO : 13
						APPROVED BY :			

TRIBHUVAN UNIVERSITY

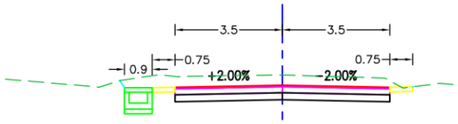
GROUP MEMBERS:

ABINA TAMANG THA076BCE004

DATE REVISION

Design & Drawing by SW Road V2

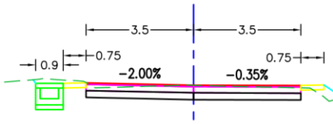
Ch: 2+380
GL:1368.567
DL:1368.240



Datum 1364 m

Soil Type: Ordinary Soil
Cut – 6.469 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

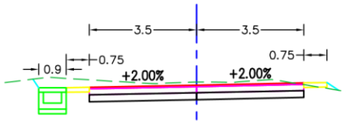
Ch: 2+440
GL:1372.210
DL:1372.221



Datum 1368 m

Soil Type: Ordinary Soil
Cut – 3.224 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.199 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

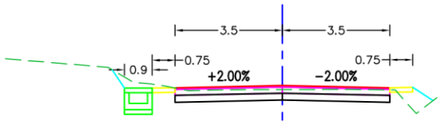
Ch: 2+500
GL:1373.049
DL:1372.951



Datum 1368 m

Soil Type: Ordinary Soil
Cut – 4.700 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.041 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

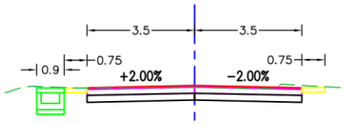
Ch: 2+360
GL:1366.330
DL:1366.461



Datum 1362 m

Soil Type: Ordinary Soil
Cut – 3.063 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.444 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

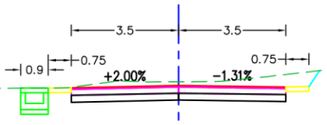
Ch: 2+420
GL:1371.628
DL:1371.686



Datum 1367 m

Soil Type: Ordinary Soil
Cut – 3.436 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

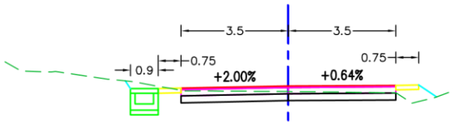
Ch: 2+480
GL:1372.829
DL:1372.707



Datum 1368 m

Soil Type: Ordinary Soil
Cut – 5.203 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

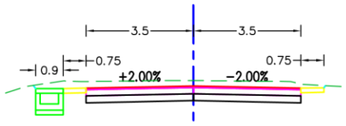
Ch: 2+340
GL:1364.751
DL:1364.931



Datum 1360 m

Soil Type: Ordinary Soil
Cut – 2.399 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.392 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

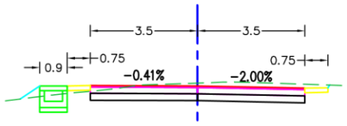
Ch: 2+400
GL:1370.199
DL:1370.020



Datum 1366 m

Soil Type: Ordinary Soil
Cut – 5.347 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Ch: 2+460
GL:1372.562
DL:1372.464



Datum 1368 m

Soil Type: Ordinary Soil
Cut – 3.976 m2
DrainCut – 0.503 m2
StructureCut – 0.000 m2
Fill – 0.157 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION				DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
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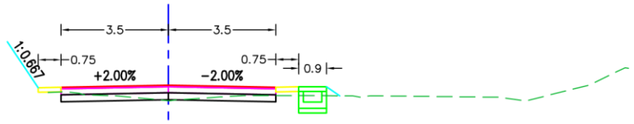
						CHECKED BY :		2+340-2+500	SHEET NO : 14
TRIBHUVAN UNIVERSITY	GROUP MEMBERS:		DATE	REVISION	SIGNATURE	APPROVED BY :			
	ABINA TAMANG THA076BCE004								

Ch: 2+560

GL: 1373.172

DL: 1373.681



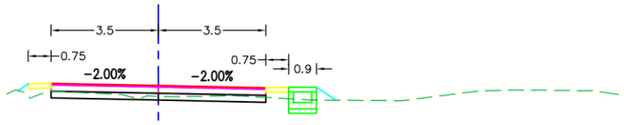
Soil Type: Ordinary Soil
Cut – 0.925 m2
DrainCut – 0.504 m2
StructureCut – 0.000 m2
Fill – 0.172 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1369 m

Ch: 2+540

GL: 1373.085

DL: 1373.438



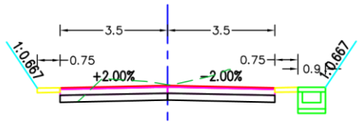
Soil Type: Ordinary Soil
Cut – 1.106 m2
DrainCut – 0.404 m2
StructureCut – 0.000 m2
Fill – 0.482 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1369 m

Ch: 2+589.43

GL: 1374.069

DL: 1374.039



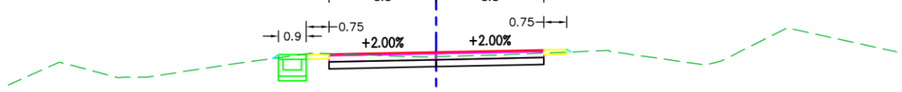
Soil Type: Ordinary Soil
Cut – 0.000 m2
DrainCut – 0.000 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1370 m

Ch: 2+520

GL: 1373.045

DL: 1373.194



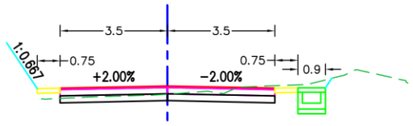
Soil Type: Ordinary Soil
Cut – 2.760 m2
DrainCut – 0.727 m2
StructureCut – 0.000 m2
Fill – 0.015 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1369 m

Ch: 2+580

GL: 1373.660

DL: 1373.924



Soil Type: Ordinary Soil
Cut – 2.264 m2
DrainCut – 0.765 m2
StructureCut – 0.000 m2
Fill – 0.000 m2
BackFill – 0.000 m2
Pavement – 0.350 m2

Datum 1369 m

	SAMUNDRA SAPKOTA THA076BCE097	KALOPATI TO MANDEV MARG ROADSECTION			SIGNATURE	DESIGNED BY :	SCALE 1:200 (2 m 0 4 m)	Cross-Section	DATE:
						DRAWN BY :			DRG NO : 1
						CHECKED BY :		2+520-2+589.43	SHEET NO : 15
						APPROVED BY :			

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GROUP MEMBERS:

ABINA TAMANG THA076BCE004

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