**SANJAY MEMORIAL INSTITUTE OF TECHNOLOGY**

Approved by AICTE New Delhi & Affiliated to B.P.U.T. (Rourkela)

Certified by ISO 9001-2000



**A PROJECT REPORT ON**

**EXTENSION OF AN EXISTING HIGHWAY**

****

**BY**

**STUDENTS OF CIVIL ENGINEERING**

**BATCH:-**2010-14

Under the guidance of

**Prof. Sitaram Panda**

**SANJAY MEMORIAL INSTITUTE OF TECHNOLOGY**

DEGREE ENGINEERING COLLEGE

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Submitted in partial fulfillment of the requirement for award of the degree of B.Tech(Civil Engineering)

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**CERTIFICATE**

**DATE: 15/04/2014**

This is to certify that this project report entitled “**Road Project**” is submitted by the students as mentioned in pre page of 2014 batch (Civil) in partial fulfillment of requirement for the award of degree of bachelor of technology from BPUT. It is a faithful record of students own work carried out by them under my supervision & guidance during the 8th semester of the academic session of 2014 . To the best of my knowledge & belief, this work is original and not submitted earlier in connection with any academic obligation.

**PROF.S.R.PANDA**

**H.O.D**

**CIVIL ENGINEERING DEPARTMENT**

**ACKNOWLEDGEMENT**

First we want to thank the almighty God for showering His wonderful blessings on us and giving a sound mind for making our life purposeful.

At the beginning of our project, we were completely lonely distracted, depressed and full of worries regarding the completion of our project . We were completely hopeless thinking about how to bring it to end.

We would like to think the most supportive person without whom this project would have been a mere dream to complete. The person is none other than **Professor Sitaram Panda, H.O.D.(Dept. of Civil Engineering)** who guided us from beginning to end. He is a guide, path finder, philosopher throughout the project. His patient of listening our doubts, clearing them at any time, problem solving ability has made it possible. This project is result of his support and work which can’t be expressed in words. We thank him for his endless support and help.

We also like to thank our principal for his support and help during the period. We thank him for giving his valuable time and sharing with us his idea, views regarding the project work. His idea has also helped us many times and we are able to complete the project within the stipulated time and submitted it without fail.

At the end it was a wonderful and successful journey. Last but not the least we are thankful to faculty members of civil engineering department Er.Monika, Er.Rasmi Maharana, Er.Jasaswini Misra, Er. Lopamudra Dalai&Er.Sutthapa Nayak for their active co-ordinate and help. They have never hesitated to give a word of advice and encouragement.

**ABSTRACT**

Transportation is the back bone of a countries progress and development. This also affects the economy & culture of the country. Road transport is the leading mode world wide as by this mode of transport all the places can be covered off including all hilly and deep forest areas and cost effective. So in India; highly diversity in area as well as population road way carries a important role in India.

The aim of our project is to give a detailed about the roads, curves, materials used for road works etc. . We design the curves, retaining structures as per Indian standards . For the curves we mentioned tne L.S and C.S of the road at a constant interval and the area of cutting and filling also detected in detail.

A bridge also provides for a given discharge at the lowest R.D. . two piers are given as support and deck slab is designed as per IRC code . A detail about materials, estimates & specification also given in this report for a specific

Quantity.

For construction of a road way or any civil engineering aspects at first the sub base soil type and characteristics are examined first. Then a suitable site is selected for laying out the alignment. If curves has to be provided they should be designed properly. In bridge the IRC specifications should be followed. The materials required and to be used should be analyzed. After this estimation of the project is calculated carefully. The dimension and site selection for bridge is important for its stability and long life. A cost benefit ratio is compared at last for its importance and future uses. To complete our project in a smooth and step by step we take suggestions from our sir and madams and visited some sites recently. Every task of this report is prepared in group and by taking suggestion and help of all students.

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* CONCLUSION

**INTRODUCTION**

**IMPORTANCE OF TRANPORTATION**

**Role of transportation**

Transportation contributes to the economic, industrial social and cultural development of any country. Transportation is vital for the economic development of any region since every commodity produced whether it is food, clothing, industrial products or medicine needs transport at all stage from production to distribution. In the production stage, transportation is required for carrying raw materials like seeds, manure, coal, steel etc. In the distribution stage, transportation is required from the production center viz. forms and factories and the consumers for distribution. The inadequate transportation facilities retard the process of socio-economic development of the country. The academy of transportation system of a country indicates its economic and social development.

**Economic Activity and transport**

The economic activities are the process by means of which the products are utilized to satisfy human wants. Two important factors well known in economic activity are

Production and

1. Consumption for human wants or demand

Man and his products are thus not bound to his local surroundings. The importance of transportation in economic activity is to be found in its effect on both human wants for goods and satisfaction through production and distribution. While discussing the general effect of transportation, it may be said that the increased productivity and its efficient transportation can lower the cost of the products. The transportation cost is always an influencing factor on consumer price of commodities.

**Role of transportation in rural development**

With over 75% of the country living in the villages, the development in urban center alone doesn’t indicate the overall development of the country. Only if the improvement in the transportation facilities in rural areas

there could be faster development in rural center. The fertilizer and other input for agriculture and cottage industries could reach the rural population easily and similarly the products can be sold at the nearest marketing centre for more remunerative price resulting in fastereconomic growth and decreased wastage. With improve facility for education health care and other social need in the villages, the urge for the migration to the urban center decreases, thus helping in the balance development of the country as a whole.

***IMPORTANCE OF ROAD IN INDIA***

**Significance of planned road network**

It may be said that deficiency in the road development in India has contributed greatly to the setback in agriculture, commercial and industrial sectors. It is essential to provide roads links between the villages and market centers. The prosperity around the urban areas alone do not reflect the economic and living condition of the people of our country as a whole. Overall economic progress can be achieved, only if reasonably adequate transport facility are made available between the villages and other district head quarters and commercial centers. The road network have also to be supplemented with express way to keep pace with the requirement of uninterrupted movement of fast vehicle along the arterial roads. In general developing countries have to raise their transportation system to a higher level both in terms of length and quality so as to meet the demand which is being generated by the development plans. Also road development generates considerable employment potential. It is estimated by planning commission and the National Council of Applied Economic Research that . 1000 crores invested in road would yield employment for six million persons.

It has been shown that a paved surface in reasonably good condition can contribute to 15 to 40 percent saving in vehicle operational cost. This is very significant from the point of view of energy crisis and conservation of fuel. Thus it is all the more important to construct and maintain road pavements in good condition. Revenue from the road transport in India has been much higher than the investment made on road development plans. Out of the estimated revenue of .10,000 crores from the road sector during the sixth five year plan 1980-85, only. 3439 crores was provided for roads during the plan period. During the seventh plan .6,000 crores was spent for road development in the country. There is great need and considerable scope for higher investment for development of road transportation in India.

*HISTORICAL DEVELOPMENT OF ROAD CONSTRUCTION*

The oldest mode of travel obviously was on the foot-paths. Animal were also used to transport men and materials. After the invention of wheel, necessity of providing a hard surface is believed to have existed in Mesopotamia in the period about 3500 B.C. Only in the period of Roman Empire, road were constructed in large scale and the earliest construction techniques known are of roman roads. Hence romans areconsidered to be the pioneers in road construction.

*ROMAN ROADS*

Many of the early roman roads were of elaborate constructions. Some of these roads are still in existence after over 2000 years. The Appian way was built in 312 B.C. extending over 580 km which illustrates the road building techniques used by Roman.

The main features of Roman roads are.

They are built straight regardless of gradient.

They were built after the soft soil was removed and a hard stratum was reached.

The total thickness of the construction was as high as 0.75 to 1.2 meters at some places, even though the magnitude of wheel loads of animal drawn vehicle was very low.

*TYPICAL CROSS SECTION OF ROMAN ROAD FIGURE*

*TELEFORD CONSTRUCTION*

Thomas Telford (1757-1834) began his work in early 19th century. He was the founder of the Institution of civil Engineers at London. He used heavy foundation stone above the soil subgrade in order to keep the road foundation firm. He insisted on providing a definite cross slope for top surface of the pavement by varying the thickness of the foundation stone.

*MECADAM CONSTRUCTION*

JOHN MACADAM (1756-1836) put forward an entirely new method of construction as compared to all the previous methods. The first attempt to improve the road condition was made by him in 1815. Macadam was the surveyor general of road in England and his new concept of road construction became known by the year 1827.

*ROAD PATTERNS*

The various road pattern are of following types

Rectangular or block pattern

Radial or star and block pattern

Radial or star and circular pattern

Radial or star and grid pattern

Hexagonal Pattern

Minimum travel pattern

*CLASSIFICATION OF ROAD*

The different types of road are classified into two categories, depending on weather condition of their use during different seasons of the year.

* All weather Roads
* Fair weather Roads

**All weather Roads**

These roads are those which are negotiable during all weather, except at major river crossing where interruption to traffic is permissible to some extent, the road pavement should be negotiable during all weathers.

**Fair weather Roads**

On these roads, the traffic is interrupted during monsoon because they meet such streams without cross drainage works. Based on type of carriage way or the road pavement, the roads are classified as follows:

* Paved Roads
* Unpaved Roads

**Paved road**

They are provided with a hard pavement course which should be at least a Water Bound Macadam (WBM) layer.

**Unpaved Roads**

They are not provided with a hard pavement course of at least a WBM layer. Thus earth road and gravel road may be called as Unpaved Roads.

Based on the type of paved surfacing provide roads are classified as follows:

* Surfaced Roads
* Unsurfaced Roads

**Surfaced Roads**

Roads Which are provided with a bituminous or cement concrete surfacing is known as Surfacing Roads.

**Unsurfaced Roads**

RoadsWhich are not provided with bituminous or cement concrete surfacing are known as UnsurfacingRoads.The roads provide with bituminous surfacing are also called as Black Toped Roads.

**METHODS OF CLASSIFICATION OF ROADS**

The roads are generally classified on the following basis:

* Traffic volume
* Load transport of tonnage
* Location and function

The classification based on location and function should be a more acceptable classification for a country.

The Nagpur Road plan classified the roads in India based on location and functions into following five categories:

* National Highways (NH)
* State Highways (SH)
* Major District Roads (MDR)
* Other District Roads (ODR)
* Village Roads (VR)

**National Highways (NH)**

These are the main highways running through the length and breadth of India, connecting major ports, foreign highways, capital of states, industrial and tourist centers including road required for strategic movements for the Defence of India.

The highway connecting Delhi-Ambala-Amritsar is denoted as NH-1, where as a bifurcation of this highway beyond Jalandhar to Srinagar and Uri is denoted as NH-1-A.

The highway connecting Madurai and Rameswaram is NH-49 and Mumbai-Agra is NH-3.

**STATE HIGHWAYS (SH)**

These are arterial road of the state, connecting with the national highways, state capital, district headquarters and important cities within the state and they serve the arteries for traffic to and from district roads.

**MAJOR DISTRICT ROADS(MDR)**

These are the important roads within the district serving areas of production and markets and connecting those with each other or with the main highways of a district. The MDR has lower speed and geometric design specification than NH/SH.

**OTHER DISTRICT ROADS (ODR)**

These roads connecting to market centers, taluk headquarters, block headquarters or other main roads serving rural areas of production and providing. These are of lower design specification than MDR.

**VILLAGE ROADS (VR)**

These are roads connecting villages or groups of villages they connect to the nearest road of a higher category.

**MODIFIED CLASSIFICATION OF ROAD SYSTEM BY THIRD ROAD DEVELOPMENT PLAN, 1981-2001**

The road in the country are now classified into three classes, for the purpose of transport planning, functional identification, earmarking administrative jurisdictions and assigning priorities on a road network.

* Primary system
* Secondary system
* Tertiary system or rural roads

A primary system consists of two category.

* Expressways
* National highways(NH)

**CROSS SLOPE OR CAMBER**

Cross slope or camber is the slope provided to the road surface in the transverse direction to drain off the rain water from the road surface. Drainage or quick disposal of water from the pavement surface by providing cross slope is considered important because of two reasons:

1. To prevent the entry of surface water into the subgrade soil through pavement; the stability, surface condition and the life of the pavement gets adversely affected if the water enters in the subgrade and the soil gets soaked.
2. To prevent the entry of water into the bituminous pavement layers, as continued contact with water causes stripping of bitumen from the aggregates and results in deterioration of the pavement layer.

**WIDTH OF PAVEMENT OR CARRIAGEWAY**

The pavement or carriageway width depends on the width of traffic lane and number of lanes. The carriageway intended for one line of the traffic movement may be called a traffic lane. When the side clearance is increased (upto a certain limit) there is an increase in operation speed of vehicle and hence an increase in capacity of the traffic lane. Keeping all these in view a width of 3.75m is considered desirable for a road having single lane for vehicles of maximum width 2.44m. For pavement having two or more lanes,width of 3.5m per lane is considered sufficient.

The maximum width of vehicle as per IRC specification is 2.44m. If a single lane carriage way of width 3.8m is provided a side clearance of 0.68m would be obtained in the case of two lane pavement of width 0.7m. A minimum clearance between two lanes of traffic would be 1.06m for the widest vehicle on the road.

WIDTH OF CARRIAGEWAY

|  |  |  |
| --- | --- | --- |
| Sl. No. | Class of road | Width of carriageway |
|  | Single lane | 3.75m |
|  | two lane, without raised curbs | 7.0m |
|  | two lane, with raised curbs | 7.5m |
|  | Intermediate carriageway(except on important roads) | 5.5m |
|  | Multilane pavement | 3.5m per lane |

**TRAFFIC SEPARATOR OR MEDIANS**

The main function of traffic separator is to prevent head-on collision between vehicles moving in opposite direction on adjacent lanes.

The separator may also help to

* Channelize traffic into streams at intersections
* Shadow the crossing and turning traffic
* Segregate slow traffic and to protect pedestrians

On urban highway with six lanes or more, medians should invariably be provided. The minimum recommended width of medians at intersections of urban roads are 1.2m for pedestrian refuge, 4.0 to 7.5m for protection of vehicles making right turn and 9.0 to 12m for protection of vehicles crossing at grade. The absolute minimum width of median in urban area is 1.2m and desirable minimum is 5.0m.

**CURBS**

Curb indicate the boundary between the pavement and shoulder; or sometimes islands or foot path or curb parking space.

There are varieties of curbs design. Curbs may be mainly divided into three groups based on their functions.

1. Low or mountable type curbs
2. Semi barrier type curbs
3. Barrier type curbs

**Low or mountable type curbs**

Low mountable type curbs which though encourage traffic to remain in the through traffic lanes, yet allow the driver to enter the shoulder area with little difficulty. The height of this type of shoulder curbs is about 10cm above the pavement edge with a slope or batter to help vehicles climb the curb easily.

**Semi barrier type curbs**

Semi barrier type curb is provided in the periphery of a roadway where the pedestrian traffic is high. This type curb has a height about 15 cm above the pavement edge with a batter of 1:1 after a height of 7.5 cm. This curb prevents encroachment of parking vehicles, but at acute emergency it is possible to drive over this curb with some difficulty.

**Barrier type curb**

Barrier type curb is provided in built-up areas adjacent to foot path with considerable pedestrian traffic. The height of curb stone is about 20 cm above the pavement edge with a steep batter of 4 vertical to 1 horizontal.

**WIDTH OF ROADWAY OR FORMATION**

Width of formation or roadway is the sum of width of pavements or carriageway including separators if any; and the shoulders. Formation or road way width is the top width of the highway embankment or the bottom width of highway cutting excluding the side drains. The width of roadways standardized by the Indian Road Congress are given in table.

Width of roadway of various classes of roads

|  |  |  |  |
| --- | --- | --- | --- |
| Sl. No. | Road Classification | Roadway Width in m | |
| Plain and rolling terrain | Mountainous and steep terrain |
|  | National & State Highway   1. Single lane 2. Two lane | 7.5  12.0 | 6.25  8.80 |
|  | Major district road   1. Single lane 2. Two lane | 6.0  10.0 | 4.75  \_ |
|  | Other district road   1. Single lane 2. Two lane | 6.0  10.0 | 4.75  \_ |
|  | Village roads-single lane | 6.0 | 4.0 |

**RIGHT OF WAY**

Right of way is the area of land acquired for the road, along its alignment. The width of this acquired land is known as land width and it depends on the importance of road and possible future development. Road side development starts taking place making it difficult later on to acquire more land if required for future widening or for other improvement. This is particularly true in urban and industrial areas.

The land width is governed by the following factors:

1. Width of formation depending on the category of highway and width of roadway and road margin.
2. Height of embankment or depth of cutting which is governed by the topography and their vertical alignment.
3. Side slopes of embankment or cutting which depends on the height of the slope, soil type and several other considerations including aesthetics.
4. Drainage system and their size, which depends on the rainfall, topography and runoff.

**CURVES**

There are two types of curves which are used in road works:

1. Vertical curves
2. Horizontal curves

**VERTICAL CURVES**

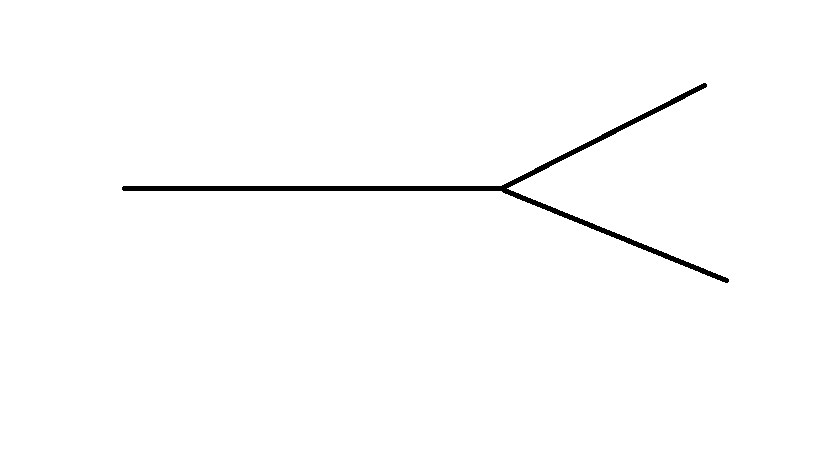
Due to change in grade in vertical alignment of highway, it is necessary to introduce vertical curve at the intersection of different grades to smoothen the vertical profile and thus ease off the changes in gradients for the fast moving vehicles.

The vertical curve used in highway may be classified into two categories :

1. Summit curves or crest curves with convexity upwards.
2. Valley or sag curves with concavity upwards.

There are three cases arise in vertical curves :

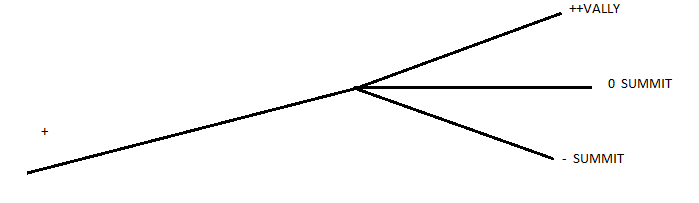
**Case-1:**



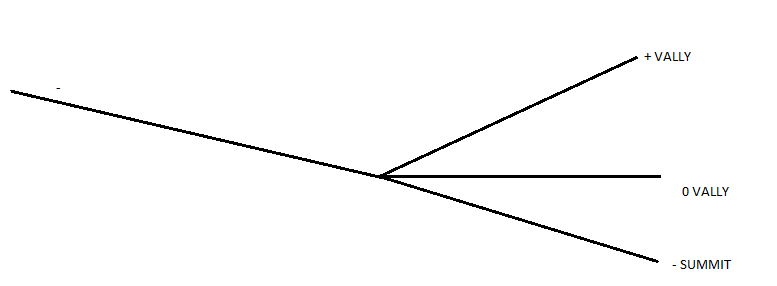
+Valley

-Summit

**Case-2:**



**Case-3:**



**SUMMIT CURVES**

Summit curves with convexity upwards are formed in any one of the case.

1. When a horizontal gradient meets a falling gradient.
2. Rising gradient meets a falling gradient.
3. Falling gradient meets another more falling gradient .
4. Rising gradient meets a horizontal alignment.

The deviation angle between two intersecting gradient is equal to the algebraic difference between them.

A summit curve is provided at R.D 3000 for smooth passage of traffic. Summit curve are generally made parabolic.

The equation is given by

y=ax²

where, a=

N=Deviation angle=

L=Length of curve

For length of curve horizontal distance is taken since difference between horizontal and curved length is negligible.

**LENGTH OF SUMMIT CURVE FOR STOPPING SIGHT DISTANCE(SSD)**

Two cases are to be considered in deciding the length:

1. When the length of curve is greater than the stopping sight distance i.e. L>SSD
2. When the length of curve is less than the stopping sight distance i.e. L<SSD

**L>SSD**

The general equation for length ‘L’ of parabolic curve is given by:

L

Where, Llength of summit curve

Sstopping sight distance

Ndeviation angle, equal to algebraic

difference in grades, radians or tangent of

the deviation angle

Hheight of eye level of driver above roadway

Surface; normally assumed as 1 to 2m.

hheight of object above the pavement is

assumed as 0.15m

**L<SSD**

The general equation for the length of parabolic summit curve, when it is less than the sight distance is given by :

L 2S

Here L,S,H& N is same as before. On the given project work a summit curve is provided at the R.D 3000.

**LENGTH OF SUMMIT CURVE FOR THE SAFE OVERTAKING SIGHT DISTANCE OR INTERMEDIATE SIGHT DISTANCE**

Two cases to be considered in deciding the length are:

1. When the length of curve is greater than the overtaking sight distance (L>S).
2. When the length of curve is less than the overtaking sight distance(L<S).

Length of vertical summit curve for overtaking sight distance First the safe overtaking sight distance is found.

OSD0.28t0.28T2s0.28VT

Where, T

speed of overtaking vehicle in kmph

Vspeed of overtaking vehicle in kmph

S=spacing of vehicle(0.7+6)

Aacceleration kmph/sec

For one way traffic OSD

For two way traffic OSD

Length of summit curve(L>S):

L

Length of curve less than the OSD (L<S)

L

**VALLEY CURVE**

Sag curves are formed when a falling gradient meets:

1. Another falling gradient of lesser magnitude
2. A level alignment
3. A rising gradient
4. A rising gradient meets another rising gradient of higher magnitude

There is a no problem of sight distance during day time but minimum SD is required during night driving under head lights of vehicles, the sight distance available at valley curve is decreased.

Two factors are considered in designing of a valley curve:

1. Impact free movement of vehicles at design speed
2. Stopping sight distance under head light of a vehicle at night driving.

At valley curves centrifugal force acts downwards adding to the pressure on springs and the suspension of the vehicle in addition to weight of vehicle.

**LENGTH OF VALLEY CURVE**

Valley curve is designed by providing two similar transition curve of equal length without any circular curve. Minimum radius R at point of intersection.

Length of one transition curve

Where, vspeed of vehicles in m/sec

Crate of change of centrifugal acceleration 0.5

to 0.8 m/

R

**Length Of Valley Curve For Head Light Sight Distance**

Length of valley curve for head light sight distance is determined under two condition;

a)L>SSD

b)L<SSD

**a)L>SSD**

The sight distance should be minimum when the vehicle is at lowest point of the curve

Let height of head light

inclination of beam of light

If curve is assumed to be parabolic with

Equation, ya

Where a

­­­­+S aS²

L

**b)L<SSD**

L=2S-

The valley curve at R.D 3000 is formed by joining the alignment slope of 1 in 5000 to zero slope.

So there will be no problem of sight distance

**Horizontal Curve**

**Radius of horizontal curve**

Centrifugal force is counteracted by lateral friction and super elevation. To keep the centrifugal ratio at minimum the radius of curve should be large.

e + f =

R=

Radius of horizontal curve,

R=1746.5/30=58.2 m say 60 m

Length of horizontal curve,

L=

L=

L=31.41 m

**Superelevation**

To counteract the effect of centrifugal force and to reduce the tendency of the vehicle to overturn or skid, the outer edge of the pavement is raised with respect to the inner edge. Thus providing a transverse slope through at the length of the horizontal curve . The transverse inclination to the pavement surface is known as Super elevation.

e =

**Widening Of Pavement on Horizontal Curve**

On horizontal curve the pavement is widened for the following reason.

i) When the vehicle moves along a curve, at a speed higher than the designed speed. The superelevation and lateral friction are not able to counter the thrust due to centrifugal force. The rear wheel will take a path on the outside of those taken by front wheel for which some extra width of pavement is required.

ii) In a vehicle only the front wheel turn in straight drive and low speed the back wheel follows the path of front wheel. But in sharp curve and high speed the rear wheel do not follow the front. This phenomenon is called off-tracking which depends on length of wheel base, angle of turn and radius of curve.

iii) The path traced by the wheel of a trailer in the case of trailer unit is also likely to be on either side of the central path of the towing vehicle depending on the speed rigidity of the universal joint and pavement roughness.

iv)In order to take curved path with larger radius and to have greater visibility at curve the drivers have tendency not to follow the outer side at the beginning of a curve.

v) While two vehicles cross or overtake at horizontal curve there is a psychological tendency to maintain a greater clearance between the vehicles, than on straight for increased safety.

**Horizontal Transition Curve**

A transition curve has a radius which decreases from infinity at the tangent point to a designed radius of circular curve. When a transition curve is introduced between a straight and circular curve, the radius of transition curve decreases becomes minimum at the beginning of the circular curve.

**Different type of transition curve**

Type of transition curve commonly adopted in the horizontal alignment is:

i) Spiral

ii)Lemniscate

iii) Cubic parabola

The Indian Road Congress Recommended the use of the spiral as transition curve in the horizontal alignment of highway due to following reasons.

1. The spiral curve satisfies the requirements of an ideal transition.
2. The geometric property of spiral is such that the calculations and setting out the curve in the field is simple and easy.  
   The equation of spiral may be written as :

L.R =

Therefore, L = m

Here m = constant =

**Calculation of Length of transition curve**

Length of transition curve designed to fulfill three conditions.

i)Rate of change of centrifugal acceleration to be developed gradually.

ii) Rate of introducing the designed superelevation to be at a reasonable rate.

iii)Minimum length by IRC empirical formula.

**I)Rate of change of centrifugal acceleration**

At the tangent point the centrifugal acceleration () is zero at the radius R is infinity. At the end of transition the radius R has minimum value .

Let the length of transition curve be meter. If ‘t’ is time taken in second to traverse , this transition length at uniform design speed of v , t= . The maximum centrifugal acceleration of is introduced in time ‘t’ through the transition length and hence the rate of change of centrifugal acceleration ‘c’

is given by

c

c ()

The IRC has recommended the following equation for finding the value of C for the design speed V kmph.

C

i.e. the minimum and maximum value of C are limited to 0.5 and 0.8respectively . Once the value of C is decided on the basis of design speed as given above the length of transition curve can be calculated from the equation which may be written as :

If the design speed is

Hence Length of transition curve

CAllowable rate of change of centrifugal acceleration as given in equation

R Radius of circular curve in meter

**ii)Rate of Introduction of super elevation**

Let ‘e’ be the rate ofsuperelevation designed for the highway curve having normal pavement width W. Let be the extra widening provided at the circular curve. So that the total width B of pavement and the total rising of pavement with respect to the

Inner edge E

If it is assumed that the pavement is rotated about center line after neutralizing the camber then the maximum amount by which the outer edge is to be raised at the circular curve with respect to the center

Hence allowing the rate of change of super elevation of 1 in N (where minimum value of N is 150to 60 as discussed above)

The length of transition curve is given by:

However if the pavement is rotated about the inner edge, the length of transition curve is given by:

e.N

**iii) Empirical Formula**

According to IRC standards, the length of horizontal transition curve should not be less than the given value by the following equation for terrain classification.

a) For plain & rolling terrain

2.7

b) For mountainous and steep terrains;

**Design of Transition curve**

a)Length of transition curve as per allowable rate of centrifugal acceleration, C:

The value is in between 0.5 & 0.8 and hence accepted

0.0215

b) Length by allowable rate of introduction of ‘e’

Super elevation rate, e

As the value is greater than 0.07

Check for co-efficient of lateral friction.

F

As the value is greater than the allowable of 0.15, the super elevation 0.07 is not safe for design speed in kmph .

Maximum allowable speed;

Total rise of outer edge pavement with respect to the center line

For mountainous &steep terrain

The length of transition curve for the design should be the highest of the three value mentioned above. Therefore the design steps are given below.

a) Find the length of transition curve based on allowable rate of change of the centrifugal acceleration.

b) Find the length of transition curve based on rate of change of super elevation.

c) Check for the minimum required value of as per IRC standard empirical formula.

d) Adopt the highest value of given by the above there as the designed length of transition curve.

The length of transition curve required on a horizontal curve therefore depends upon the following factor.

**PROBLEM**

***Q. Prepare a project report for an extension of a new state highway of 6km length with following data given below. A suitable bridge should be designed for a discharge of 135cumec. at the lowest R.L. by following data. Horizontal and vertical curves also designed at suitable points.***

Density of concrete =24KN/

Density of R.C.C=25KN/

Angle of repose ()=

Safe bearing capacity of soil (P)=200

Coefficient of internal friction (µ)=0.5

=20N/m,=415N/m

**LONGITUDINAL SECTION OF ROAD**

|  |  |
| --- | --- |
| R.D OF ROAD | R.L OF ROAD |
| 0 | 0 |
| 500 | 245.00 |
| 1000 | 246.625 |
| 1500 | 247.2 |
| 2000 | 247.61 |
| 2500 | 248.12 |
| 3000 | 248.65 |
| 3500 | 247.9 |
| 4000 | 247.31 |
| 4500 | 246.87 |
| 5000 | 246.195 |
| 5500 | 245.65 |
| 6000 | 246.31 |
| All dimensions are in meter |  |

**Design of Horizontal Curve:**

D=4 at RD of 500m to 1500m

R==436.625m

Length of curve =

l==

l=30.48m31m

Tangent Length ==

= R

=436\*

=15.25m

Length of Long chord =

=2R

=2\*436.6

=30.47m

Apex distance AB = R()

=436.6()

=0.3m0.266m

Mid-ordinate BC = R(1-)

=436.6(1-)

=0.2650.3m.

CD = BD-BC =436.625-0.265

=436.36m

Let V = 60

E = = = 0.065m

Extra widening

Mechanical widening = =

=0.082m

Psychological widening

= = = 0.302m

Total widening = + = 0.3842m

**Design of Vertical Curve**

= 1:200

=+0.5%

= 1:100

=-1%

Length of Vertical Curve = = 450m

So = = 225m.

of = of B – l\*

= 248.65+225\* = 247.525m

Let Chain age of intersection point B = 500m

Chain age of = 500 - 225 = 275m.

Chain age of = 500 + 225 =725m.

R.L of = 248.65 - = 247.525m.

R.L of = 248.65 - = 246.4m.

R.L of = (247.525+246.4) = 246.9m

R.L of =(248.65+246.9) = 247.775m

Tangent correction of center = 248.65-247.775

=0.875m

Tangent correction are found out at 30m interval from the

relation.

**DESIGN OF RETAINING WALL**

(1)**DIMENSION OF RETAINING WALL:**

1. Minimum depth of foundation

=

=

=1.234m

1.25m of foundation depth is provided.

Bed level of foundation=242.55-1.25=241.30m

Bed level considering scour depth=240.7m

So provide cutoff depth of (241.3-240.7)m=0.60m

The end of stream side of the foundation

Width of cut off=0.30m

Overall depth of retaining wall=2.85+1.25=4.10m

(2)**THICKNESS OF SLAB(T)**

1. T==

=337.5mm

So thickness of base slab 350mm is provided

1. Width of base slab is 0.5H to 0.6H

b=0.5\*4.05 to 0.6\*4.05m

=2.025 to 2.43m

So assume width of 2.2m

1. Design of stem

Height of stem=4.1-0.35=3.75m

bending moment of slab

=

=

=50.65KNm

By limit state method 1.5x50.65=75.97KN-m

According to IS:456-2000

0.138b

d=

=

=>d=109.2mm(say 120mm)

So D=350mm is safe.

Adopt D=350mm

Effective cover =50mm

d=350-50=300mm

**(4)AREA OF STEEL**

0.87d(1-)

=>75.97\*=o.87\*415\*300\*\*(1-)

=>=739.17sqmm

Provide 12mm(a=113sqmm)@=152.87c/c

So provide 12 @ 150c/c at base and curtilement is

done at half section i.e h/2.Hence 12mm@ 300c/c at top.

Distribution steel

As per IS:456-2000;Clause-26.5.2.1,Pg-48

Minimum k=0.12%

=

Provide o.5 on each face i.e=420/2=210mm

Trying 8mm @

Provide 8mm @230 c/c on both faces.

STABILITY CALCULATION

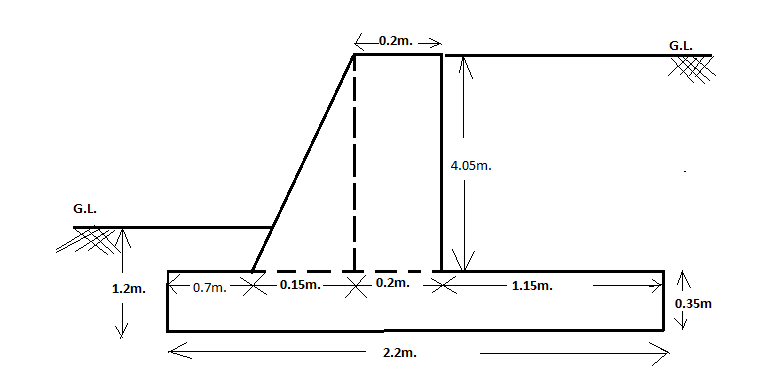
Taking 1m.width of wall.

|  |  |  |  |
| --- | --- | --- | --- |
| Load per 1m. width of wall | Magnitude of load(KN) | C.G distance from point a  (m) | Moment about point a(KN-m) |
|  | 18.5 | 1.25 | 23.12 |
|  | 6.9375 | 1.4 | 9.7125 |
|  | 76.59 | 0.575 | 44.04 |
|  | 19.25 | 1.1 | 21.175 |
| Moment due | To earth | pressure | =50.657 |

Total ∑W=121.275 ∑M=148.70

stability of dam equation =

=



**Check for shear:**

=

Here > hence design is safe for shear

**Check for safety against sliding:**

Total horizontal earth pressure

P =

**=**0.5\*

Total weight=121.275KN

Frictional force discharge

=

=0.5\*0.9\*121.275=54.57KN

Factor of safety=

Hence 1.11<1.5 which is safe against sliding

***Design of T-beam***

Data given

Span=18m

Effective cover=40+=60mm

Assume =0.5m=500mm

400mm

**Dimension calculation**

According to IS:456-2000

+6

=clear span + width of bearing

=18+0.4=18400mm

+6\*500=6466.67mm

or distance of clear span =2400+400=2800mm

provide width of flange==2800mm

**Depth calculation**

**Assume** overall depth (D) is to depending upon load

= to =1333.33 to 800mm

Take D=1100mm

E.C=60 mm

d =1100-60=1040mm

**Load calculation**

Self weight of flange=0.4\*2.8\*25=28

Self weight of W.C=0.1\*2.8\*24=6072

Self weight of Web=0.4\*0.6\*25=6

Total dead load =28+6.72+6=40.72

Considering class AA tracked vehicle

Total live load=70tn=700KN

Live load (per m)==38.89

Total load=D.L+L.L=40.72+38.89=79.7

Factored load=1.5\*79.7=119.43

Bending moment===4836.24KN-M

By Limit State Method the neutral axis lies in flange

So C=T

=>0.36\*25\*=0.87\*415\*

=>==0.0143

Bending moment=T\*Z

=>4836.24\*=375492-2.12

=>=13983.73

=0.0143\*

=0.0143\*13983.78=199.96 < 500mm

Hence safe..

Taking 32mm bar (a=804)

Number of bars==18 no.

Spacing of 32mm bars =\*804=57.49 mm

**Minimum reinforcement**

=

**==**852.04

=4% \*\*D

=0.04\*300\*1100=13200

Hence design is safe..

**Check for shear**

==1074.87KN

=2.583N/

==3.74

As per IS:-456-2000,Pg-73,table-18;

=0.92N/

=3.1N/

<<

So shear reinforcement is to be provided

**DESIGN OF DECK SLAB**

Data given

Clear Span=18m

Curb=750\*300 mm

**Depth of slab & effective span:**

Assume thickness of slab=400mm

Effective span=clear span+ effective depth

=18+400-25-=18.362m

**Load calculation:**

D.L=0.4\*1\*25=10

Wearing coat of 100mm thick=0.1\*1\*24=2.4

Live load will be calculated as class AA loading vehicle

**Impact factor:**

As per IRC-6-2000, page-23,clause-2.11.3

Impact factor is 10% up to 40m

To obtain max. B.M the tracked vehicle placed symmetrically on the span

For tracked vehicle =700KN

Impact 10%=70KN

Total load=700+70=770KN

So live load per m. Run==42.07KN

Max.B.M=42.07\*=166.2KN-M

D.L moment ===519.1KN-M

Factored B.M=1.5\*(519.1+166.2)=1027.9KN-M

Check for depth

d ==326 mm<400mm

so assumption is safe

Effective cover=400-60=340mm

=50\*[1-]

=50\*[1-]

=>=1.009

=

=>9520

Spacing ==51.57

So 25 @50 mm c/c should be provided

**Distribution Steel**

Bending Moment for distribution steels

=0.3+0.2

=0.3\*166.2+0.2\*519.1

=153.68KN-M

Effective Depth d=400-75-6=319 mm

=1.5\*153.68=230.52KN-M

=50-()

=>=0.23%

===2054.36

Try 12mm(a=113.1) @=154 mm

So provide 12mm @150mm c/c

**ANALYSIS**

**AND**

**SPECIFICATION**

**ANALYSIS OF RATES AND SPECIFICATION**

* Schedule of rate is prepared by all govt. department and P.S.U who execute engineering works.
* Schedule of rate facilitates preparation of estimate and to guide deciding rates of contractors and know the approximate cost of the project.
* Schedule of rate is based on a region and it changes from place to place.

**ANALYSIS OF RATES**

* It is the basis of arriving a correct and reasonable rate per unit quantity of work or supply of a particular item following, its specification .
* Analysis of rate is prepared on two basis:-

1. As per actual observation at the site of works. The cost of different types of labour wages and cost of material usedis calculated. The quantity of work done is measured and the unit cost is arrived.
2. Analysis is also done basing on schedule of rate where different item of work is required in a complete andspecific finished item.

* The finished rate includes:-

1. Quantity and cost of materials like cement, sand, aggregate, wood, steeletc at the prevailing market rate.
2. Transportation cost from the railhead, quarry,factory to the site of work.
3. Sales tax, VAT, insurance charges and royalty of materials.
4. Cost of labour, employed likes skilled mulia, mason, carpenter, fitter, welder etc.
5. Cost of small tools and plants like crowbar, spade, trowel, plumb bob, spirit level etc. Lump sum 2% is provided is the rate towards cost of small tools and plants.
6. Hire and running charges of machineries like pump, concrete mixture, vibrator, transport vehicle, crane, excavator, road roller, bitumen mixing plant.Cost of different types of labour used in the work like mason, carpenter, blacksmith, operator, helper etc.
7. Contingencies and small T&P 2% of the total cost.
8. Overhead charges (contractor’s profit) of 10 to 20% is added over and above the cost of all 7 items.

The prevailing cost of material has been taken as follows in preparation of this report.

**MATERIALS COST**

1. Cement Rs.380 per bag
2. Steel Rs.5000 per quintal
3. Sand Rs.200 per cum
4. Brick Rs.4000 per 1000 no.
5. Hard granite stone Rs.280 per cum
6. Hard granite broken aggregate (40mm) Rs.810 per cum
7. Hard granite chips (12mm) Rs.1180 per cum
8. Hard granite chips (20mm) Rs.1120 per cum
9. Bitumen Rs.22600 per ton

Royalty is paid to govt. for collecting mineral materials like stone product, moorum, sand. So provision is made in the analysis for royalty.

Material cost includes actual cost + conveyance + royalty.

**Cost of carriage of material per cum:-**

For every extra km beyond 5km up to 50km:-

* Up to 5km = Rs.120
* Beyond 5km upto 50km, Rs.15 per km
* Beyond 50km , Rs.10 per km

**LABOUR COST**

Head mason = Rs. 350

Mason 1st class = Rs. 300

Mason 2nd class = Rs. 280

Male/Female mulia = Rs. 150

Operator = Rs. 150

Carpenter/Painter 1st class = Rs. 300

Carpenter/Painter 2nd class = Rs. 280

**1.EARTHWORK IN EXCAVATION**

Earthwork in hard or gravely soil in embankment, roads etc.(maximum laboratory dry density shall not be less than 1.44gm/cc or 1.5gm/cc to 1.65gm/cc) in road embankment upto 3m height and top 0.3m below subgrade level with initial lift of 1.5m and initial load of 50m from approved borrow pits, 5m away from toe of the final section of the road embankment. Pit not being cut by imaginary line having a slope of 1:4 projected from the edge of the final section of the bank including rough dressing and breaking clods to maximum 5cm to 7cm and laying in layers not exceeding 23cm in depth up to required level including removal of roots, shrub, bushes and all foreign debris from the earth and benching the old embankment, sectioning and cambering, cost of T & P articles required for the work and complete in all respects as per specification of work as direction of the engineer in charge and to be measured in section measurement after compaction under OMC (for 100cum) including cost of controlled compaction with PRR, watering up to OMC and conforming to approved specification including hire and running charges of PRR.

**PER 1CUM**

Excavation by mechanical means considering Hitachi excavator capacity of bucket = 0.9cum

Considering effective working of 50 min/hr., production of loose earth per hour

= {(50 \* 60 \* 0.9 \* 90)/16} \* 0.83 = 127.46cum

Hire charge excluding supervision per hour = 50 min/hr. = Rs. 2050

Cost of mechanical excavation per cum

= 2050/127.46 = Rs. 16.08

**TRANSPORTATION CHARGES**

Capacity of tipper (loose soil) 5.70cum

Taking 80% carrying capacity = 4.56cum

**TAKING 1KM. LEAD**

* Loading time = 2.15min
* Loaded haul at 25km/hr. = 2.40min
* Empty haul at 25km/hr. = 2.40min
* Spotting, turning and unloading time = 1.40min

Total time taken = (2.15 + 2.40 + 1.40) = 8.35min

Quantity to be carried per hour = (8.50/8.30) \* 4.56 = 28.50cum

Hire charge of tipper hour = Rs.498.31

Depreciation of tires & tubes = Rs. 9.00

Total cost = (498.31 + 9.00) = Rs. 507.31

For 1cum of transportation cost = 507.31/28.50 = Rs.17.80

Cost of transportation for loose earth = Rs. 16.05

Construction of maintenance of haul roads spreading of earth = Rs. 1.50

Spreading of earth = Rs. 4.00

TOTAL = (17.80 + 16.05 + 1.50 + 4.00) = Rs. 39.38

Adding overhead charges of 10% = Rs. 3.938

Total cost = (39.38 + 3.938) = Rs. 43.32

For an average soil 120cum loose earth when compacted to 95% proctor density under OMC will measure 100cum.

Per cum earth = 43.32 \* (120/100) = Rs. 52

For 100cum of earth = 52 \* 100 = Rs. 5200

**LABOUR CHARGE**

Man mulia 21.5 @ Rs. 150 = Rs. 3225

Woman mulia 21.5 @ Rs. 150 = Rs. 3225

Sundries and T&P @ 2% of above = Rs. 129

Water charges 1% of the total = Rs. 40

Overhead charges 10% of total = Rs. 403

Hire and running charges of PRR = Rs.77

Total cost = Rs.17499

Per 100cum = Rs.14583

2.Cement concrete with M15 grade concrete containing crushed granite, coarse aggregate of size 40mm, 20mm &down graded mixed in batching & transportation of mixed concrete with initial load of 50 m.& laying in dams, barrages, bridges with all lifts/deliftsupto 1.5m height.

Considering for 10 cum.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description of items** | **Quantity** | **Rates**  **(Rs)** | **Amount**  **(Rs)** |
| **Material Required**   * Stone chips * Sand(coarse) * Cement | 9.0 cum  4.5 cum  33 qtl  = 66 bags | 1120/cum  200/cum  380/bag | 10080.00  900.00  25080.00 |
| **Labour Required**   * Head mason * Mason * Mazdoor (including4 bhisthi) | ½ nos  3nos  23 nos | 350.00  300.00  150.00 | 175.00  900.00  3450.00 |
| Water charges &Lumpsum @ 1% of Total |  | Total =  = | 40585.00  405.85 |
| T & P @ 2% of total |  | Total =  = | 40991.00  819.82 |
| Profit &over head charges @ 10 % of total |  | Total =  = | 41811.00  4181.10 |

Grand Total = 45992.10

Rate per cum = Rs.4599.20 Rs.4600.00

**3.**Cement concrete M20 grade with hard granite chips 20mm down graded including cost of all materials , labour, carriage, royalty complete

Rate as per item 2 above Rs.4600

Add extra cost of cement

4.3-3.3=1 qtl(2 bags) Rs.760

Total Rs.5360

**4.**Random rubble hard granite stone masonary in cement mortar 1:4 in foundation and plinth including cost of all materials, labours, royalty, taxes, complete .

Considering for 10 cum.

|  |  |  |  |
| --- | --- | --- | --- |
| **Description of items** | **Quantity** | **Rates**  **(Rs)** | **Amount**  **(Rs)** |
| **Material Required**   * Stone (undressed) * Through stone as headers * Sand * Cement | 11.70 cum  0.80 cum  3.4 cum  25 bags | 1120/cum  1180/cum  200/cum  380/bag | 13104.00  944.00  680.00  9500.00 |
| **Labour Required**   * Head mason * Mason * Mazdoor (3 nosbhisthi) | ½ nos  10 nos  19 nos | 350  300  150 | 175.00  3000.00  2850.00 |
| Water charges &lumpsum @ 1% of total | | Total =  = | 30253.00  303 |
| T & P 2% of total | | Total =  = | 30556  611 |
| Profit &over head charges @ 10 % of total | | Total =  = | 31167  3117 |

Grand Total = Rs.34284

Rate per cum =Rs.3428

* including conveyance spreading of filter materials and filling the interstices by spreading the same over the surface, watering and consolidation with PRR including hire and running charges of PRR complete but excluding cost and conveyance of materials and filter materials. (unit=cum). Taking output = 2.83 cumLabour for spreading the metal and packing the voids with small stones and hand packing the stone to proper camber

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Description** | **Unit** | Quantity | Rates  (Rs) | Amount  (Rs) |
| a) **Labour**   * Man mulia for removing stacks spreading metal to proper camber & turf edging * Woman mulia | Each  Each | 1 nos  3 nos | 150.00  150.00  Total = | 150.00  450.00  600.00 |
| b) **Machinery**  Add hire & running charges of PRR for consolidation considering 42 cum of out turn with PRR per day (8 hours) = 2.83 | Hour | 0.539048 | 269.00 | 145.00 |
| Over head charges @ 10% of total  Sundries T & P @ 2% of total | | | Total (a+b) =  =  = | 745.00  74.50  14.90 |

Grand total (for 2.83 cum) = 834.40

Rate per cum

1. Labourfor spreading moorum and consolidation with HRR including cost and conveyance of moorum. Unit = cum

Taking output = 2.83 cum.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Description | Unit | Quantity | Rates  (Rs) | Amount  (Rs) |
| a) Labour   * Man mulia for removing from stacks each spreading & rolling. * Woman mulia for watering & each conveyance etc. | Each  Each | 1.5 nos  1.5 nos | 150.00  150.00  Total = | 225.00  225.00  450.00 |
| Overhead charges @ 10% of total  Sundries T & P @ 2% of total | | |  | 45.00  9.00 |

Grand total (for 2.83 cum) = 504.00

Rate per cum =

**1.GRANULAR SUB-BASE**

***a) SPECIFICATION***

**MATERIALS**

Natural sand, Moorum, gravel, crushed stone, or combination of thereof depending upon grading requirements.

**PHYSICAL REQUIREMENTS**

* Water absorption value <2.0%
* Material passing 425micron

shall have

liquid limit <25.0%

plastic index <6.0%

**grading of close-graded granular sub-base materials**

|  |  |  |  |
| --- | --- | --- | --- |
| IS sieve | Percent by weight passing the IS sieve | | |
| Designation | Grading-I | Grading-II | Grading-III |
| 75.0mm | 100 | - | - |
| 53.0mm | 80-100 | 100 | - |
| 26.5mm | 55-90 | 70-100 | 100 |
| 9.50mm | 35-65 | 50-80 | 65-95 |
| 4.75mm | 25-55 | 40-65 | 50-80 |
| 2.36mm | 20-40 | 30-50 | 40-65 |
| 0.425mm | 10-25 | 15-25 | 20-35 |
| 0.075mm | 3-10 | 3-10 | 3-10 |
| CBR value(min) | 30 | 25 | 20 |

**Grading of coarse-graded granular sub-base materials**

|  |  |  |  |
| --- | --- | --- | --- |
| IS sieve | Percent by weight passing the IS sieve | | |
| Designation | Grading-I | Grading-II | Grading-III |
| 75.0mm | 100 | - | - |
| 53.0mm | - | 100 | - |
| 26.5mm | 55-75 | 50-80 | **100** |
| 9.50mm | - | - | - |
| 4.75mm | 10-30 | 15-35 | 25-45 |
| 2.36mm | - | - | - |
| 0.425mm | - | - | - |
| 0.075mm | < 10 | < 10 | < 10 |
| CBR value(min) | 30 | 25 | 20 |

**THICKNESS**

Water of 1.0 to 2.0% less than OMC should be sprinkled over the layer.

Roller speed should not >5.0 kmph

Overlap of each pass not <

Rolling should be done from edge.

**CONSTRUCTION MACHINARIES**

80-100 KN smooth wheeled roller

200-300 KN pneumatic tyredroller

**QUALITY CONTROL**

**Control tests and minimum frequency**

|  |  |
| --- | --- |
| TEST | FREQUENCY(min) |
| 1.Gradation | One test per 200 cum |
| 2.Atterbergs limit | One test per 200 cum |
| 3.Moisture content(before construction) | One test per 250 cum |
| 4.Density of compacted layer | One test per 500 cum |
| 5.Deleterious constituents | As required |
| 6.CBR | As required |

***b) ANALYSIS***

Labour for admixing sand and moorumEtc.complete including cost of all labours and hire charge, T&P

materials required for work as per specification and direction of Engineer-in-charge including cost and conveyance

of sand and moorum .

**Unit=Cum**

**Taking output=1 cum**

**a) Labour**

Man mulia for mixing

Sand and moorumeach 0.25 150 37.50

b)Labour for spreading moorum

and sand, consolidation with HRR

including water

i)Male Mulia for removing from

stacks spreading and rolling each 1.5 150 225.00

ii)Women Mulia for watering

conveyanceetc each 1.5 150 225.00

Rate per cum (i+ii)/2.83 159.00

So per cum 196.50 /2 98.25

Cost and conveyance of sand

andmoorum (90+200)/2+150= 295.00

Total 393.25

T&P @ 2% 7.85

401.10

c)Overhead charges @ 10% on (a) 40.10

Rate per cum 441.20

**2.WATER BOUND MECADAM**

***a) SPECIFICATION***

**MATERIALS**

Coarse aggregates

Crushed stone

Crushed slag

**PHYSICAL REQUIREMENTS**

Not less than 90% by weight retained on 4.75 mm sieve

Water absorption value < 2.0%

Loss angles abrasion value 40.0%(max)

Or aggregate impact value 30.0%(max)

Combined flakiness and elongation

Indices (total) 30.0%(max)

**Grading requirement of coarse aggregates**

|  |  |  |
| --- | --- | --- |
| Size range | IS sieve | Percent by weight passing |
| 1)90mm to 45mm | | |
|  | 125mm | 100 |
| 90mm | 90-100 |
| 63mm | 25-60 |
| 45mm | 0-15 |
| 22.4mm | 0-5 |
| 2)63mm to 45mm | | |
|  | 90mm | 100 |
| 63mm | 90-100 |
| 53mm | 25-75 |
| 45mm | 0-15 |
| 22.4mm | 0-5 |
| 3)53mm to 22.4mm | | |
|  | 63mm | 100 |
| 53mm | 95-100 |
| 45mm | 65-90 |
| 22.4mm | 0-10 |
| 11.2mm | 0-5 |

**SCREENING/BINDING MATERIAL**

Non plastic material such as morum

**PHYSICAL REQUIREMENT**

Passing 75micron < 10%

Liquid limit < 20.0%

Plasticity index <6.0%

**Grading for screening**

|  |  |  |  |
| --- | --- | --- | --- |
| Grading classification | Size of screening | IS sieve designation | % by weight passing IS sieve |
| A | 13.2mm | 12.2mm | **100** |
|  |  | 12.2mm | 95-100 |
| 5.6mm | 15-35 |
| 180µ | 0-10 |
| B | 11.2mm | 11.2mm | 100 |
|  |  | 5.6mm | 90-100 |
| 180µ | 15-35 |

**THICKESS**

Compacted thickness 100mm for grading-1

Compacted thickness 75mm for grading-2 and 3

Water to be sprinkled to wet over the layer

Roller speed should not >5.0kmph

Overlap of each pass not <

Rolling should be done from edge

**CONSTRUCTION MACHINARIES**

80-100 KN smooth wheeled roller

80-100 KN vibratory roller

**QUALITY CONTROL**

Atmospheric temperature shall less than 0º centigrade

**Control tests and minimum frequency**

|  |  |
| --- | --- |
| Test | Frequency(min) |
| 1.Aggregate impact value | One test per 200 cum of aggregate |
| 2.Grading | One test per 100 cum |
| 3.Flakiness index and elongation | One test per 200 cum of aggregate |
| 4.Atterbergs limit of binding material | One test per 25 cum of binding material |
| 5.Atterbergs limit of aggregate passing 425µ sieve | One test per 100 cum of aggregate |

**QUANTITY**

Binding material 0.06-0.09 cum/10 sqm.for 75mm compacted thickness

Binding material 0.08-0.10 cum/10 sqm for 100 mm compacted thickness

Quantity of screening for 100/75 mm, compacted for 10 sqm

|  |  |  |  |
| --- | --- | --- | --- |
| Stone screening | | Crushable type | |
| Grading, classification & size | Loose quantity | Grading, classification & size | Loose quantity |
| Grading-1, size-90mm to 45mm,compacted thickness 100mm, loose quantity 1.21 to 1.43 cum | | | |
| Type-A 13.2mm | 0.27 to 0.30 cum | Not uniform | o.30 to 0.32 cum |
| Grading-2, size-63mm to 45mm, compacted thickness 75mm,loose quantity 0.91 to 1.07 cum | | | |
| Type-A 13.2mm | 0.12 to 0.15 cum | Not uniform | 0.22 to 0.24 cum |
| Type-B11.2 mm | 0.20 to 0.22 cum | Not uniform | 0.22 to 0.24 cum |
| Grading-3, size-53mm to 22.4mm, compacted thickness 75mm, loose quantity 0.91 to 1.07 cum | | | |
| Type B 11.2 mm | 0.18 to 0.21 cum | Not uniform | 0.22 to 0.24 cum |

***b) ANALYSIS***

Unit=cum

Taking output=360 cum

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **DESCRIPTION** | **UNITS** | **QUANTITY** | **RATES** | **AMOUNTS** |
| **a) Labour** |  |  |  |  |
| Male | Each | 10.08 | 150 | 1512 |
| Mulia skilled | Each | 2 | 190 | 380 |
| Mulia unskilled | Each | 250 | 150 | 37500 |
| Total |  |  |  | 39392 |
|  |  |  |  |  |
| **b) Machinery** |  |  |  |  |
| Smooth 3 wheeledsteelroller@30cum/hour | Hour | 12 | 339 | 4068 |
| Water tanker  6 KL capacity | Hour | 24 | 582 | 13968 |
| **Total** |  |  |  | 18036 |
|  |  |  |  |  |
| **c) Materials** | | | | |
| **(i) Grading-I** |  |  |  |  |
|  |  |  |  |  |
| **(A) Using moorum or gravel** |  |  |  |  |
| Grading-I(90mm to 45mm)@1.21 cum per 10 sqmFor compacted thickness of 100 mm | Cum | 435 | 750 | 326250 |
| Crushable type such as MoorumGravel for grading-I @ 0.30 cum per 10 sqm | Cum | 108 | 90 | 9720 |
| Cost of water | KL | 144 | 20 | 2880 |
| Total |  |  |  | 338850 |
|  |  |  |  |  |
| **d) Overhead charges @ 10% on (a+b+c)** |  |  |  | 39627.8 |
| Cost for 360 cum =a+b+c+d |  |  |  | 435905.8  =435906 |
| **Rate per cum = (a+b+c)/360** |  |  |  | 1211 |
|  | | | | |
| **Grading-II** |  |  |  |  |
|  |  |  |  |  |
| **(A) Using moorum- or Gravel** |  |  |  |  |
| Grading-II (63 mm to 45mm)@0,91 um per 10 sqm for compacted thickness of 75 mm | Cum | 435 | 790 | 343650 |
| Crushable type such as Moorum or Gravel for grading-II @0.22 cum per 10 sqm | Cum | 105.59 | 90 | 9503 |
| Cost of water | KL | 144 | 20 | 2880 |
|  | | | | |
| **d) Overhead charges @ 10% on (a+b+c)95603.3** |  |  |  |  |
| Cost for 360 cum = a+b+c+d |  |  |  | 451636 |
| **Rate per cum = (a+b+c+d)/360** | |  |  | 1254 |
|  |  |  | | |
| **(iii) Grading-III** | | | | |
|  |  |  |  |  |
| **(A) Using crushable type such as moorum or gravel** |  |  |  |  |
| Grading-III (53mm to 22.4mm)@0.91 cum per 10 sqm for compacted thickness of 75 mm | Cum | 435.6 | 810 | 352836 |
| Crushable type such as moorum or gravel for grading-III @0.22 cum  Per 10 sqm | Cum | 105.59 | 90 | 9503 |
| Cost of water | KL | 144.00 | 20 | 2880 |
|  |  |  |  |  |
| **d) Overhead charges @ 10% on (a+b+c)** |  |  |  | 36522 |
| Cost for 360 cum = a+b+c+d |  |  |  | 401741 |
| **Rate per cum = (a+b+c+d)/360** |  |  |  | 1116 |
|  |  |  |  |  |
| **Average on three Grindings** |  |  |  | 1194 |

**3.PRIME COAT**

***a) SPECIFICATION***

Application of single coat of low viscosity liquid bituminous material to a porous granular surface.

**MATERIALS**

Low porosity bitumen for WBM

Medium porosity bitumen for cement stabilized soil

High porosity bitumen for gravel base

**CONSTRUCTION MACHINARIES**

Self-propelled distributor

Towed bituminous pressure sprayer

Hand spray for small area

**QUALITY CONTROL**

Atmospheric temperature shall less than 10º centigrade

Primer shall not applied during dust storm or water in foggy, rainy or windy

Primer shall not applied after rain or wind speed exceeds 40kmph at 2m high

**Control tests and minimum frequency**

|  |  |
| --- | --- |
| TEST | **FREQUENCY(min)** |
| 1.quality of binder | As IS code 732178887 |
| 2. binder temp. for application | At regular close interval |
| 3.rate of pread of binder | One test per 500 sqm not less than 2 test per day |

**QUANTITY**

Payment shall be made on basis of application rate of 0.6 kg per sqm

**Viscosity and quantity of liquid bituminous primer**

|  |  |  |
| --- | --- | --- |
| Type of surface | Kinetic viscosity at 60º centigrade | Quantity per 10 sqm(kg) |
| Low viscosity | 30-60 | 6-9 |
| Medium viscosity | 70-140 | 9-12 |
| High viscosity | 250-500 | 12-15 |

***b) ANALYSIS***

Providing and applying prime coat withBitumen emulsion using emulsion Pressure distributor at the rate of 0.20 kg Persqm on the prepared surface as per Clause 503 of MoSRT&HSpecificationsFor Road & Bridge works (4th Revision)

**Unit=sqm**

**Taking output=3500 sqm**

**a)Labour**

**Male**  each 0.08 190 15.2

Mulia unskilled each 2 150 300

315.2

**b) Machinery**

Mechanical broom hour 2.8 460 1288

@ 1250 sqm per hour

Air compressor 250 cfm hour 2.8 410 1148

Emulsion pressure distributor hour 2.8 1030 2890

@ 1750 sqm per hour

5626

**c) Material**

Rapid setting Bitumenton0.731500 22077

Emulsion @ 0.2 kg per sqm

**b) Overhead charge @ 10%on**

**(a+b+c)** 2802

Cost for 3500 sqm=a+b+c+d 30820

**Rate per sqm=(a+b+c+d)/3500 *8.80***

**4.OPEN-GRADED PREMIX SURFACING**

***a)SPECIFICATION***

construction having 20mmth composed of small sized aggregate premixing with bituminous binder on previously prepared base.(serve as wearing coarse)

MATERIALS

Paving bitumen as per IS:73

Physical requirement

Not less than 90% by weight retained on 4.75mm sieve

(Physical requirement of coarse aggregates)

|  |  |  |
| --- | --- | --- |
| Property | Test | Specification |
| Cleanliness | Grain size analysis | 5% Passing  0.075mm  (Max.) |
| Particle shape | Flakiness and elongation | 30%(Max.) |
| Strength | Loss Angeles Abrasion Value | 40%(Max.) |
|  | Aggregate impact Value | 30%(Max.) |
| Durability | Sounded |  |
|  | Sodium sulphate | 12%(Max.) |
|  | Magnesium sulphate | 18%(Max.) |
| Water Absorption | Water absorption | 1%(Max.) |
| Stripping | Coating and stripping of bitumen and agg.Mixtures | 95% Retained coating(Min.) |
| Water sensibility | Retained tensile strength | 80%(Min.) |

THICKNESS

Appropriate Tack coat shall applied as applicable

Compacted thickness 20mm

Appropriate seal coat shall applied immediately after laying the surfacing

CONSTRUCTION MACHINARIES

Hot mix plant

80-100 KN Smooth wheeled Roller

Quality Control

Atmospheric temperature shall less 10 deg Centigrade

No work shall be done during dust storm or water in foggy, rainy or windy.

Nowork shall be done after rain or wind speed exceeds 40 Kmph at 2m high.

The HMP shall have dryer arrangement for heating aggregate

Temp. of binder at time of mix 150-163 geg C

Temp. of aggregate at time of mix 155-163 geg C

Deff of temp for binder and agg should not exceed 14 deg C

Discharge temp of 130-160 deg C

Rolling operation shall be completed before the temp of mix falls below 100 deg C

(Control Tests and Minimum frequency)

|  |  |
| --- | --- |
| Test | Frequency(Min) |
| 1.Quality of binder | As IS code 73,217,8887 |
| 2.Agg. Impact value/Loss Angels abrasion Value | One test per 50 cum of aggregate |
| 3.Flekiness index and elongation index | One test per 50 cum of aggregate |
| 4.Stripping value of aggregate | One set of 3 specimen for each source of supply |
| 5.Water absorption of aggregate | One set of 3 specimen for each source of supply |
| 6.Water sensitivity of mix | One set of 3specimen for each source of supply |
| 7.Grading of aggregate | One test per 25 cum of aggregate |
| 8.Soundness(Magnesium and sodium sulphate) | One determination by each method for each source of supply |
| 9.Polished stone value | As required |
| 10.Temp of blinder at application | At regular interval |
| 11.Binder content | One test per 500 cum, and not less than two test per day. |
| 12.Rate of soreyed of mix material | Regular control through check on layer thickness |
| 13.Percentage of fractured faces | When gravel is used one test per 50cum of agg. |

**QUANTITY**

Quantity Required for 20mm Thick of Open graded premix surfacing

|  |  |
| --- | --- |
| Description | Quantity |
| Aggregate |  |
| (a) Normal stone size 13.2mm (Passing 22.4mm and retained on 11.2mm) | 0.18Cum |
| (b) Normal stone siz 11.2mm (Passing 13.2mm ) | 0.09 Cum |
| Total | 0.27 Cum |
| Binder |  |
| (a) For 0.18 Cum of 13.2mm nominal size stone at 52 kg | 9.5Kg |
| (b) For 0.09 Cum of 11.2mm nominal size stone at 56kg | 5.1Kg |
| Total | 14.6Kg |

OPENING TO TRAFFIC

The newly laid surface shall not be open to traffic for at least 24 hour often laying and completion of compaction.

***b) ANALYSIS***

Labour for laying 20mm thick premix Carpet using 0.23cum of 13.2mm to 5.6mm size crushed stone chipping and 12.70kg. Penetration grade of bitumen For 9.29sqm including hire and running Charges of PRR etc. Complete but excluding

Cost and conveyance

Unit = sqm

Taking output = 5889sqm

a) Labour

Mulia for mixing and spreading

carpet

@ 7nos. For 92.90sqm

==444Nos.

Semi-SkilledMulia for handling each 44 170 7480

Man Mulia = 444-44 = 400 each 400 190 76000

**b) Materials**

Fuel for heating tar @ 305kg per

1.016MT

Tar required = =8.05MT

Fuel required = =2.42MT MT 2.42 6500 15730

**c) Machinery**

Hire and running charges of PPR day 11 4300 47300

Considering 535sqm of out turn

With per day (8 hours)

**d) Overhead Charges @ 10% on**

**(a+b+c)**14651

**e) Sundries, T&P @ 2% on (a+b+c)**

Cost per 5889 sqm = a+b+c+d+e 161161

Rate per sqm = (a+b+c+d+e)/5889 ***27.35***

**5.SEAL COAT**

***A) SPECIFICATION***

Application of seal coat for sealing the voids in a bituminous surface laid to specified levels, grade and cross fall (camber).

Type of seal coat

(a)Liquid seal coat:- application of binder followed by a cover of stone chips .

(b)Premixed seal coat:-Thin application of fine agg. Mixed with bituminous binder.

**MATERIALS**

Paving bitumen as per IS:73

Bitumen Emulsion as per IS:8887

**AGGREGATES**

Type –A seal coat:-100% passing in 11.2mm sieve and shall be of 6.7mm size

Type –B seal coat:-100% passing in 2.36mm sieve and retained on 180 micron

**Physical requirement**

(Physical requirement of Coarse aggregate)

|  |  |  |
| --- | --- | --- |
| Property | Test | Specification |
| Cleanliness | Grain size analysis | 5% Passing  0.075mm (Max.) |
| Particle shape | Flakiness and elongation index | 30% (Max.) |
| Strength | Loss Angeles Abrasion value | 40% (Max.) |
|  | Aggregate impact value | 30% (Max.) |
| Durability | Sounded |  |
|  | Sodium sulphate | 12% (Max.) |
|  | Magnesium sulphate | 18% (Max.) |
| Water Absorption | Water absorption | 1% (Max.) |
| Stripping | Coating and stripping of bitumen and agg. Mixtures | 95% Retained coating (Min.) |
| Water sensibility | Retained tensile strength | 80% (Min.) |

**Thickness**

Applied immediate after laying the bituminous coarse which required to be sealed

The prepared surface should be dust free, clean and dry

(Except in the case of cationic emulsion where the surface shall be damp)

**CONSTRUCTION MACHINARIES**

Hot Mix Plant

Self-propelled mechanical sprayer

80-100KN smooth wheeled Roller

80-100KN vibratory Roller

**Quality Control**

Atmospheric temperature shall less than 10 deg centigrade

No work shall be done during dust storm or water in foggy, rainy or windy.

No work shall be done after rain or wind speed exceeds 40 kmph at 2m high.

Temperature of bitumen at the time of spray shall be 150-163 deg C.

The HMP shall have dryer arrangement of heating aggregate

Temp. of binder at time of mix 150-163 deg C

Defference of temp for binder and aggregate should not exceed 14 deg C

Discharge temp of mix 130-160 deg C

Rolling operation shall be completed before the temp of mix falls 100 deg C

|  |  |
| --- | --- |
| **Test** | Frequency (Min) |
| 1.Quality of binder | As IS code 73,217,8887 |
| 2.Agg. Impact value/loss angels abrasion value | One test per 50 cum of aggregate |
| 3.Fleckiness index and elongation index | One test per 50 cum of aggregate |
| 4.Stripping value of aggregate | One set of 3 specimen for each source of apply |
| 5.Water absorption of aggregate | One set of 3 specimen for each source of apply |
| 6.Water sensitivity of mix | One set of 3 specimen for each source of apply |
| 7.Grading of aggregate | One test per 25 cum of aggregate |
| 8.Soundness (Magnesium and sodium sulphate) | One determination by each method for each source of supply |
| 9.Polished stone value | As required |
| 10.Temp. of binder at application | As regular interval |
| 11.Rate of sorayed of mix material | One test per 500 sqm of work, and not less than two test per day, |
| 12.Percentage of fracture face | When gravel is used one test per 50 cum of agg. |

**QUANTITY**

Aggregate used for spreading shall be 0.09 cum per 10 sqm for Type-A

Quantity of bitumen used for premixing 9.8 Kg per 10 sqm for type-A

Quantity of emulsion used for premixing 15.0 Kg per 10 sqm for Type-A

Aggregate used for premixing shall be 0.06 cum per 10 sqm for Type-B

Quantity of bitumen used for premixing 6.8 Kg per 10 sqm for type-B

Quantity of emulsion used for premixing 10.5 Kg per 10 sqm for Type-B

**OPENING TO TRAFFIC**

Traffic shall not be permitted to run any newly surface

In special cases traffic shall be allowed at speed limit to 16 KMPH

***b) ANALYSIS***

Providing and laying seal coat sealing the voids in a bituminous surface laid to the specified levels, grade and cross fall using Type-A seal coat with 0.09 cum of 6.7mm size chips and 9.80kg of 60/70 Penetration grade of bitumen for 10 sqmas per Clause No. 513 of mosrt&hspecification for Road & Bridge works (4th Revision)

Unit = sqm

Taking output = 10250 sqm (92.25 cum)

**a) Labour**

Male skilled each 0.24 190 45.60

Mulia unskilled each 6 150 900

**b) Machinery**

Hydraulic self-propelled chip

Spreader hour 6 3000 18000

Tipper 5.5 cum capacity hour 6 1000 6000

Front end loader 1 cum

Bucket capacity hour 6 1020 6120

Bitumen pressure distributor

@ 1750 sqm per hour hour 6 1350 8100

Smooth wheeled roller

8-10 ton weight hour 6 530 3180

**c) Material**

60/70 penetration grade of

Bitumen @ 9.80kg per 10sqm ton 10.045 22600 227017

Crushed stone chipping of

6.7mmsize defined as 100 cum 92.25 1180 108855

Percent passing 11.2mm sieve

And retained on 2.36mm

Sieve applied @ 0.09 cum

Per 10

Total 378217.60

**d) Overhead charges @10% on** 37821.75

**(a+b+c)**

Cost for 10250 sqm =a+b+c+d 416039.35

Rate per sqm = (a+b+c+d)/10250 ***Rs. 40.50***

9 (A) Supplying, fitting and placing uncoated HYSD bar reinforcement complete as per drawing and technical specification.

Unit-1 MT

Taking Output = 1 MT

**a) Material**

HYSD bars including 5 percent

Overlaps and wastage 1.05MT MT 50000 52500

Binding wire kg 8 60 480

**b)Labour**

Labour for cutting, bending,

Shifting to site, tying and

Placing in position

Male each 0.44 no 190 83.60

Blacksmith(special) each 3.00 nos 170 510

Man mulia each 8.00 nos 190 1520

c) Overhead charges @ 10% on (a+b) 5509.35

Total (a+b+c) 60603

Rate per MT 60603

Rate per 1 quintal 6060.30

**DETAILED**

**ESTIMATE**

**1.EARTH WORK IN EXCAVATION**

a) Formation

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| RD  (m) | Length  (m) | Area(sqm) | | | | |
| Cutting  (sqm) | Filling  (sqm) | Which ever is more | M**e**an  (sqm) | Quantity  (cum) |
| 0 | - | 5.027 | - | 5.027 | - | - |
| 500 | 500 | 17.542 | - | 17.54 | 11.28 | 5642.25 |
| 1000 | 500 | 20.24 | - | 20.24 | 18.89 | 9445 |
| 1500 | 500 | 30.08 | - | 30.08 | 25.16 | 12580 |
| 2000 | 500 | 31.93 | - | 31.93 | 31.005 | 15502 |
| 2500 | 500 | 49.63 | - | 49.63 | 40.781 | 20390 |
| 3000 | 500 | 43.01 | - | 43.01 | 46.32 | 23160 |
| 3500 | 500 | 39.94 | - | 39.94 | 41.48 | 20740 |
| 4000 | 500 | 31.44 | - | 31.44 | 35.69 | 17845 |
| 4500 | 500 | 22.14 | - | 22.14 | 26.80 | 13400 |
| 5000 | 500 | 12.60 | - | 12.60 | 17.37 | 8685 |
| 5500 | 500 | 9.73 | - | 9.73 | 11.17 | 5585 |
| 6000 | 500 | 22.83 | - | 22.83 | 16.285 | 8142.50 |
|  |  |  |  |  | Total | 161117 |

b)Bridge

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Item | Nos | Length | Width | Depth | Quantity |
| Abutment | 2 | 8.8 | 2.1 | 1.25 | 46.20 |
| Piers | 2 | 8.8 | 4.0 | 1.25 | 88 |
| Wing walls | 4 | 2.5 | 2.1 | 1.25 | 26.25 |

c)For filling and any other earth works 200

total 161477cum

**2.Cement concrete of M15 grade with hard granite metal**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Item | Nos | | Length | | Width | | Depth | | Quantity |
| Abutment | 2 | | 8.8 | | 2.1 | | 0.3 | | 11.088 |
| Piers | 2 | | 8.8 | | 4.0 | | 0.3 | | 21.12 |
| Wing wall | 4 | | 2.5 | | 2.1 | | 0.3 | | 6.30 |
| Wearing coat |  | | 59.8 | | 7.0 | | 0.08 | | 33.488 |
| Total 71.996cum  Say 72cum  **3)Cement concrete M20 with hard granite aggregate of 20mm size** | | | | | | | | | |
|  | | | | | | | | | |
| Item | Nos. | | Length | | Width | | Depth | | Quantity |
| Slab | 1 | | 59.8 | | 8.8 | | 0.4 | | 210.496 |
| T-beam | 3\*3 | | 19.8 | | 0.4 | | 0.64 | | 45.619 |
| Kerb | 2 | | 59.8 | | 0.3 | | 0.3 | | 10.764 |
| Railing | 2 | | 80 | | 0.1 | | 0.75 | | 12.00 |
|  |  | |  | |  | |  | |  |
| Total 278.879cum  Say 279 cum  **4)R.R Stone masonry In CementMortar1:4** | | | | | | | | | |
| Items | Nos | | Length | | Width | | Depth | | Quantity |
| Abutment | 2 | | 8.8 | | 1.5 | | 2.05 | | 54.12 |
| Pier | 2 | | 8.8 | | 2 | | 2.05 | | 72.16 |
| Wing wall | 4 | | 2.5 | | 1.5 | | 2.5 | | 37.50 |
|  |  | |  | |  | | Total | | 163.78  Say 164cum |
| **5.Bending and binding wire** | | | | | | | | | |
| Supplying, fitting and placing uncoated HYSD for reinforcement as per drawing and technical specification | Cement concrete M20 | | 266.88cum @ 2 qtl per cum = 534qtl | |  | |  | |  |
|  | | | | | | | | | |
| **6)granular sub-base** | | | | | | | | | |
| Supplying good quality moorum, sand and laying in sub base including cost carriage | | 1 | | 6000 | | 8 | | 0.2 | 9600 |
| **7)water bound macadam** | | | | | | | | | |
| Supplying gr-I,gr-II&gr-III and laying in layers, watering, rolling, complete as directed | | 1 | | 6000 | | 7.2 | | 0.315 | 13608 |
| **8.Prime coat** | | | | | | | | | |
| Providing and applying prime coat with bitumen using emulsion pressure @ of 0.20 kg per sqmexcluding cost of bitumen | | 1 | | 6000 | | 7 | | - | 42000  Sqm |
| **9)premix carpet** | | | | | | | | | |
| Labour for laying 22mm thick premix carpet using 0.23cum of 13.2mm to 5.6mm chips excluding cost carriage of all materials | | 1 | | 6000 | | 7 | | - | 42000  Sqm |
| **10)seal coat** | | | | | | | | | |
| providing and laying seal coat for sealing the voids of a bitumen surface lay to the specified level grade and cross fall | | 1 | | 6000 | | 7 | | - | 42000  Sqm |
| **11)cost and conveyance of aggregate** | | | | | | | | | |
| Cost and conveyance of aggregate including taxes and royalty .  For premix carpet aggregate 11.2mm to 22.4mm size,  For 10 sqm0.27cum.  For 42000sqm=42000\* | | | | | | | | | 1134 cum |
| **12.Cost and Conveyance** | | | | | | | | | |
| i.Premix carpet  For 0.18cum of 13.2mm size aggregate=9.5kg  For 0.09cum of 11.2mm size aggregate= 5.1kg For 10sqm =14.6kg  So for 42000 sqm =42000\*  ii.Seal coat  9.8kg per 10sqm  So for 42000sqm= | | | | | | | | | 61320kg  41160kg  102480kg  102.5ton |
| **13.Centring and Shuttering** | | | | | | | | | |
| Rigid and smooth centering and shuttering for RCC works including false work and dismentlingupto 4.3m. height  Below road slab 3\*18\*(7+6\*0.4)  Sides 2\*59.8\*0.8  Kerb 2\*59.8\*0.3 | | | | | | | | | 507.6  95.68  35.88  639.16sqm |
| **14.Stone packing** | | | | | | | | | |
| Rough stone dry packing in aprons and revetments with hard granite stones of size30 cm and above. | | | | | | | | |  |
| Between pier and abutment 3\*18\*8.8\*0.3  U/S and D/S bed 1\*10\*60\*0.3  Slope 4\*5\*4.5\*0.3 | | | | | | | | | 142.56  180  27  349.56  Say 350cum |
|  | | | | | | | | | |
| 15.Fixing KM stone sign boards etc | | | | | | | | | L.S |

**ABSTRACT OF ESTIMATE**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| SL No. | Description of item | Quantity | Unit | Rate | Amount |
| 1 | Earthwork in excavation in filling and cutting | 161477.2 | cum | 16.08 | 25,96,553 |
| 2 | Cement concrete of M15 grade | 71.996 | cum | 4600 | 3,31,182 |
| 3 | Cement concrete of M20 grade | 266.88 | cum | 5360 | 14,30,477 |
| 4 | R.R. Stone masonry in cement mortar 1:4 | 16.78 | cum | 3428 | 57,522 |
| 5 | Bending and binding wire | 534 | qtl | 6060 | 32,36,040 |
| 6 | Granular Sub base | 9600 | cum | 441.20 | 42,35,520 |
| 7 | Water bound mecadam | 13608 | cum | 1194 | 1,62,47,952 |
| 8 | Prime cost | 42000 | Sqm | 8.80 | 36,960 |
| 9 | Premix carpet | 42000 | Sqm | 27.35 | 1,14,870 |
| 10 | Seal coat | 42000 | Sqm | 40.50 | 1,70,100 |
| 11 | Cost & Conveyance of aggregate | 1134 | cum | 1300 | 14,74,200 |
| 12 | Cost & Conveyance of bitumen | 102.5 | ton | 22800 | 23,37,000 |
| 13 | Rigid & Smooth centring& shuttering for RCC work including false work &dismentallingupto 4.3m hight | 639.16 | Sqm | 700 | 4,47,412 |
| 14 | Rough stone dry packing | 349.56 | cum | 450 | 1,57,302 |
| 15 | Fixing KM stone sign boards etc |  |  |  | 2,00,000 |

Total Rs 3,30,73,090

**CONCLUSION**

Roads are central medium of social and economic interactions, as well as common medium of transportation and it contributes to the economic, industrial social and cultural development of any country. The introduction of a new road, or the widening of an existing road, may cause disruptions to local interactions. Increasing level of traffic congestion is an inescapable result of strong economic activities and life in urban areas and a challenge to the planning authority and government so to avoid such circumstance we extended the existing road to a length of 6km.