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# *Design & Estimation of Flexible Pavement on Kandukur road for a Stretch of 2 km*

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***Abstract***

*The design and estimation of flexible pavement on Kandukur road of stretch 2 km by traffic counts, levelling and soil test. Traffic count is vehicular traffic which is along a particular road, path or intersection .A traffic count is commonly under taken either automatically or manually by observes who visually count and record traffic on a hand-held electronic device or tally sheet .Traffic count is very important to increase efficiency and life of road and reduces traffic volume at a particular section.*

*Levelling is the process by which difference in height between two or more points can be determined. Common levelling instruments include the spirit level. The dumpy level, digital level and the laser level levelling in a branch of surveying the object of which is to find or establish the elevation of a given point with respect to given or assumed datum point or reference point California Bearing Ratio (CBR) test is most commonly used test for designing of thickness of pavements. CBR test is penetration test for evaluation of mechanical strength of natural ground, sub-grade and base coarse beneath new carriage way construction CBR rating was developed for measuring the load bearing capacity of soil used for buildings, roads. The harder the surface the higher the CBR rating higher quality crushed rock as a CBR over 80.the*

*standard material for this test is crushed California limestone which has valve of 100.CBR values of over 100 in well compacted areas. Estimation of flexible pavement was done by MORTH [ministry of road transport and highways] specifications and using excel sheets.*

*Hence the design and estimation of flexible pavement is done by traffic counts, leveling and soil test.*

***Keywords:*** *Traffic volume count, CBR, thickness of pavement, camber, morth, irc 37,*

## 1. INTRODUCTION

Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded.

## TRAFFIC COUNT

A traffic count is a count of vehicular or pedestrian traffic, which is conducted along a particular road, path, or intersection. A traffic count is commonly undertaken either automatically (with the installation of a temporary or permanent electronic traffic recording device), or manually by observers who visually count and record traffic on a hand-held electronic device or tally sheet. Traffic counts can be used by local councils to identify which routes are used most, and to either improve that road or provide an alternative if there is an excessive amount of traffic. Also, some geography fieldwork involves a traffic count. Traffic counts provide the source data used to calculate the Annual Average Daily Traffic (AADT), which is the common indicator used to represent KANDUKUR ROAD FOR A STRECH OF 2 KM traffic volume. Traffic counts are useful for comparing two or more roads, and can also be used alongside other methods to find out where the CBD of a settlement is located. Traffic counts that

include speeds are used in speed limit enforcement efforts, highlighting peak speeding periods to optimize speed camera use and educational efforts.

To permanently or temporarily monitor the usage of a road, an electronic traffic counter can be installed or placed to measure road usage continuously or for a short period of time. Most modern equipment called ATR's (Automatic Traffic Recorders) store count and/or classification data recorded in memory in a timestamp or interval fashion that can be downloaded and viewed in software or via a count display on some equipment. In some instances people either draw up a table and/or use a tally to keep a record of vehicles which pass manually as an alternative to ATR's

**TRAFFIC COUNT TABLE**

This is a traffic count table, showing the type of vehicle and the data collected at mock site. This data has been compiled into numbers from each direction and a total count.

***Table: 1***

| Vehicle Type | Lane 1 | Lane 2 | Total count |
|---|---|---|---|
| Bicycles | 5 | 2 | 7 |
| Passenger Cars | 48 | 47 | 95 |
| Passenger Trucks | 15 | 9 | 24 |
| Buses | 3 | 2 | 5 |
| Semi-Truck/Lorry | 16 | 11 | 27 |

***Types of counts***

***1. Levels of measurement of flow:***

The three common levels of measurement of vehicle flow are:

**a.** Average annual flow, expressed in vehicles per year.

**b.** KANDUKUR ROAD FOR A STRECH OF 2 KM Annual Average Daily Traffic (AADT),expressed in vehicles per year.

**c.** Hourly flow, expressed in vehicles per hour.

## SHORT TERM AND LONG TERM COUNTS

The duration of counts depends upon the purpose for which the data are needed and the financial and man-power resources at the command of the traffic engineer. sometimes, it is only necessary to measure the flow for a short term ,say an hour ;at other times the flow may be measured for an intermediate periods such as a full day of twenty-four hours ;in some situations , the count may extend for a duration of a full week; and lastly ,the count may be a continuous and regular affair. The examples of situations where the above types of counts are made are given below.

***Methods available for traffic counts:***

The methods available for a traffic counts are listed below

1. Manual method
2. Combination KANDUKUR ROAD FOR A STRECH OF 2 KM of manual and mechanical methods
3. Automatic devices
4. Moving observer method
5. Photographic methods.

## TRAFFIC VOLUME STUDIES

***Definition:***

The term traffic volume study can be termed as traffic flow survey or simply the traffic survey. It is defined as the procedure to determine mainly volume of traffic moving on the roads at a particular section during a particular time.

***Ways of conducting Traffic Survey / Methods of Traffic Volume Study:***

Following are the means of conducting traffic survey:

1. By toll Plaza Ticketing
2. Registration offices
3. Statistical Approach
4. By interviewing
5. By Check posts
6. Modern Global Positioning Systems.

***Importance of Traffic Volume Study:***

Traffic survey is very important to be performed because it can:

1. Increase the efficiency and life of roads
2. Reduces traffic volume at a particular section
3. Provide better means for development of infrastructures
4. Provide better means to utilize other roads in case of special events in the city
5. Provide estimate of no vehicles against no of person.

***Method using in this project:***

Now we can use **manual countmethod** in this project because:

1. Details such as vehicle classification and number of occupants can be easily obtained. With automatic devices these data are unfortunately lacking, and hence automatic counting should be supported by manual counts.
2. it is very easy to compare the other methods.
3. it is less economical because there is no electronic devices are used.
4. Specific vehicular movements such as left-turns, right-turns, straight-a heads etc at a junction can be noted and recorded.
5. Manual methods use field personnel to count and classify traffic flowing past a fixed point.
6. The data can be collected giving the breakdown of traffic in each direction of travel.
7. Data accumulated by manual methods are easy to analyze.
8. Manual methods are suitable for short term and non continuous counts

***Automatic device method is not used because:***

1. Enable count of traffic to be taken at any given location and a record to be kept of the count so we are not choosing the method.
2. It is more economical because sensors are used in this method.
3. In this method the recording devices usually run on 6 volt batteries, which needsto be charged at regular intervals.
4. It is very hard.

***A combination of manual and mechanical method*** is not used because:

It involves the services of field personnel who operate mechanical devices to count and record the arrival of vehicles at any given point across a road.

***Moving vehicle method is not used because:***

Moving vehicle method is special traffic engineering technique which results in the collection of data on the flow and speed traffic, travel time, delay at junctions and parking.

***Photographic method is not used because:***

Photographic methods for measuring flow and other traffic characteristics are becoming powerful tools in the hands of the traffic engineer.

**COMPUTATION OF DESIGN TRAFFIC:**

The design traffic is considered in terms of a cumulative number of standard axles to be carried during the design of life of the road. This can be computed the following equation.

$$N = \frac{365x[(1+r)^n-1]}{r} x\ A\ x\ D\ x\ F$$

Where,

N= the cumulative number of standard axles to be created for in the design of MSA

A= initial traffic in the year of completion of construction terms of the number of commercial vehicles per day.

D= lane distribution factor, F=vehicle damage factor , n=design life factors

r= annual growth rate of commercial vehicles (for 7.5% annual growth)

The traffic in the year of completion is estimated using the following formula

$A=P(1+r)^x$

Where,

P=no of commercial vehicles as per last count

X= no of years between the last count and the year of completion of construction

$N=[365*[(1+0.075)^{15}-1]]*100*1*1.25/0.075$

N=1.20 MSA

**SURVEYING**

The art of measuring the distances and angles on ground in such a way that it becomes reproducible on a map which is drawn to scale later on is called surveying.

Knowing about the relative position of various objects, determination of distances between them, measurement of angles, measurement of height, determination of

boundaries and relative heights of various points come under the purview of surveying.

Appropriate measuring tape (Fiber, steel, etc.) or chain is used. The metallic end of the tape is also taken into account while measuring the length. The distances are written on the tape in m, cm, etc.

**LEVELING**

The process of finding the elevation at a specified location relative to another known elevation.

**BASIC THEORY:**

- Add rod readings to the elevation of the benchmark to get the elevation of the line of sight
- Subtract rod readings from the elevation of the line of sight to establish the elevation of unknown points

**TYPES OF LEVELLING**

Barometric Leveling
Trigonometric Leveling
Differential Leveling:
Modern Tilting Leveling
Profile Levelling

**DUMMPY LEVEL:**

Dumpy level is the profile leveling.

- Levels by the help of bubble tube. Adjustment of level bubble needed only once after level set up
- These are more basic levels often used in construction work. The telescope is rigidly attached to a single bubble and the assembly is adjusted either by means of a screwed ball-joint or by foot screws which are adjusted first in one direction, then at 90.

**COMPONENT PARTS OF LEVELING INSTRUMENTS**

A leveling instrument essential consist of the following

a. A leveling head with three foot screws which enables to bring the bubble center

b. A telescope that provides line of sight to bisect the distant object

c. A bubble tube to make line of sight horizontal

d. A tripod for supporting the leveling instrument, platinum wires or line attached on glass plate

**FIELD BOOK (LEVEL SURVEY)**

**METHODS OF LEVELING**

There are two methods by which the levels of different points situated on ground is calculated after completing the field work. These are:

1. Height of Instrument method or collimation method

2. Rise and fall method.

**1. COLLIMATION METHOD**

It consist of finding the elevation of the plane of collimation ( H.I.) for every set up of the instrument, and then obtaining the reduced level of point with reference to the respective plane of collimation.

1. Elevation of plane of collimation for the first set of the level determined by adding back side to R.L. of B.M.

2. The R.L. of intermediate point and first change point are then obtained bystarching the staff reading taken on respective point

(IS & FS) from the elation of the plane collimation. [H.I]

3. When the instrument is shifted to the second position a new plane collimation is set up. The elevation of this plane is obtained by adding B.S. taken on the C.P From the second position of the level to the R.L. C.P. The R.L. of successive point and second C.P. are found by subtract these staff reading from the elevation of second plane of collimation

Arithmetical check

Sum of B.S. – sum of F.S. = last R.L. – First R.L.

This method is simple and easy.

Reduction of levels is easy.

Visualization is not necessary regarding the nature of the ground.

There is no check for intermediate sight readings

This method is generally used where more number of readings can be taken with less number of change points for constructional work and profile leveling.

**2. RISE AND FALL METHOD**

It consists of determining the difference of elevation between consecutive points by comparing each point after the first that immediately preceding it. The difference between there staff reading indicates a rise fall according to the staff reading at the point. The R.L is then found adding the rise

to, or subtracting the fall from the reduced level of preceding point.

***Arithmetic check***

Sum of B.S. – sum of F. S. = sum of rise – sum of fall = last R. L. – first R.L.

This method is complicated and is not easy to carry out.

Reduction of levels takes more time.

Visualization is necessary regarding the nature of the ground.

- Shifting bench mark from sku main gate to kandunkur road
- Then finding the exisisting levels of the ground

**BM @ SKU main gate =368.183**
**BM @kandukur road =368.303**

***California bearing ratio test (CBR)***

California bearing ratio test was developed by the California state highway department as a method for evaluating the strength of sub grade soil and other pavement materials for the design and construction of flexible pavements. The CBR test results have been correlated with flexible pavement thickness requirements for highway and air fields. Being an empirical test method, CBR test results cannot be related accurately with any fundamental property of the soil or pavement material tested. The CBR method of test has also been standardized by the Bureau of Indian standards (BIS).

CBR test denotes a measure of resistance to penetration of soil or flexible pavement material, of standard plunger under controlled test conditions. The CBR test may be conducted in the laboratory generally on re-molded specimens; the test may also be conducted on undisturbed soil specimens. The laboratory test procedure should be strictly adhered if high degree of 1reproducibility is desired. Procedure for field determination of CBR value of soil in-place or in-situ has also been developed and standardized by different agencies including the BIS.

The basic principle in CBR test is by causing a cylindrical plunger of 50mm diameter to penetrate into the specimen of soil or pavement component material at a rate of 1.25 mm per minute. The loads required for 2.5mm and 5.0mm penetration of the plunger into the soil/material tested are recorded. The CBR value of the material tested is expressed as a percentage of standard load value in standard material.

The standard load values have been established on large number of tests onstandard crushed stone aggregate at the respective penetration levels of 2.5 and 5.0 mm. these standard values given below may directly be used to compute the CBR value of the test material.

***Standard load values on crushed stone aggregate for specified Penetration values***

| Penetration, mm | Standard load, kg | Unit standard load, kg/cm2 |
|---|---|---|
| 2.5 | 1370 | 70 |
| 5.0 | 2055 | 105 |

***Applications of CBR test in flexible pavement design:***

Several agencies in different countries have standardized CBR test method and have developed charts for the design of flexible pavements for roads and runways based on CBR values of sub grade soil and other pavement materials. CBR test as well as CBR method of flexible pavement design are simple and performance studies of these pavements have been extensively investigated and found to be generally satisfactory. The Indian Road Congress (IRC) has standardized the guidelines for the design of flexible pavements based on CBR test (vide IRC: 37-2001) and this method is being followed for the design of flexible pavements for all categories of roads in India.

**Determination of CBR value in the laboratory:**

The laboratory CBR apparatus consists of a mould 150 mm diameter with a base plate and a collar , a loading frame with the cylindrical plunger of 50 mm diameter and dial gauges for measuring the expansion on soaking and the penetration values.

The specimen in the mould is compacted to a dry density corresponding to the minimum state of compaction likely to be achieved in practice. In the absence of information the specimens may becompacted to maximum dry density at the optimum moisture content (OMC). IS heavy compaction asper IS: 2720part VIII is preferred for high trafficked roads like expressways and national and state highways; however IS light compaction as per IS: 2720 part-VII may be adopted for low volume roads. The specimen is subjected to four days soaking and the swelling and water adsorption values are noted. The surcharge weight is placed on

the top of the specimen in the mould and assembly is placed under the plunger of the loading frame as shown in fig.

The load values are noted corresponding to penetration values of 0.0, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 4.0, 5.0, 7.5, 10.0 and 12.5mm. The load penetration graph is plotted as shown in fig. Alternatively the load may be converted to pressure values and plotted against the penetration values.

Two typical types of load- penetration curves may be obtained as shown in fig. The normal curve is with convexity upwards as for specimen no.1 and the loads corresponding to 2.5 and 5.0 mm penetration values are noted. Sometimes a curve with initial upward concavity is obtained, indicating the necessity of correction as can be seen for specimen no.2 in the graph. In case , the " corrected origin " is established by drawing a tangent from the steepest point on the curve, to obtain the corrected origin as shown in fig. The load values corresponding to 2.5 and 5.0 mm penetration values from the corrected origin are noted.

***The CBR value is calculated using the relation:***

***CBR, % = [load sustained by the specimen at 2.5 or 5.0mm penetration] /[load sustained by standard aggregates at the corresponding penetration level ]*100***

The causes for the initial concavity of the penetration curve calling for the correction in origin due to;

1. The top layer of the soaked soil is too soft or slushy after soaking in water
2. Top surface of the soil specimen is not even and
3. The penetration plunger of the loading machine is not vertical; therefore the bottom surface of the plunger is not horizontal and is not fully in contact with the top surface of the specimen.

Normally the CBR value at 2.5 mm penetration is higher than that 5.0mm and the higher value is reported as the CBR value of the material. However if the CBR value obtained at 5.0mm penetration is higher than that obtained at 2.5mm , then the test is to be repeated for checking. If the check test again gives similar results, the higher value obtained at 5.0mm penetration is reported as the CBR value. The average CBR value of three test specimens is reported as the CBR value of the material, to the first decimal place. If the variation in

CBR value between the three specimens is more than the prescribed limit, tests should be repeated on additional three samples and the average CBR value of six specimens is accepted.

The CBR test is essentially an arbitrary strength test and hence cannot be used to evaluate the soil properties like cohesion or angle of internal friction or shearing resistance. Unless the test procedure is strictly followed, dependable results cannot be obtained. Presence of coarse grained particles would results in poor reproducibility of CBR test results. Material passing 20mm sieve is only used in the test.

Field CBR test is carried out using in situ penetration equipment. In situ tests are not generally recommended for design purposes, as it is not possible to satisfactorily simulate the critical conditions of dry density and moisture content in the field.

**RESULT OF CBR ON KANDUKUR ROAD**

- The cbr value for 1 km stretch on kandukur road is **2.5%**
- The cbr value for remaining 955 mt on kandukur road is **3%**

**CAMBER:**

**DEFINITION:**

The convexity or curvature ofthe road to avoid staying of the water is known as camber. The highest point of camber is known as crown.

camber is

1. To curve upward in the middle.
2. To arch slightly.

***Road camber height depends upon***

1. Rainfall intensity in the area.
2. Type of the road surface whether it is flexible or rigid.
3. In case of flexible pavement, the recommended height of camber is 2% of the total width of the pavement.
4. For rigid pavement, the maximum recommended width is 1:72..
5. Camber Value

As per IRC-37 camber is taken **as 2%** for single lane low rainfall areas**.**

***Components of flexible pavements:***

The components of flexible pavement structure are shown in below figure. The flexible pavement structure consist of a number of layers. The top surface of the pavement has to sustain the highest magnitude of stresses and wear and tear due

to the moving traffic loads. The surface course has also to withstand the adverse effect of rainfall, flow of surfacewater and the resultant adverse effects of variations in water content and temperature due to climaticconditions of thelocality. Therefore the highest quality materials are made use of in the top layers. As the lower layers of the pavement are subjected to less severe stress and other adverse conditions, inferior and cheaper may be made use of. The components of a typical flexible pavement structure (from the bottom to the top) consist of:

1. Prepared soil sub grade.
2. Granular sub-base cum drainage layer.
3. Granular base course.
4. Bituminous binder and surface course.

***Thickness of the Pavement***

As per Indian Road Congress(IRC) 37 Recommended Designs for Traffic Range 1-10 msa

- *Cumulative Traffic (msa) is* ***1.2***
- *Thickness of the Pavement for 1 km stretch is* ***616mm***
- *Thickness of the pavement for remaining 955 mts is* ***562mm.***
- Determination of Formation Levels

***Formula***:

- Camber = (Existing Level (EL) – Formation Level(FL) ) ×100/Thickness of the Pavement
- Formation Level =Existing Level (EL) – (camber ×Thickness of the Pavement)

**DEFINITION OF ESTIMATING AND COSTING**

Estimating is the technique of calculating or Computing the various quantities and the expected Expenditure to be incurred on a particular work or project.

In case the funds available are less than the estimated cost the work is done in part or by reducing it or specifications are altered, the following requirement are necessary for preparing an estimate.

a) Drawings like plan, elevation and sections of important points.

b) Detailed specifications about work men ship & properties of materials etc

**NEED FOR ESTIMATION AND COSTING**

1. Estimate give an idea of the cost of the work and hence its feasibility can be

determined i..e whether the project could be taken up with in the funds available or not.

2. Estimate gives an idea of time required for the completion of the work.

3. Estimate is required to invite the tenders and Quotations and to arrange contract.

4. Estimate is also required to control the expenditure during the execution of work.

5. Estimate decides whether the proposed plan matches the funds available

**PROCEDURE OF ESTIMATING OR METHOD OF ESTIMATING**

Estimating involves the following operations

1. Preparing detailed Estimate.
2. Calculating the rate of each unit of work
3. Preparing abstract of estimate

**DATA REQUIRED TO PREPARE AN ESTIMATE**

1. Drawings i.e. plans, elevations, sections etc.
2. Specifications.
3. Rates.

**DRAWINGS**

If the drawings are not clear and without complete dimensions the preparation of estimation become very difficult. So, It is very essential before preparing an estimate.

**RATES:**

For preparing the estimate the unit rates of each item of work are required.

1. For arriving at the unit rates of each item.
2. The rates of various materials to be used in the construction.
3. The cost of transport materials.
4. The wages of labour, skilled or unskilled of masons, carpenters, Mazdoor,

**UNITS OF MEASUREMENTS:**

The units of measurements are mainly categerised for their nature, shape and size and for making payments to the contractor and also. The principle of units of measurements normally consists the following:

a) Single units work like doors, windows, trusses etc., are expressed in numbers.

b) Works consists linear measurements involve length like cornice, fencing, hand rail, bands of specified width etc., are expressed in running meters (RM)

(b) Works consists areal surface measurements involve area like plastering, white washing, partitions of specified

thickness etc., are expressed in square meters ($m^2$)

c) Works consists cubical contents which involve volume like earth work, cement concrete, Masonry etc are expressed in Cubic meters.

**RULES FOR MEASUREMENT:**

The rules for measurement of each item are invariably described in IS-1200. However some of the general rules are listed below.

1. Measurement shall be made for finished item of work and description of each item shall include materials, transport, labour, fabrication tools and plant and all types of overheads for finishing the work in required shape, size and specification.

2. In booking, the order shall be in sequence of length, breadth and height or thickness.

3. All works shall be measured subject to the following tolerances.

i) Linear measurement shall be measured to the nearest 0.01m.

ii) Areas shall be measured to the nearest 0.01 sq.m

iii) Cubic contents shall be worked-out to the nearest 0.01 cum

4. Same type of work under different conditions and nature shall be measured separately under separate items.

5. The bill of quantities shall fully describe the materials, proportions, workmanships and accurately represent the work to be executed.

6. In case of masonary (stone or brick) or structural concrete, the categories shall be measured separately and the heights shall be described:

a) from foundation to plinth level
b) from plinth level to First floor level
c) from Fist floor to Second floor level and so on.

**TYPES OF ESTIMATES**

**DETAILED ESTIMATE:**

The preparation of detailed estimate consists of working out quantities of various items of work and then determine the cost of each item. This is prepared in two stages.

***i) Details of measurements and calculation of quantities:***

The complete work is divided into various items of work such as earth work concreting, brick work, R.C.C. Plastering etc., The details of measurements are taken from

drawings and entered in respective columns of prescribed proforma. the quantities are calculated by multiplying the values that are in numbers column to Depth column as shown below:

***ii) Abstract of Estimated Cost:***

The cost of each item of work is worked out from the quantities that already computed in the details measurement form at workable rate. But the total cost is worked out in the prescribed form is known as abstract of estimated form. 4%of estimated Cost is allowed for Petty Supervision, contingencies and unforeseen items.

The detailed estimate should accomplice with

i) Report
ii) Specification
iii) Drawings (plans, elevation, sections)
iv) Design charts and calculations
v) Standard schedule of rates.

***Then quantity of the materials will be found out***

*Quantity of materials for 1 km length =2595.2 cum*

*Quantity of materials for remaining 1 km length=2522.33 cum*

**APPROXIMATE ESTIMATION:**

***Approximate Estimate for 1 km Stretch***

| Sno | Type Of Work | Per Km | Stretch Length( Mts) | Cost Of Stretch |
|---|---|---|---|---|
| 1 | Earth Work Up To Sub Grade | 6,50,520.129 | 1000 | 6,50,520.129 |
| 2 | Granular Work | 19,39,804.154 | 1000 | 19,39,804.154 |
| 3 | Bituminous Work<br><br>Dense Bituminous Macadam | 14,65,404.387 | 1000 | 14,65,404.387 |
| 4 | Bituminous Concrete | 9,63,036.800 | 1000 | 9,63,036.800 |
| | Total | | | 50,18,765.471 |

***Approximate Estimate for Remaining 1 km Stretch is***

| Sno | Type Of Work | Per Km | Stretch Length(Mts) | Cost Of Stretch |
|---|---|---|---|---|
| 1 | Earth Work Up To Sub Grade | 5,93,494.013 | 1000 | 5,93,494.013 |
| 2 | Granular Work | 17,69,756.388 | 1000 | 17,69,756.388 |
| 3 | Bituminous Work<br>Dense Bituminous Macadam | 13,36,943.612 | 1000 | 13,36,943.612 |
| 4 | Bituminous Concrete | 8,78,614.742 | 1000 | 8,78,614.742 |
| | Total | | | 45,78,808.757 |

The total approximate estimate for flexible pavement of stretch 2kms=***95,97,574.228 rupees.***

Contractors profit = 10%

=***9,59,757 rupees***

Total approximate estimation for 2 kms stretch = ***1,05,57,331.4 Rupees***

## CONCLUSIONS

1. Cumulative Traffic (msa) is **1.2**

The CBR value for the one kilometer stretc h on Kandukuru road is **2.5%**

The CBR value for the 955 MT kandukur r oad **3%**

Thickness of the Pavement for 1 km stretch s **616mm**

Thickness of the pavement for remaining 95 5 mts is **562mm**

Quantity of materials for 1 km length =2595 .2 cum

Quantity of materials for remaining 1 km length=2522.33 cum

Total approximate estimation for 2 kms stret ch = **1,05,57,331.4** Rupees

## REFERENCES

I. Highway Engineering – S.K.Khanna&C.E.G.Justo

II. Highway Materials & Pavement Testing

III. Wells,G.R. 'Highway planning techniques'-The balance of cost and benefit, Griffin, London.

IV. MORTH, Road Development Plan: "vision – 2021', Ministry of Road Transport&Highways, Indian Road Congress, New Delhi.

V. IRC, 'Manual of standards and Specifications of two laning of state Highways on BOT basis', IRC : SP:73-2007, Indian Road Congress, New Delhi.

VI. Surveying and Levelling by N NBasak.

VII. Surveying vol 1&2 by Dr.B.C.Punmia.

VIII. Estimation & Costing by B.N.Dutta.