PLANNING, ANALYSIS AND DESIGN OF FLYOVER AT CROSS CUT ROAD AND DR.NANJAPPA ROAD JUNCTION

A PROJECT REPORT

Submitted by

Ms.LAVANYA.N	(Reg.no:71205103016)
Ms.PRIYANKHA.K	(Reg.no:71205103027)
Ms.SARANYA LAKSHMI.T	(Reg.no:71205103040)

in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

CIVIL ENGINEERING

KUMARAGURU COLLEGE OF TECHNOLOGY

Coimbatore-641006

ANNA UNIVERSITY: CHENNAI 600 025

APRIL 2009

P-2670

BONAFIED CERTIFICATE

Certified that this project titled.....''PLANNING,ANALYSIS AND DESIGN OF FLYOVER AT CROSS CUT ROAD AND DR.NANJAPPA ROAD JUNCTION'' The bonafied work done by.. Reg no................................ who carried out the work under my supervision. Certified further, that to the best of my knowledge the work reported here does not form part of which a degree or award was confirmed on an earlier occasion on this or any other candidate

S.L. Narasimhan

HOD/GUIDE

Dr.S.L.NARASIMHAN

HEAD OF THE DEPARTMENT

DEPARTMENT OF CIVIL ENGINEERING

Place: Coimbatore

Date: 26.04.09

Submitted for the project viva-voce examination on ...29..04..09

at Kumaraguru College of Technology, Coimbatore – 641006

S.L. Narasimhan

Internal Examiner

External Examiner

ACKNOWLEDGEMENT

We the members of this project wish to express our gratitude to our beloved Ex principal **Dr.JOSEPH.V.THANIKAL** and our wise principle **Mr.R.ANNAMALAI** for providing all the facilities in completing our project.

We place our record on sincere thanks to head of the department and guide **Dr.S.L.NARASIMHAN**, professor, department of Civil Engineering, for providing his valuable guidance immense efforts and perennial encouragement in bringing out his meritorious volume amidst all his works.

We express our sincere thanks to the Coimbatore city municipal corporation for providing us the information we required and for their timely help.

We also express our sincere thanks to Prof.**Dr.J.PREMALATHA** for helping us in fulfilling this volume.

We wish to thank Mr.K.RAGHUNATHAN CAD engineer, department of civil engineering for giving helping hand in course of this project.

We are greatly indebted to our parents, our teachers and friends whose mark of affection gave us a new life.

TABLE OF CONTENTS

SYNOPSIS

SYNOPSIS

The main objective of this project is to gain knowledge on different phases in the construction of flyover.

The lanes in this project are provided with two way/one way without any hindrance to traffic. No signal or no police to regulate the traffic is required Three minutes of waiting for signal is saved for thousands of people. Huge amount of fuel consumed by the vehicle will be saved. This saves several lakh man hours of work. Provisions are made such that they get ample space for parking and about 200 cars can be parked in the ground lane. This flyover comprises of 3 layers – Top level, Ground level and Underground level. Traffic volume has been found by means of Peak hour traffic survey. Roads are connected as follows

Top level –Straight traffic trough sathy road (Dr.Nanjappa road) Both up and down.

Ground level – Free lefts from Sathy road to V.K.K.Menon road and from V.K.K.Menon road to Dr.Nanjappa road and from Dr.Nanjappa road to cross cut road and right turn from V.K.K.Menon road to Sathy road

Underground level – Right turn from Dr.Nanjappa road to V.K.K.Menon road and Another right turn from Sathy road to Cross cut road – single lane.

The flyover has been designed with flat slab construction and also with secondary and main beam construction for super structure. The cost of both

LIST OF SYMBOLS

The following symbols carrying the meanings noted against them are used in this volume

A =area

Ast =area of steel reinforcement

Ag =gross area of the section

BM =bending moment

B =breadth of the beam,slab and shorter span

D =overall depth of beam or slab

d =effective depth of beam or slab

D1 =depth of the footing

D2 =depth of the footing at the face of the column

fy =characteristics strength of steel

fck =characteristics compressive strength of the concrete

l =length of the beam

lx =length of the shorter span

ly =length of the longer span

Mux =maximum uniaxial moment capacity for an axial load of Pu

V =shear force

M =modular ratio

W =total load

UDL =uniformly distributed load

SBC =safe bearing capacity

Ld =development length

N =newton

Mm =millimetre

c/c =center to center distance

Fe415=high yield strength of deformed bars

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

CHAPTER 1

INTRODUCTION

Though bridges have existed through the history of human civilisation, flyovers can be considered as the brainchild of 20^{th} century. They are the result of a growing population and the limitations of an expanding city. Though they are primarily urban phenomena, the designs of flyovers are often incongruous to the design elements of the city's structures. some are also not visually appealing.

Most early flyovers have , infact, been purely utilitarian. Their main function was to enable the transportation of vehicle from one end to the other to ease the flow of traffic. No thought was given to the design or scale of the flyover in conjunction with the surrounding buildings or even the ambiance of general.

It must be noted here the flyovers require a grade degree of foresight when it comes to their design. considering that the flyover is said to be a permanent fixture on the cityscape on the long time to come, It should also be designed to please one's senses. The designer should be sensitive to the nature and the needs of the area in which the flyover is supposed to be built. Further, a deeper understanding of the whole context with significant factor such as the heights of the surrounding building when their architecture is required.

Change in an inevitable element of progress

The flyover comprises of three layers-top level, ground level and underground level. The four roads are connected by means of their volume of traffic. Traffic volume is found by means of peak hour traffic survey. connections of the roads are as follows

Top level – Dr.Nanjappa road and sathy road are connected to the extend of 200m on either side from the centre. The hight of the top level from the ground level is 5m: width of the lane is 8.5m and slope is 1 :20

Ground level – cross cut road and V.K.K.Menon road are connected in the ground level. free left is provided in each road. Space is provided for car parking.

Underground level – right turn from sathy road to cross cut and another right turn from Dr.Nanjappa road to V.K.K.Menon road. The hight of this lane is 4m from the ground level. Width of each lane is 3.6m and slope 1:20

After discussing the various facts, we can say that the flyover should be constructed only if the benifits from it or far greater than the cost incurred.also proper location must be decided in constructing it with proper management. It should be seen that as far as possible the flyovers purpose is consummated.

REVIEW OF FLOWER

CHAPTER 2

REVIEW OF FLYOVER

FLY OVER

It is a bridge that carries one road or railway line above another either with or without subsidiary roads, for communication between the two.

Reason behind going for a flyover: - As the traffic on the road goes on increasing and we don't have any space left in both the dimensions, then the only option left will be to go to the third dimension and that is done through flyover construction.

Classification

At Crossings:

Railway crossings: At railway crossing where there is high traffic congestion in terms of frequency of trains passing by or the traffic on the road, in both the cases the flyover should be providing along the road. Here the flyover becomes indispensable.

Road crossing: There are two types of flyovers which are used for traffic management at road crossings.

Simple flyovers: - In this case, the main road is used for fast traffic, which is made to pass at a high level by a bridge, providing ramps on both the approaches; and the slow traffic is made to pass underneath. Thus the traffics

N.B. flyover bridges are not well suited to roads where separate provision for cyclists is to be made, because climbing a flyover becomes difficult for a cyclist. Even after providing the flyover, as we have to continue providing the traffic lights at the intersection beneath the flyover so as to make a person approaching from any direction reach every other direction, the flyover is not replacing the traffic lights.

There are two direction of traffic flow at two different times. This we cannot afford if two both the roads are having heavy and fast traffic. So we have to find some other option so that no one will be interrupted. The option is to contrast a cloverleaf junction.

Grade separator: - The Rotary Grade Separator dovetails the benefits of a rotary with the concept of a flyover. It is essentially a multi-level rotary with traffic segregation at distinct vertical levels on the basis of mode of traffic and not direction alone. We already accept the horizontal segregation of traffic in separate lanes based on direction and within lanes based on speed of travel. The Rotary Grade Separator carries this idea of segregation through to a traffic crossing. While the flyover focuses on enabling fast movement of traffic, it ignores pedestrians' difficulty in negotiation. The biggest benefit of the Rotary Grade Separator is that it is designed around the human being- the pedestrian and providing him safe and secure movement and access.

Cloverleaf Junction: - It is also a type of grade separator. It was first used in America. It requires a very large area of land. All conflicting streams of traffic are avoided, and so traffic can move at its own speed. This is more advantageous than a roundabout, as there is no necessity for weaving and slowing down of traffic.

For any person approaching the intersection there are three ways through any of totally there should be 4*3=12 connectivities, which can be seen in the figure (of the cloverleaf junction) enclosed.

The cloverleaf is the simplest way to connect two freeways. The only bridges required are to separate the two roadways. If land is expensive, so too can be the cloverleaf, which becomes a choice between tight turning radii or lots of consumed land.

We can notice that most loop ramps are blanked to counteract centrifugal forces.

A small advantage that "Falls out of the design" is the "second chance:" if we miss the first ramp to the right, we can simply take three loops in a row to get back on track.

A disadvantage to the plain cloverleaf is the "weaving" process, where drivers exiting one loop have to merge and cross other drivers entering the next one.

- **Alternate route:-** One purpose of flyover is to provide alternate routes from one place to another. But in this case it may happen that the flyover may add to the traffic. For example there is a crossing connecting four roads and there is a place, which can be reached through one of these roads by crossing a railway line. In order to prevent crossing the railway track and also to provide an alternate route, If a flyover is constructed between the crossing and that place then there will be one more road added at the crossing. With this the management of traffic becomes very difficult at the crossing as the traffic will be increased by a considerable amount by its introduction. So, here the flyover is adding to the traffic rather than reducing it.

Flyovers have many advantages, but shortcomings arise only because of some

Advantages of flyover-

Flyovers play a major role in streamlining the traffic control system.

- Through flyovers plenty of time is saved avoiding congestion.
- Pollution effect is reduced.
- Flyovers reduce the risk of accidents.
- Flyovers also contribute a lot to the aesthetics of the city. The persons travelling on the flyover can enjoy the panoramic view of the city.

BACKGROUND

Coimbatore, the Manchester of south India, is strategically located proximate to the metro polls and forming the knowledge triad along with Chennai and Bangalore. The population of the city id 9.3 lakhs as per 2001 census, extended over an area of 105.5sq.km. Traditionally, Coimbatore has a recall as strong industrial base predominately in the automotive components, textiles and pump set business. Recently, Coimbatore with its good potential and availability of good manpower is emerging as IT centre in the country. Government of Tamilnadu has taken initiative to develop Coimbatore as one of the tier II citied in the state. Major IT firms have anchored in for construction of IT parks in Coimbatore. Considering the employment potential and related economic activity coupled with achieving the objective of development of tier II cities as IT destination, it is necessary to improve the transport infrastructures in Coimbatore. A radial road network comprising of five arterials and three sub arterials serves the city of Coimbatore. The arterials are Avinashi road (old NH 47), Trichy road (NH67), and Mettupallayam road (NH 67), Sathy (NH 209) and Palghat (old NH 407). The sub arterials include Siruvani road, Thadagam road and Maruthamalai road. Hence it is essential to improve transport infrastructure along these corriders to cope with the proposed economic growth initiatives.

Existing status of the transport infrastructure

as the road system has not grown commensurate to the vehicle the major roads creating lower travel speed and less freedom of movement within the city. Also the available facilities are adequate to cater to the future travel demand of vehicles and pedestrians of the city.

Sathyamangalam road corridor

Sathyamangalam road popularly known as sathy road (NH209)is another important arterial road connecting Coimbatore with Bangalore and mysore. It connects at somasundaram mill junction on avinashi road and passes through Dr.Nanjappa road. It provides access to Gandhi puram, Ram nagar, Siddhapur, Ganapathy, etc..

Mobility concerns and solutions

The important mobility concerns arising from the existing transportation facilities and the growing personalized traffic on the road.

- Poor quality of roads connecting the arterials
- Highly congested junctions
- Delays at railway crossings
- Absence of pedestrian facilities
- Lack of state of the art facilities for mass transportation

The solution for the listed mobility concerns are,

- Better connecting road between the arterials
- Grade separated junctions
- Pedestrians subways/foot over bridges, foot paths etc
- Planning for an alternative mass transport facility to cater future mobility needs

Grade separated facility

From the peak hour traffic analysis, it is clear that both the junctions will cross 10000 PCU in the near future. Hence warrants grade separator at both the junctions.

Flyover options

Various options were examined to evolve best flyover and concluded with a combined six lane flyover connecting both the junctions as they are located close to each other. The proposed flyover on Sathy road will cater to the straight movements, the major movements at the two junctions. All other movements are proposed at grade. When considering the straight component of traffic at both the junctions, a six lane flyover is proposed as a two lane flyover will not be sufficient for the future.

TRAFFIC SURVEY DETAILS

CHAPTER 3

TRAFFIC SURVEY DETAILS

GANDHIPURAM JUNCTION

This is a major signalized junction on Sathy road connecting Sathy road with Bharathiyar road and cross cut road. Sathy road constitutes the two arms, one arm linking to 100 ft road while Nanjappa road towards Avinashi road. Bharathiyar road link intersects Balasundaram road in Sidhapudur and constitutes an internal link between Sathy road and Avinashi road. Cross cut road is the internal link between Sathy road and Mettupalayam road. This junction is one of the central locations in the city with town bus stand located between Dr.nanjappa and Bharathiyar road, central bus stand located along Dr. Nanjappa road and the SETC bus stand located along Bharathiyar road. Cross cut road acts as one of the major retail commercial centres in Coimbatore. To manage the heavy traffic flow at this junction, the cross cut road is made one way with traffic towards Mettupalayam road side.

TRAFFIC SCENARIO

The findings of turning count surveys conducted at this junction for 12 hours from morning 8.00 are presented below

PEAK HOUR TRAFFIC AND COMPOSITION

The peak hour at this junction is with 11,172 PCUs corresponding to a volume of 11,518 vehicle observed between 6.15 pm and 7.15 pm. Out of the total traffic, passenger vehicles composition is very high (about 96%) due to the proximity of bus terminals. Good vehicles and slow moving vehicles shared 2%

TRAFFIC MOVEMENTS

It is observed that all the three straight movements present (cross cut road is one way) at the junction and right turning movements from Dr. Nanjappa road towards Bharathiyar road and from Bharathiyar road to Ganapathy side are significant. But the other right turning movement from Ganapathy side to cross cut road is found less, since the traffic from Ganapathy side to bypasses this congested junction by using the link roads connecting cross cut road and 100 ft road. Right turning of buses to Bharathiyar road from Dr.Nanjappa road and Ganapathy side is high due to bus stands.

TABLE A) CLASSIFIED TURNING VOLUME COUNT SURVEY

From cross cut road (one way)	⤴	⇩	⇨
City bus	0	0	0
Mofussil bus	0	0	0
Other bus	0	0	0
Mini bus	0	0	0
Cars/jeep/van	0	0	0
Two wheeler	0	0	0
Auto rikshaw	0	0	0
Trucks	0	0	0
Mav	0	0	0
LCV	0	0	0
Cycles	0	0	0
Carts	0	0	0
Cycle rikshaw	0	0	0
T.Vehicle	0	0	0
T.PCU	0	0	0

TABLE B) CLASSIFIED TURNING VOLUME COUNT SURVEY

From ganapathy	⇨	⇩	⇦
City bus	66	11	0
Mofussil bus	18	28	0
Other bus	10	3	0
Mini bus	9	11	0
Cars/jeep/van	238	220	105
Two wheeler	826	991	275
Auto rikshaw	85	154	60
Trucks	3	2	0
Mav	0	0	0
LCV	15	21	1
Cycles	43	26	37
Carts	0	1	0
Cycle rikshaw	0	0	0
T.Vehicle	1313	1468	478
T.PCU	1338	1485	465

TABLE C) CLASSIFIED TURNING VOLUME COUNT SURVEY

From Dr.Nanjappar road	↑	→	←
City bus	60	37	0
Mofussil bus	0	32	0
Other bus	9	0	0
Mini bus	3	4	2
Cars/jeep/van	249	141	247
Two wheeler	1257	947	991
Auto rikshaw	156	111	95
Trucks	9	0	0
Mav	0	0	0
LCV	28	4	1
Cycles	86	26	56
Carts	0	1	0
Cycle rikshaw	0	0	0
T.Vehicle	1857	1303	1392
T.PCU	1826	1305	1262

TABLE D)CLASSIFIED TURNING VOLUME COUNT SURVEY

From Bharathiyar road	⇧	⇨	⇦
City bus	92	0	0
Mofussil bus	1	16	0
Other bus	4	0	0
Mini bus	10	1	2
Cars/jeep/van	119	123	330
Two wheeler	370	652	1571
Auto rikshaw	40	81	107
Trucks	2	6	0
Mav	0	0	0
LCV	13	0	3
Cycles	21	34	109
Carts	0	0	0
Cycle Rikshaw	0	0	0
T.Vehicle	672	913	2122
T.PCU	757	874	1863

LOAD ANALYSIS

CHAPTER 4

LOAD ANALYSIS

(Equivalent UDL Method)

Assume M30 tor steel

B/L = 10/12 = 0.83

On referring IS 456 k value

K = 2.276

Effective Width:

bef = kx(1-x/l)+bw

x = 6m

l = 12m

bw = 2t

= 2(0.3+0.08)

bw = 0.76

bef = 2.276 * 6 (1-6/12) + 0.76

Effective Width = 7.588m

Effective Width < Available Width

7.588 < 10m

Effective Width = 1.2 + 0.85 +1.2 + 0.85/2 +7.588/2

= 7.469m

Moment about the centre:

Load = 700/7.469

= 93.72 KN/m

Moment = 46.86 * 6 – (93.72/4.36) * (4.36/2) * (4.36/4)

= 230.082 KN-m

Impact factor = 25%

Total Live Load Bending Moment = 230.082*1.25

=287.603 KN-m

Weight of dead load = 0.3*1*1*25 = 7.5

Weight of wearing coat = 0.08*1*1*22 = 1.76

Total dead load = 9.26 KN/m^2

TOTAL LOAD ON EACH PANEL

Live load =1.25 * 700 =875 KN

Dead load =0.3 * 25 * 10 * 12 = 900 KN

Wearing coat =0.08 * 22* 10 * 12 = 211.2 KN

Total factored load = 2979.3 KN

Load per m^2 = 24.82 KN/m^2

TYPICAL DESIGN OF FLAT SLAB, COLUMN, FOUNDATION

CHAPTER 5

TYPICAL DESIGN OF FLAT SLAB, COLUMN, FOUNDATION

DESIGN OF FLAT SLAB:

SLAB PANEL:

It is a two lane road

Clear carriage way width	=	8.5m
Kerb width on each side	=	0.5m
Width of parapet wall	=	0.25m on each side
Total width of slab panel	=	10m
c/c distance of column	=	12m

DESIGN OF FLAT SLAB:

Design constants

For M30 concrete, we have $\sigma_{cbc} = 10\ N/mm^2$

$fy = 415\ N/mm^2$

Panel dimension

Length of panel	= 12m
Width of panel	= 10m
Drop size:	1.5 *1.5

a)Moment in longer direction

L1 = 12m   L2 = 10m   Ln = 12 – 0.3 = 11.7m

W = 9.26 * L2 * Ln

= 9.26 * 10 * 11.7

= 1083.42 KN

MU = W/ Ln = (1083.42 * 11.7)/8

Dead load Bending Moment = 1584.50 KN-m

= 287.603 +1584.50

= 1872.866 kn-m

M1=Negative design moment=0.65*Total Moment

=0.65*1872.103

=1216.866 KN-m

M2=Positive design moment = 0.35*Total Moment

= 0.35*1872.103

= 655.236 KN-m

Width of column strip in longer direction:

=0.25*10=2.5m on each side of column centre

Line

<0.25 * 12 = 3

Hence adopt   2.5 * 2 = 5m

Width of middle strip = 10 – (2.5+2.5)

= 5m

Bending moment for column strip:

Negative Bending moment = 75% of (–ve) design moment

= 0.75*1216.866

=912.649 KN-m

Positive Bending moment = 60* of (+ve) design moment

= 0.60*655.236

= 393.141 KN-m

Bending moment for middle strip:

Negative Bending moment = 25% of (–ve) design moment

= 0.25*1216.866

= 304.216 KN-m

Positive Bending moment = 40* of (+ve) design moment

= 0.40*655.236

= 262.094 KN-m

b)Moment in shorter direction

L1 = 10m L2 = 12m ln = 10-0.3 = 9.7

W = 9.26 * 12 * 9.7

=1077.864 KN

M0 = (W*ln)/8 = 1306.910 KN-m

Total moment = dead load bending moment + live load bending moment

=1306.910 + 287.603

= 1594.513 KN-m

=1036.433 KN-m

M2 = positive design moment = 0.35 * 1594.513

= 558.079 KN-m

Width of column strip in shorter direction = 0.25 * 12

= 3m <0.25 * 10 =2.5

Hence adopt 2.5 * 2 = 5m

Width of middle strip in shorter direction = 12- (2*2.5)

=7m

Bending moment for column strip:

Negative moment = 75 % of M1

=0.75 * 1036.433 = 777.324 KN-m

Positive moment = 60% of M2

= 0.6 * 558.079 = 334.847 KN-m

Bending moment for middle strip :

Negative moment = 25% of M1

= 0.25 * 1036.433=259.108 KN-m

Positive moment = 40% of M2

= 0.4 * 558.079 = 223.231 KN-m

c) Design moment for thickness

drop = 912.649 KN-m

flat slab = 393.141 KN-m

d) Thickness

drop : effective depth (d) = (MOR/Q*b)^(1/2) d = 600mm

D = 630mm

Slab : effective depth (d) = (MOR/Q*b)^(1/2)

= (393141*1000/0.904*1.5*1000)

d = 340mm

D = 370mm

e) Area of steel :

column strip longer direction :

1)Steel for positive bending moment = (393141*1000/230*0.904*340)

= 5561.259mm^2/5m

=1112.251mm^2/m

Assume dia = 16mm

Spacing = 180mm

Hence provide 16mm dia bars at 180 mm c/c spacing

Area of steel to be provided = 1117.01 mm^2

2)Steel for negative bending moment = (912649*1000/230*0.904*600)

= 7315.706mm^2/5m

=1463.141mm^2/m

Assume dia = 16mm

Spacing = 130mm

Hence provide 16mm dia bars at 130 mm c/c spacing

Area of steel to be provided = 1546.630 mm^2

Middle strip longer direction :

Steel for positive bending moment = (262094*1000/230*0.904*340)

= 3707.506mm^2/5m

=741.501mm^2/m

Spacing = 180mm

Hence provide 16mm dia bars at 180 mm c/c spacing

Area of steel to be provided = 1117.01 mm^2

Steel for negative bending moment = (304216*1000/230*0.904*340)

= 4303.351mm^2/5m

=860.670mm^2/m

Assume dia = 16mm

Spacing = 130mm

Hence provide 16mm dia bars at 130 mm c/c spacing

Area of steel to be provided = 1546.630 mm^2

Column strip shorter direction :

Steel for positive bending moment = (334847*1000/230*0.904*340)

= 4736.649mm^2/5m

=947.329mm^2/m

Assume dia = 16mm

Spacing = 200mm

Hence provide 16mm dia bars at 200 mm c/c spacing

Area of steel to be provided = 1005.309 mm^2

Steel for negative bending moment = (777324*1000/230*0.904*600)

= 6230.95mm^2/5m

=1246.190mm^2/m

Assume dia = 16mm

Spacing = 150mm

Hence provide 16mm dia bars at 150 mm c/c spacing

Area of steel to be provided = 1340.412 mm^2

Middle strip shorter direction :

Steel for positive bending moment = (223231*1000/230*0.904*340)

= 3157.761mm^2/7m

=451.108mm^2/m

Assume dia = 16mm

Spacing = 200mm

Hence provide 16mm dia bars at 200 mm c/c spacing

Area of steel to be provided = 1005.309 mm^2

Steel for negative bending moment = (259108*1000/230*0.904*340)

= 3665.267mm^2/7m

=523.609mm^2/m

Assume dia = 16mm

Spacing = 150mm

Hence provide 16mm dia bars at 150 mm c/c spacing

Area of steel to be provided = 1340.412 mm^2

Check for shear in drop and slab :

Critical section in drop :

The critical section for shear is to be taken at a distance of half the effective depth of drop from face to column as shown in figure.

Dia of the critical circle = 900mm

Total factored load = 2979.3 KN

Load / m^2 = 24.82 KN/ m^2

Load from the slab = 740.65 KN

Permissible shear stress = 0.16 * $(f_{ck})6(1/2)$

= 0.876 N/mm^2

Permissible shear stress is greater than nominal shear stress.hence it is safe in shear.

Critical section in slab :

This critical section is to be taken at a distance of half the effective depth of the slab from the edge of the drop as shown in figure.

Total perimeter of the critical section = (1840 + 1840)

= 7360mm

Total shear on the critical section = 660569.408 N

Nominal shear stress = 0.2639 N/mm^2

Permissible shear stress = 0.16 * $(f_{ck})6(1/2)$

= 0.876 N/mm^2

Permissible shear stress is greater than nominal shear stress.hence it is safe in shear.

DESIGN OF COLUMN

Unsupported length of column = 5m

Total load = 1986.2KN

Factored load = 2979.3 KN

Load on each column = 496.55 *2 = 993.1KN

Factored load = 1489.65KN

Use M30 , Fe415

Longitudinal steel in column varies from 0.8 to 6%. Use minimum of 2%

Asc = 0.02Ag

Ac = Ag – 0.02Ag

Ac = 0.98Ag

Slenderness ratio = (5000/600) = 8.3 □ 12

Hence it is a short column

P_{short} = σ_{cbc} x A_c + σ_{sc} x A_{sc}

1489.65 *10^3 = 9.8Ag + 4.6 Ag

Ag = 103447.916mm^2

Use circular section

Ag = $\pi d^2/4$ = 103447.916

d = 800 mm

use circular column of dia 800mm

Asc = 0.02 * Ag

= 0.02 * 103447.916

= 2068.95mm^2

Provide 6 no of 25mm dia bars

Lateral ties :

a) Diameter shall not be less than the greater of the following

i. One fourth of largest long bar = 25/4 =6.25

ii. 5mm

Hence adopt 10mm dia lateral ties

b) Pitch of the lateral ties shall not be more than the least of the following

i. Least lateral dimension of the compression member is 800mm

ii. 16 * dia of main bar = 16 * 25 = 400

iii. 48 * dia of tie = 48 * 10 = 480

Pithch = 400 mm

Hence adopt 10mm dia @ 400mm c/c

DESIGN OF FOOTING

Square footing

Load transferred from column = 993.1 KN

Take SBC as = 400 KN/m^2

Self weight of column = $(\pi \times 800^2 \times 5 \times 25) / 4$

= 62.83 KN

Assume 10 % as weight of footing,

Self weight of footing = 105.59 KN

Total load = 1161.52 KN

Factored load = 1742.28 KN

= 1750 KN

Area of footing required = 1750 / 400

= 4.25 m^2

Size of footing is 2.1m x 2.1m

Bearing pressure, q_0 = (1750 x 1000) / (2.1 x2.1)

= 396825.39 N/m^2

Size of inscribed square of circular column = $0.8 / \sqrt{2}$

= 0.565

Max bending moment $= q_0 \times B \times (B - a)^2 / 8$

$= 396825.39 \times 2.1 \times (2.1 - 0.565)^2 / 8$

$= 245440.104$ N/m^2

Area of trapezoid $= ((900 + 2100) /2) \times (767.16)$

$= 1150740$ mm^2

Centre of gravity of trapezoid from 900 mm face

Centre of gravity, = ((2x 2100) + 900) / (2100 + 900) x (767.16 / 3)

= 434.724 mm

Force on trapezoidal area = 0.3968 x 1150740

= 456613.63 N

Force on shaded area = 0.3968 x 900 x (900 – 565.68) / 2

= 59696.17 N

Acting at 83.58 mm from the face of the column

Moment at face of the column= 456613.63 (434.724 + 167.16) +

(59696.17 x 83.58)

= 279487255.7

= 2.79 x 10^8 N-mm

= 2.79 x 10 ^5 N-m

Design moment = 2.79 x 10 ^5 N-m

d = $\sqrt{}$ (2.79 x 10^8) / (0.904 x 900)

= 586.105 mm

Provide, D = 675 mm

d = 600 mm

A_{st} = (2.79 x 10 ^8) / (230 x 0.904 x 600)

= 2236.43 mm^2

Provide 20 mm φ bars 8 no both ways

A_{st} provided = 2513.27 mm^2

Check for shear:

V = q_o ((B x B) – (a + b) (b + d))

= 0.3968 x ((2100 x 2100) – (565.68 + 600) (565.68 + 600))

= 1748962.91 N

τ_v = 1748962.91 / 2 x (1165 + 1165) x 600

= 0.625 N / mm^2

Permissible shear stress = $K_s \tau_c$

= 0.16 $\sqrt{30}$

= 0.876 N/mm^2

$\tau_c > \tau_v$

Safe in shear

TYPICAL DESIGN OF BEAM SLAB BRIDGE, COLUMN, FOUNDATION

CHAPTER 6

TYPICAL DESIGN OF BEAM SLAB BRIDGE, COLUMN, FOUNDATION

SLAB AND BEAM BRIDGE DESIGN

DESIGN OF SLAB:

ONE WAY SLAB: 2.5 X 11.2 m

L = 2.5 m

b_{ef} = α x (1-(x/l)) + b_w

K = B/l

= 11.2 /2.5 = 4.48

X = 1.25 (2.5 /2)

For K= 4.48 from table 7.1 α = 3

b_w = 0.85 + (2 x 0.08)

= 1.01 m

b_{ef} = α x (1-(x/l)) + b_w

= 3x 1.25 (1-(1.25/2.5)) + 1.01

= 2.885

Net effective width for two wheels is given by

b_{ef} = 1.4425 + 205 + 1.4425

= 4.935 m

Therefore the wheel load will have a dispersed area = 2.5 x 4.935 m

Dispersed wheel length = length of contact + 2 (overall thickness of slab)

= 3.6 + 2 (0.22 + 0.08)

= 4.2 m

Proportional load to be considered = (2.5 x 700) / 4.2 = 416.67 KN

Intensity of loading including impact factor = (1.25b x 416.67) / (2.5 x 4.935)

= 42.21 KN/m^2

Max live load bending moment at the centre of slab is

= 42.21 x 2.5^2

= 32.97 KN-m

Live load shear force = (42.21 x 2.5) /2

= 52.76 KN

DEAD LOAD BENDING MOMENT AND SHEAR FORCE:

Self weight of slab = 0.22 x 25

= 5.5 KN/m^2

Self weight of wearing coat = 0.08 x 22

= 1.76 KN/m^2

Total dead load $= 7.26\ KN/m^2$

Dead load bending moment $= (7.26 \times 2.5^2) / 8$

$= 5.6718$ KN-m

Dead load shear force $= (7.26 \times 2.5) / 2$

$= 9.075$ KN

Design bending moment $= 32.97 + 5.67$

$= 38.64$ KN-m

Design shear force $= 52.76 + 9.075$

$= 61.835$ KN

Effective depth d $= (M/ (b \times Q))^{(1/2)}$

$= (38.4 \times 10^6) / (1000 \times 1.108)$

(1/2)

$= 186.74$ mm

Provide,

D $= 220$ mm, d= 200mm

A_{st} $= (M / (\sigma_{st} \times j \times d))$

$= (38.64 \times 10^6) / (230 \times 0.904 \times 200)$

$= 929\ mm^2$

Spacing $= (\pi \times 16^2 \times 1000) / (4 \times 929)$

$= 216$ mm

Distributors:

A_{st} = 0.12 % of bD

= (0.12 x 1000 x 220) / 100

= 264 mm^2

Spacing = (π x 8^2 x 1000) / (4x 264)

= 190.3 mm

Provide 8 mm φ bars @ 200 mm c/c

Check for shear:

τ_v = V/ b x d

= (61.835 x 10 ^3) / (1000 x 200)

= 0.309 N/mm^2

P = (A_{st} x 100) / (b x d)

= (930 x 100) / (1000 x 200)

= 0.465 %

T_c = 0.4818

$T_c > \tau_v$

Safe in shear.

Check for deflection:

Actual span / d = 2500 / 200 = 12.5

P = $(A_{st} \times 100) / (b \times D)$

$= (930 \times 100) / (1000 \times 220)$

$= 0.42\ \%$

K = 1.9

Permissible span / d = 7 x 1.9

= 13.3 > 12.5

Safe in deflection.

DESIGN OF CROSS BEAM

SPAN = 11.2 m

Self weight of slab = (0.2 x 25) + (0.08 x 22)

= 6.76 KN / m^2

= 6.76 x 2.5

= 16.9 KN/m

Self weight of beam = 0.3 x 0.5 x 25

= 3.75 KN

Total load udl = 20.65 KN

To find the reaction:

€v = 0

350 + 350 + (20.65 x 11.2) = $R_A + R_B$

$R_A + R_B$ = 931.28

$€_{MA}$ = 0

350 x 1.2 + 350 x 2.4 + (20.65 x $11.2^2/2$) = 11.2 R_B

R_B =228.14

R_A = 703.14

Taking moment about the axis at a distance of 1.2 m from A

M_x = -703.14 x 1.2 + (20.65 x $1.2^2/2$)

= -828.9 KN-m

Taking moment about the axis at a distance of 2.4 m from A

M_x = 228.14 x 8.8 – (20.65 x $8.8^2/2$) = 1208.064 KN-m

Maximum moment = 1208.64 KN-m

DESIGN OF BEAM:

Moment of resistance as T- beam

Effective width of flange shall be the least of the following:

b_f = (l_o / 6) + b_w + 6 D_f

= (2500 / 6) + 300 + (6 x 200)

= 1916.66 mm

b_f = b_w + (1/2) (clear span on either side)

= 300 + (1/2) (2500-300) x 2

= 2500 mm

Therefore width of flange = 1916.66 mm

Assuming the section to be balanced,

Critical neutral axis X_c = 0.288 x 660

= 190.08 mm

Hence it lies in flange

D_f / d $= 0.2 / 0.66$

$= 0.303 > 0.2$

$Mu = 0.36 \times (X_{umax} / d) \times (1-(0.42 \times (X_{umax} / d))) \times f_{ck} \times b_w \times d^2$

$+ 0.45\, f_{ck}\, (b_f - b_w)\, y_f\, (d - y_f /2)$

For Fe 415,

$X_{umax} / d = 0.48$

$X_{umax} = 0.3168$

$X_{umax} > D_f$, hence it is o.k

$y_f = (0.15\, X_u + 0.65\, D_f)$

$= (0.15 \times 0.3168 + 0.65 \times 0.2)$

$= 0.177 < D_f$

$Mu = 0.36 \times (X_{umax} / d) \times (1-(0.42 \times (X_{umax} / d))) \times f_{ck} \times b_w \times d^2$

$+ 0.45\, f_{ck}\, (b_f - b_w)\, y_f\, (d - y_f /2)$

$= 0.36 \times (0.48) \times (1-(0.42 \times 0.48)) \times 30 \times 300 \times 660^2$

$+ 0.45 \times 30\, (1916.66 - 300) \times 177 \times (660 - 177 /2)$

$= 540872183.8 + 2207709684$

$= 2748.58$ KN-m

BM $= 1208.64$ KN-m

MOR > BM

Hence it is a singly reinforced section.

$M = Qbd^2$

$1208.64 \times 10^6 = 1.108 \times 300 \times d^2$

$d = 1906.85$ mm

$= 1900$ mm

$A_{st} = M / (\sigma_{st} \times j \times d)$

$= (1208.64 \times 10^6) / (230 \times 0.904 \times 1900)$

$= 3059.47$ mm^2

Provide 7 no 25 mm φ bars

A_{st} provided $= 3436.11$ mm^2

Check for shear:

$\tau_v = V / b \times d$

$= (703.14 \times 10^3) / (300 \times 1900)$

$= 1.23$ N/mm^2

$P = (A_{st} \times 100) / (b \times d)$

$= (3436.11 \times 100) / (300 \times 1900)$

$= 0.6$ %

$T_c = 0.536$

$\tau_v > T_c$

Shear reinforcement is required.

V_s $= V - (\tau_c \times b \times d)$

$= 703140 - (0.536 \times 300 \times 1900)$

$= 418140$

Spacing $= (\sigma_{st} \times A_{st} \times d) / V_s$

$= (230 \times 2 \times 50 \times 1900) / 4188140$

$= 104.51$mm

Provide 2 legged 8 mm φ stirrups @ 110 mm c/c

Check for deflection:

Span / d $= (11.2 / 1.9)$

$= 5.89$

P $= (A_{st} \times 100) / (b \times D)$

$= (3436.11 \times 100) / (1916 \times 1900)$

$= 0.094$ %

K_1 $= 1.1$

b_w / b_f $= 300 / 1916 = 0.15$

K_2 $= 0.8$

Permissible span / d $= 20 \times 1.1 \times 0.8$

$= 17.6 > 5.89$

Safe in deflection

Check for Anchorage:

L_d < (M1 / V) + L_o

L_d = (230 x 16) / (4 x 1.7)

= 541.17 mm

M_1 = 3436.11 x 230 x 1.7 x 1900

= 2552686119 N – mm

L_o = 1900 or (12 x 16) whichever is greater

= 1900 mm

(M1 / V) + L_o = 23974.42 mm

Safe in anchorage

DESIGN OF LONGITUDINAL BEAM

Self weight of beam = 0.6 x 0.45 x 25

= 6.75 KN / m

Dead load = (0.2 x 25 + 0.08 x 22) x 25 x (11.2 / 2)

= 94.64 KN

€v = 0

$R_A + R_B$ = 94.64 + 94.64 + 703.14 + 94.64 + (6.75 x 10)

= 1054.56

$€_{MA}$ = 0

M_A = 703.14 x 2.5 + 94.64 x 5 + 94.64 x 7.5 + (6.75 x 8.75^2 x 10) – 7.5 R_B

R_B =470.86

R_A = 583.69

Taking moment about the axis at a distance of 3.75 m from A

M_x = 583.69 x 2.5 – 94.64 x 2.5 – (6.75 x $3.75^2/2$)

= 1175.16 KN-m

€v = 0

$R_A + R_B$ = 94.64 + 94.64 + 703.14 + 94.64 + (6.75 x 10)

= 1054.56

$\in_{MA} = 0$

$M_A = 94.64 \times 2.5 + 703.14 \times 5 + 94.64 \times 7.5 + (6.75 \times 8.75 \times 10) - 7.5\ R_B$

R_B =673.69

R_A = 380.86

Taking moment about the axis at a distance of 6.25 m from A

$M_x = 673.69 \times 2.5 - 94.64 \times 2.5 - (6.75 \times 3.75^2/2)$

= 1400.165 KN-m

Maximum moment is 1400.165 KN-m

M = Qbd^2

$1400 \times 10^6 = 1.108 \times 600 \times d^2$

d = 1450

d = 1500

D = 1540

$A_{st} = (1400 \times 10^6) / (230 \times 0.904 \times 1500)$

= 4488.90 mm^2

Provide 10 no 25 mm φ bars

A_{st} provided = 4908.73 mm^2

Check for shear:

$\tau_v = V / b \times d$

$= (673.69 \times 10^3) / (600 \times 1500)$

$= 0.7\ N/mm^2$

$P = (A_{st} \times 100) / (b \times d)$

$= (4908.73 \times 100) / (600 \times 1500)$

$= 0.545\ \%$

$T_c = 0.5 N/ mm^2$

$\tau_v > T_c$

Shear reinforcement is required.

$V_s = V - (\tau_c \times b \times d)$

$= 673670 - (0.5 \times 600 \times 1500)$

$= 223690$

Spacing $= (\sigma_{st} \times A_{st} \times d) / V_s$

$= (230 \times 2 \times 50 \times 1500) / 223690$

$= 154.23mm$

$0.75\ d = 0.75 \times 1500 = 1125\ mm$

$(A_{sv} \times f_y) / 0.4\ b = 172.91\ mm$

Provide 2 legged 8 mm φ stirrups @ 150 mm c/c

Check for deflection:

Span / d $= (10 / 1.5)$

$= 6.67$

$P = (A_{st} \times 100) / (b \times D)$

$= (4908.73 \times 100) / (600 \times 1500)$

$= 0.545\ \%$

$K_1 = 1.3$

Permissible span / d $= 7 \times 1.3$

$= 9.1 > 6.67$

Safe in deflection

Check for Anchorage:

$L_d < (M1 / V) + L_o$

$L_d = (230 \times 20) / (4 \times 1.7)$

$= 676.47$ mm

$M_1 = 4908.73 \times 230 \times 1.7 \times 1500$

$= 2878970145$ N – mm

$L_o = 1500$ or $(12 \times 20 = 240$ mm) whichever is greater

$= 1500$ mm

$(M1 / V) + L_o = 5773.43$ mm

$L_d < (M1 / V) + L_o$

Safe in anchorage

DESIGN OF COLUMN

To know the axial load from adjacent beam

$€v = 0$

$R_A + R_B = 94.64 + 94.64 + 94.64 + 94.64 + (6.75 \times 10)$

$= 446.06$

$€_{MA} = 0$

$M_A = 94.64 \times 2.5 + 94.64 \times 5 + 94.64 \times 7.5 + (6.75 \times 8.75^2 \times 10) - 7.5\ R_B$

$R_B = 223.73$

$R_A = 223.73$

Total axial load from column $= 223.73 + 673.69$

$= 897.42$ KN

Self weight of column $= (\pi \times 800^2 \times 5 \times 25) / 4$

$= 62.83$ KN

Total load $= 960.25$KN

Factored load $= 1440.375$ KN

$= 1500$ KN

Assume 2 % of longitudinal steel,

$A_{sc} = 0.02\ A_g$

$A_c = A_g - 0.02\ A_g$

$= 0.98\ A_g$

Slenderness ratio = 5000/800

= 6.25 <12

Hence it is a short column.

P_{short} = σ_{cbc} x A_c + σ_{sc} x A_{sc}

1500 x 10 ^3 = 10 x 0.98 A_g + 230 x 0.02 A_g

1500 x 10 ^3 = 14.4 A_g

A_g = 104166.67 mm^2

Assume 2 % of gross area is steel area

A_{st} = 2083.33 mm^2

No of bars = 2083.33 / (π x 25^2/4)

= 4.2

Provide 6 no 25 mm φ bars

A_{st} provided = 2945.24 mm^2

LATERAL TIES:

Diameter shall not be less than greater of the following:

1) ¼th of largest long bar = 25/4 = 6.25 mm
2) 5 mm

Adopt 10 mm φ ties

Pitch of lateral ties shall nt be more than the least of the following

1) Least lateral dimension of compression member = 800 mm
2) 16 x dia of main bar = 400 mm
3) 48 x φ of tie = 480 mm

Adopt 10mm φ ties @ 400 mm c/c

DESIGN OF FOOTING

Load transferred from column = 960.25 KN

Take SBC as = 400 KN/m^2

Assume 10 % as weight of footing,

Self weight of footing = 96.025 KN

Total load = 1056.275 KN

Factored load = 1584.41 KN

= 1600 KN

Area of footing required = 1600 / 400

= 4

Size of footing is 2m x 2m

Bearing pressure, q_0 = (1600 x 1000) / (2 x2)

= 400000 N/m^2

Size of inscribed square of circular column = 0.8 / $\sqrt{2}$

= 0.565

Max bending moment = $q_0 \times B \times (B - a)^2 / 8$

= $400000 \times 2 \times (2 - 0.565)^2 / 8$

= 205922.5 N/m^2

Area of trapezoid = ((900 + 2000) /2) x (717.16)

= 1039882 mm^2

Center of gravity of trapezoid from 900 mm face

Centre of gravity, = ((2x 2000) + 900) / (2000 + 900) x (717.16 / 3)

= 403.9 mm

Force on trapezoidal area = 0.4 x 1039882

= 415952.8 N

Force on shaded area = 0.4 x 900 x (900 – 565.68) / 2

= 60177.6 N

Acting at 83.58 mm from the face of the column

Moment at face of the column = 415952.8 (403.91 + 167.16) + (60177.6 x 83.58)

= 242567809.3

= 2.42 x 10^8 N-mm

= 2.42 x 10 ^5 N-m

Design moment = 2.42 x 10 ^5 N-m

d = √ (2.42 x 10^8) / (0.904 x 900)

= 545.38 mm

Provide, D = 650 mm

d = 575 mm

A_{st} $= (2.42 \times 10^8) / (230 \times 0.904 \times 650)$

$= 1790.62 \text{ mm}^2$

Provide 20 mm φ bars 8 no both ways

A_{st} provided $= 2513.27 \text{ mm}^2$

Check for shear:

$V = q_o ((B \times B) - (a + b)(b + d))$

$= 0.4 \times ((2000 \times 2000) - (565.68 + 575)(565.68 + 575))$

$= 1079539.65 \text{ N}$

$\tau_v = 1079539.65 / 2 \times (1140.68 + 1140.68) \times 575$

$= 0.4 \text{ N/mm}^2$

Permissible shear stress $= K_s \tau_c$

$= 0.16 \sqrt{30}$

$= 0.876 \text{ N/mm}^2$

$\tau_c > \tau_v$

Safe in shear

ESTIMATION AND COST ANALYSIS

CHAPTER 7

ESTIMATION AND COST ANALYSIS

TABLE E) ESTIMATION OF FLAT SLAB BRIDGE

PARTICULARS	VOLUME(m^3)	RATE(Rs)	COST(Rs)
Excavation	34.56	350.00	12096.00
Gravel Filling	29.76	35.00	1041.60
Footing	5.952	7126.00	42413.95
Column	5.0265	7126.00	35818.83
Column head	2.925	7126.00	20843.55
Slab	40.8	7126.00	290740.80
Railing	3	7126.00	21378.00
Cement Concrete in Wearing coat	12	450.00	8400.00
Total cost			429732.75

The total estimated cost of flat slab bridge is Rs.429732.75

TABLE F) ESTIMATION OF BEAM SLAB BRIDGE

PARTICULARS	VOLUME(m^3)	RATE(Rs)	COST(Rs)
Excavation	31.74	350.00	11109.00
Gravel Filling	26.94	35.00	942.90
Footing	5.2	7126.00	37055.20
Column	5.0265	7126.00	35818.84
Cross beam	27.36	7126.00	194967.36
Main beam	9.24	7126.00	65844.24
Slab	24	7126.00	171744.00
Railing	3	7126.00	21378.00
Cement Concrete in Wearing coat	12	450.00	5400.00
Total cost			544259.55

The total estimated cost of beam slab bridge is Rs. 544259.55

COMPARISON FOR ESTIMATION OF FLAT SLAB BRIDGE AND BEAM SLAB BRIDGE

Comparing the results of estimation of flat slab and beam slab bridges, it is found that flat slab is economical.

GEOMETRIC DESIGN STANDARDS

GEOMETRIC DESIGN STANDARDS

The IRC design standards with due consideration to the latest directive and guidelines of MOSRTH/IRC have been followed with reference to the terms of reference, as far as possible, while formulating the highway design standards. Other National and International standards and relevant technical papers/journals were also referred to wherever found relevant. Standards for the various components are briefed below:

Design speeds

An IRC guideline (IRC: 86 – 1983) "Geometric Design Standards for Urban Roads in Plains" is followed, as the flyover is within the city. The ruling design speed of 80 kmph, conforming to arterial road category is adopted.

Geometric standards

Various standards and specifications for roads as per Indian Roads Congress will be adopted for the study. The following codes are few among them:

- IRC: 86 – 1983, "Geometric Design Standards for Urban Roads inPlains".
- IRC: 73, "Geometric Design Standards for Rural highways".
- IRC: 92 – 1985, "Guidelines for the Design of interchanges in Urban areas".

Apart from the above, other codes will be referred wherever necessary.

Carriage width

Six lane carriageway widths with provision of foot path on both sides are adopted.

Camber

A camber of 2% is proposed for carriageway and that of 3% is proposed for shoulder. On super-elevated sections, the maximum super elevation is restricted to 4%

Horizontal alignment

Horizontal alignment should be fluent and blend well with the surrounding topography. The horizontal curves are designed as per IRC standards with sufficient transition lengths. The minimum curve radius adopted for ruling design speed is 150m and that for minimum design speed is 40m.

Road signs

All road signs shall be in conformity with the provision of IRC SP 32 – 1992 New TrafficSigns and IRC67 – 1977 Code of Practice for Road Signs. The signs classified as mandatory/regulatory, cautionary/warning and informatory

Road marking

The road markings are designed in conformity with the IRCstandards

- IRC 35 – 1997 : Code of Practice for Road Markings with Paint;
- IRC 30 – 1968 : Standard Letters and Numerals of Different Heights Use in Highway Signs.

SHORTCOMINGS

CHAPTER 8

SHORTCOMINGS

- Flyovers are not as a rule suitable for built up areas as they require a large areaand also it is costly. It is estimated that the cost of flyover bridge is ten times that of a roundabout(reference: a text book of highway eng by Prof. Shahane &Prof. Iyengar)
- Lack of proper management in the flyover construction may cause many problems. For example in Chennai, during the process of construction itself the wheel of the bulldozer got stuck up in to the surface of the flyover.as the people who cannot risk their lives in relying on it are not using it.so its ironical that the flyover has become a liability here instead of the asset for the city.
- There shouldn't be any bus stops in between the way along which the flyovers are constructed.obviously there cant be any bus stops on the flyovers.buses tend to attract people,who don't have any other mode of conveyance. So, the flyovers purpose here is not consummated.For example. In Mumbai because of constructing the flyovers in this way the buses are not using them.
- Loss in the case of accidents is increased. The risk of accients is reduced but in case an accident occurs the loss may be more. As the vehicle is at the high elevation,during accidents there are more chances of losing life.

CONCLUSION

CHAPTER 9

CONCLUSION

- In this project an attempt has been made to plan and design a multilevel flyover as per IRC
- This structure composed of both flat slab and beams and slab
- The reinforcement details are presented as per the code books
- To plot structural drawings, drafting software AutoCADD2004 is used
- This project helps us to familiarize with flyover components
- The design concept studied for various elements are synthesized in this project and help us to reinforce the confident.

REFERENCES:

1. BUREAU OF INDIAN STANDARDS – INDIAN STANDARDS – CODE OF PRACTICE PLAIN AND REINFORCED CONCRETE: IS456 – 2000, NEWDELHI, 2002

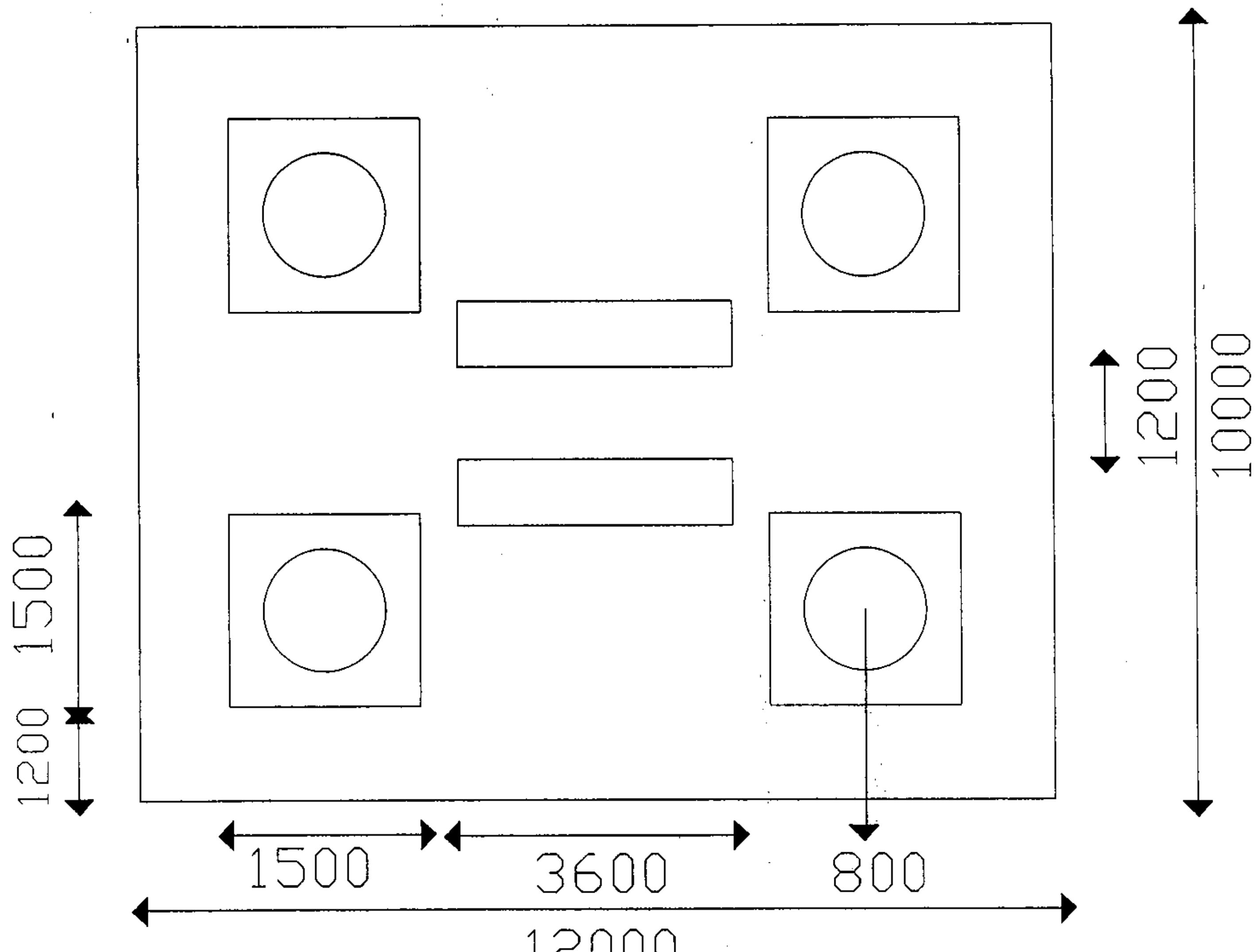
2. BUREAU OF INDIAN STANDARDS – DESIGN AIDS FOR REINFORCED CONCRETE TO IS456 – 2000, NEWDELHI, 2002

3. CONPREHENSIVE R.C.C. DESIGNS BY Dr B.C.PUNMIA, ASHOK KUMAR JAIN, ARUN KUMAR JAIN

4. FEW RELEVENT IRC CODES

STRUCTURAL DRAWINGS

FIG 1.1 FLAT SLAB PANEL



G 1.2 CRITICAL SECTION OF SHEAR IN DROP

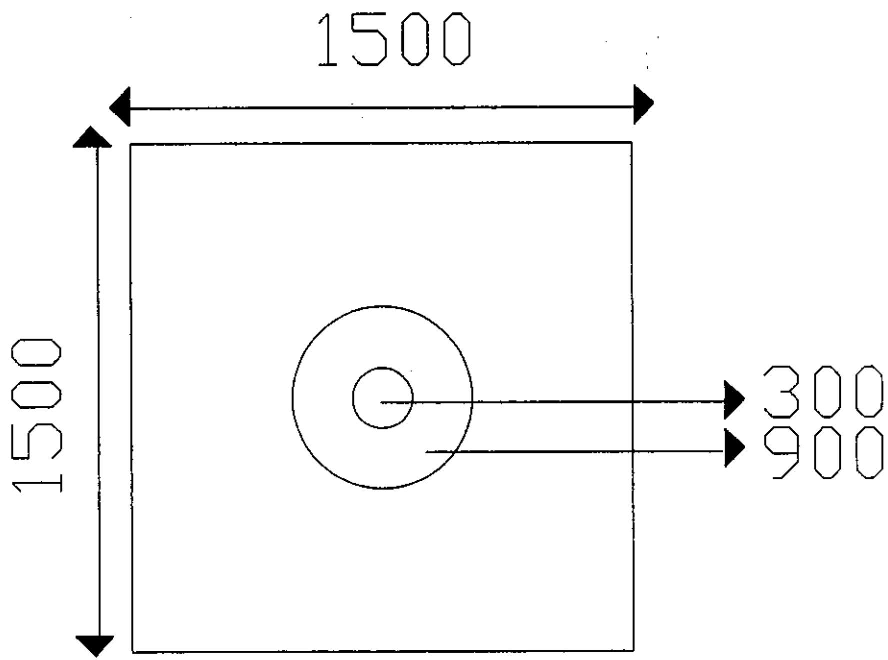


FIG 1.3 CRITICAL SECTION OF SHEAR IN SLAB

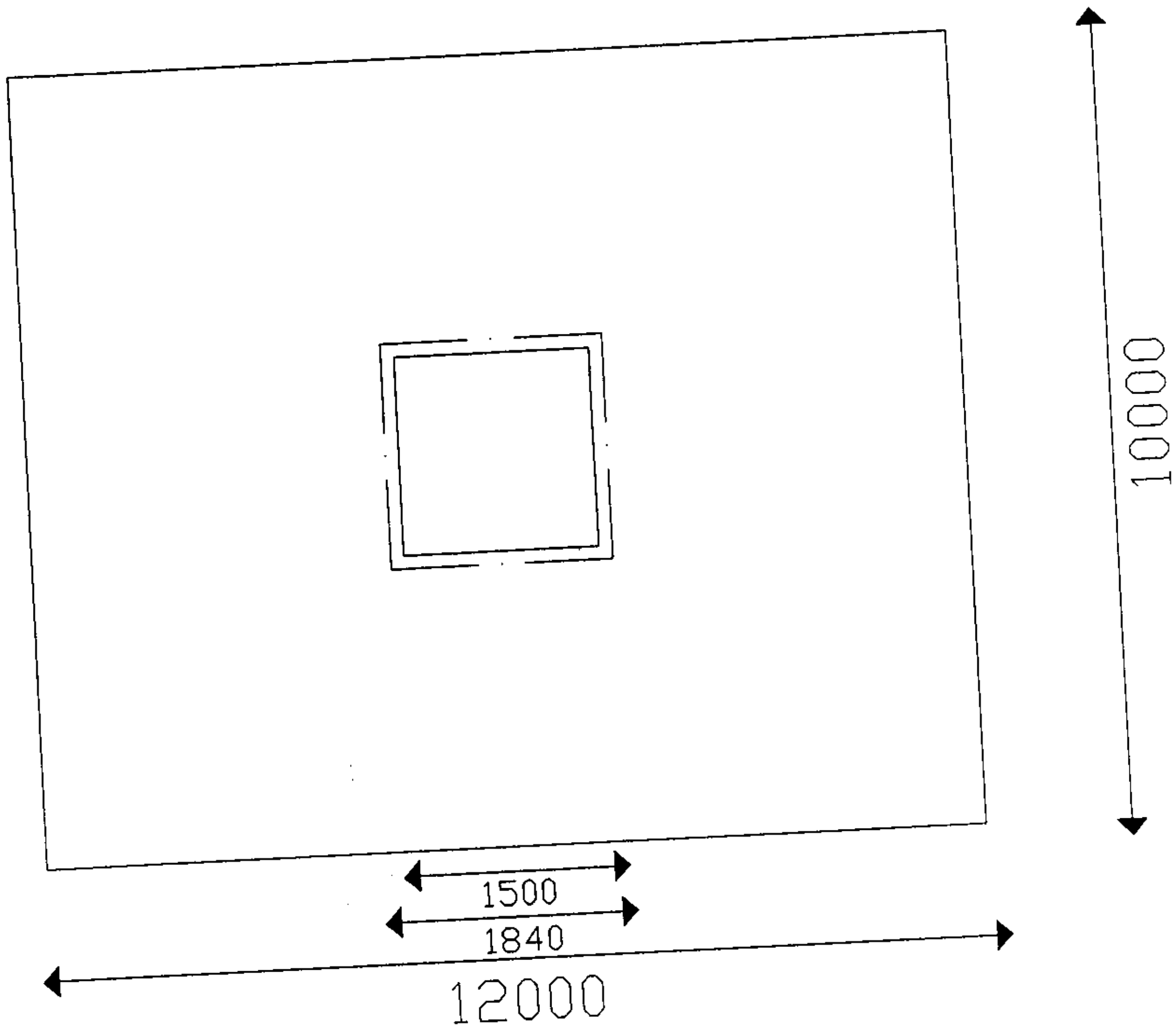


FIG 1.4 REINFORCEMENT DETAILING OF FLAT SLAB

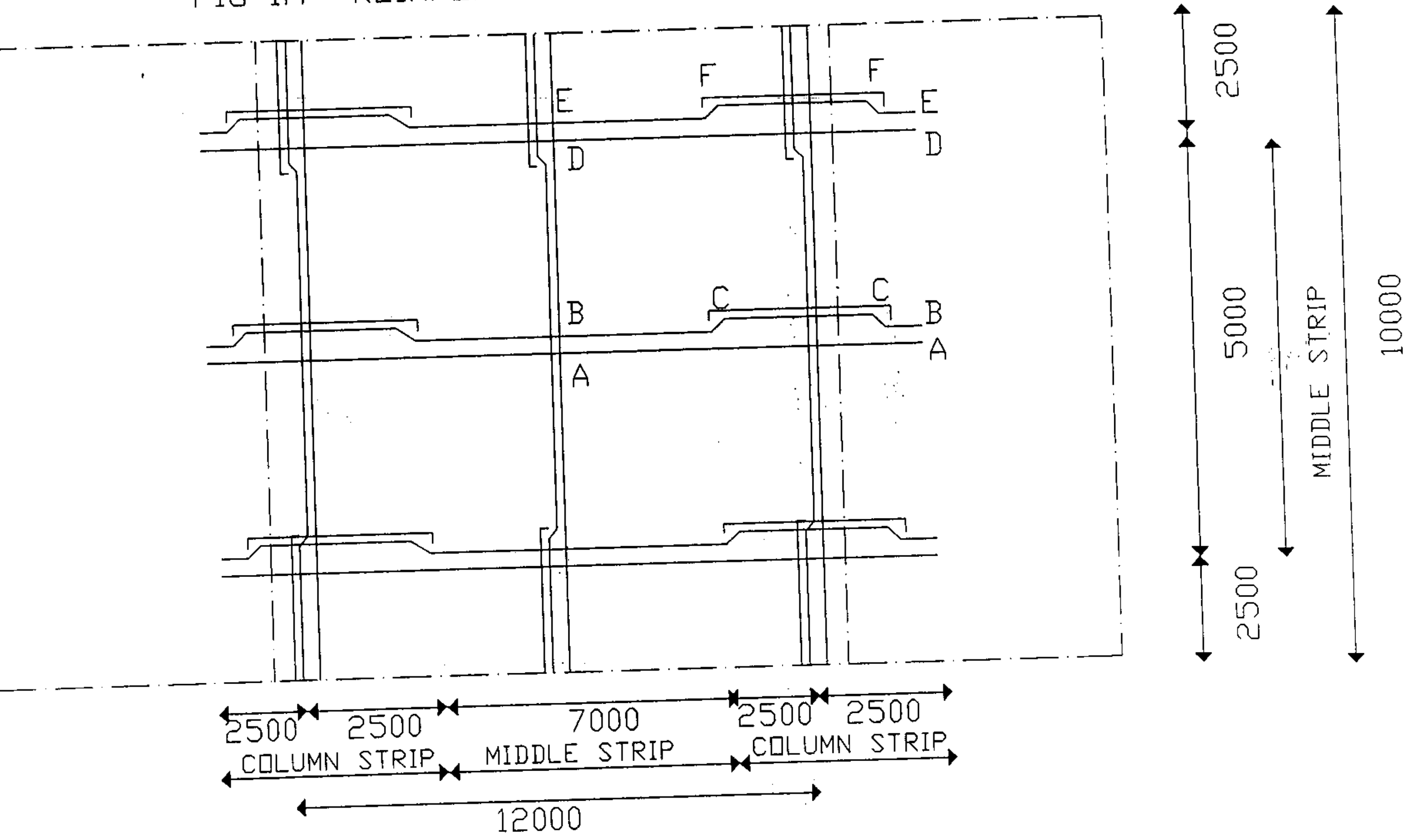


FIG 1.5 MIDDLE STRIP SHORTER DIRECTION

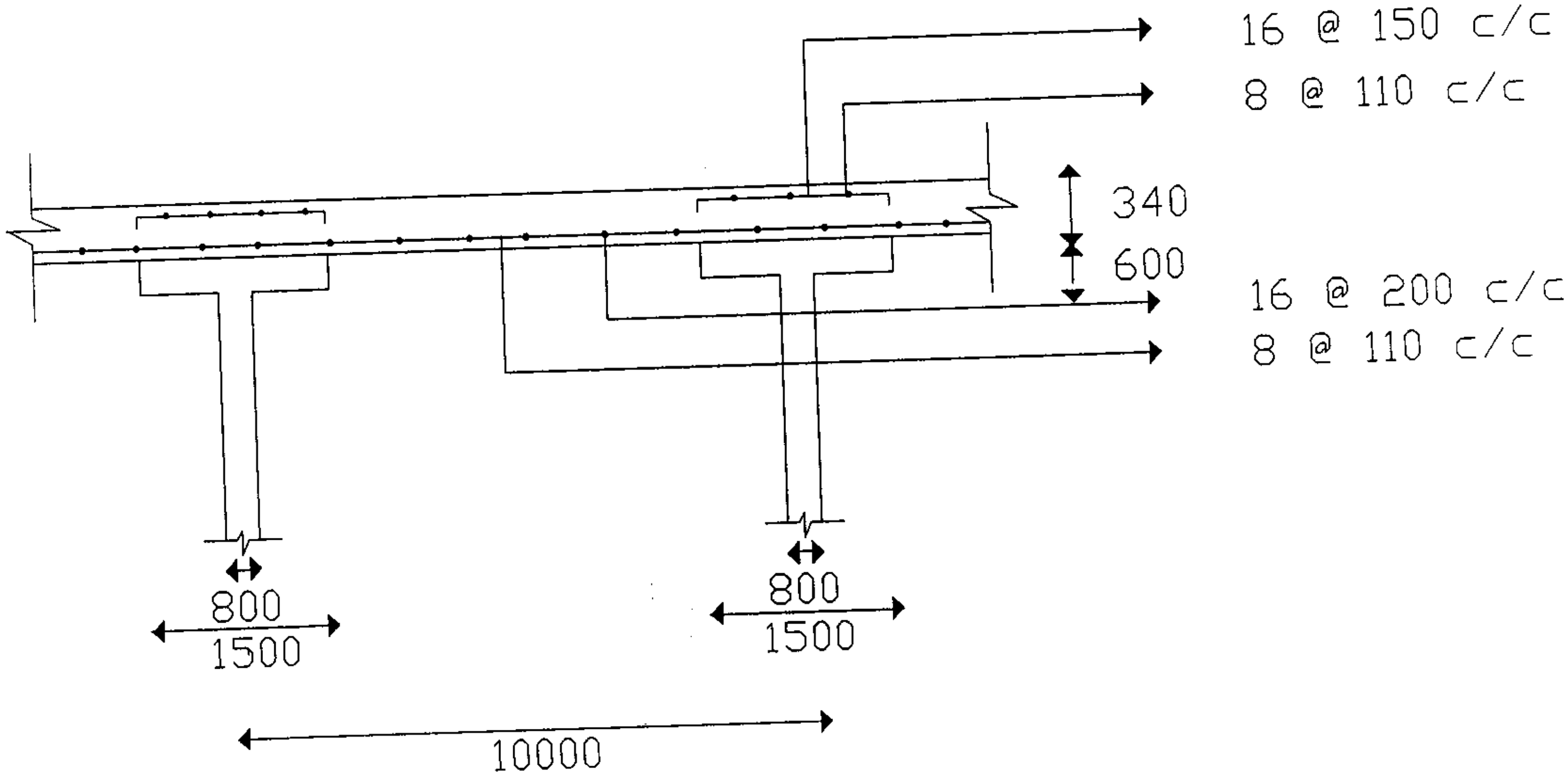


FIG 1.6 COLUMN STRIP SHORTER DIRECTION

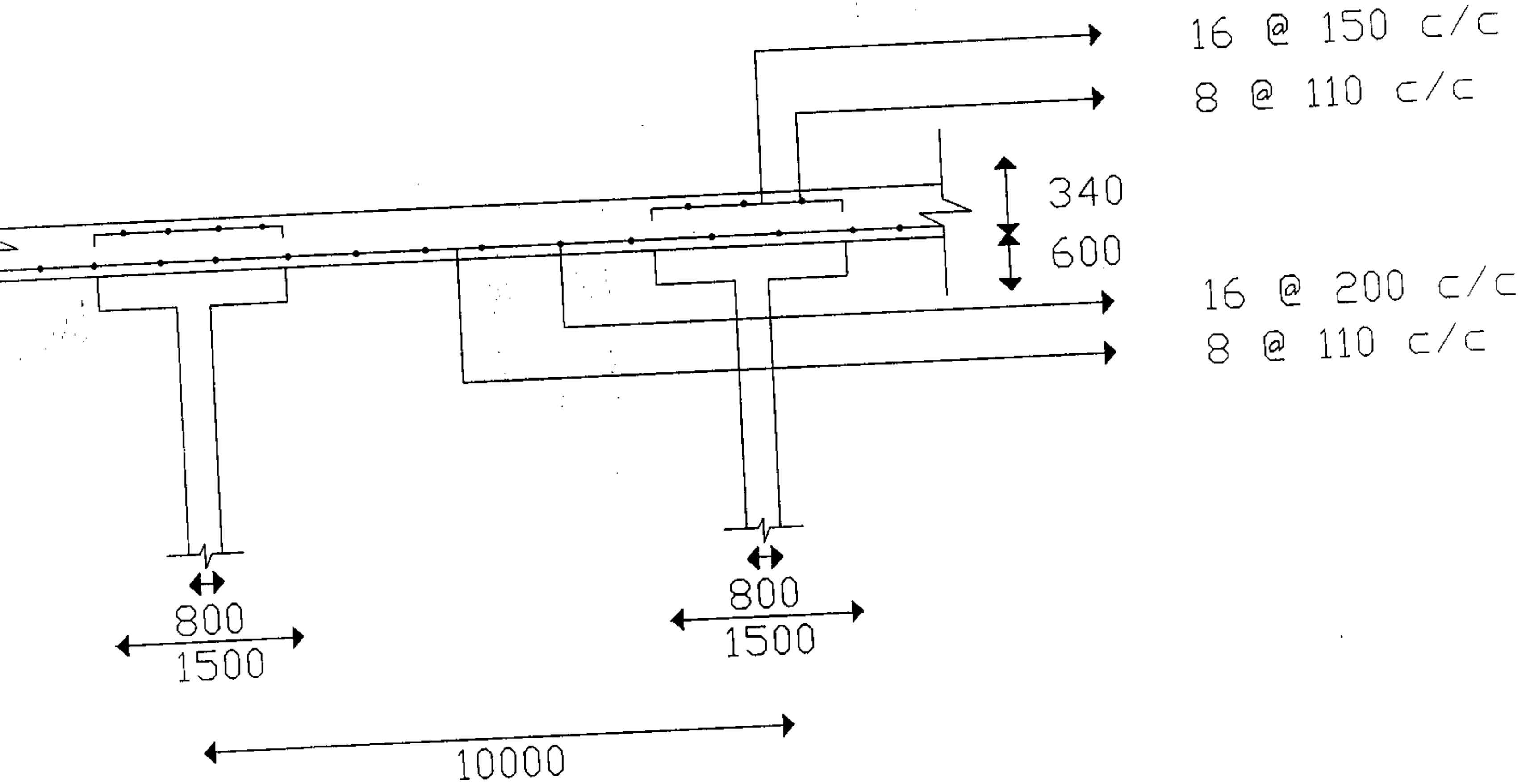


FIG 1.7 MIDDLE STRIP LONGER DIRECTION

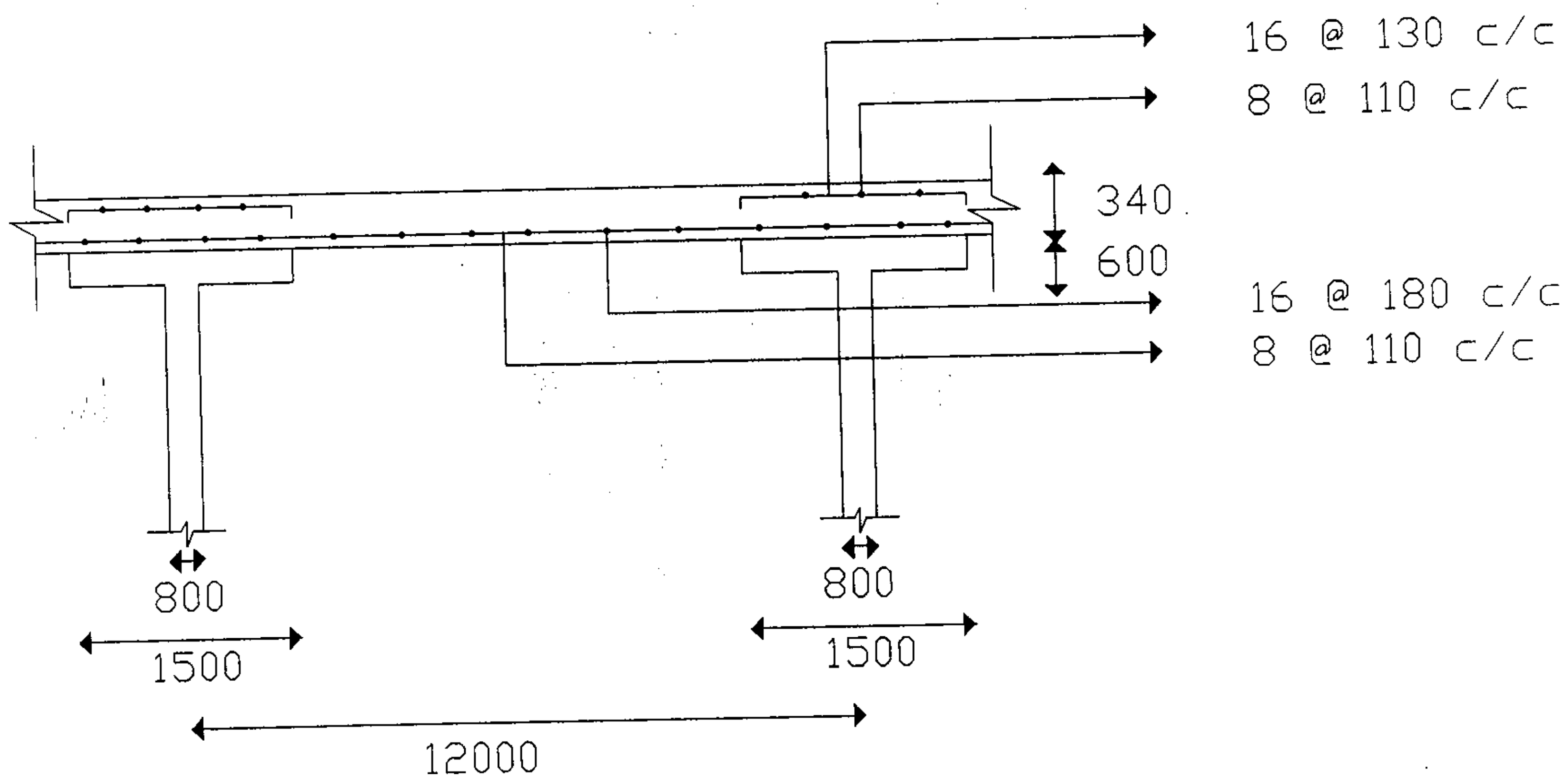


FIG 1.8 COLUMN STRIP LONGER DIRECTION

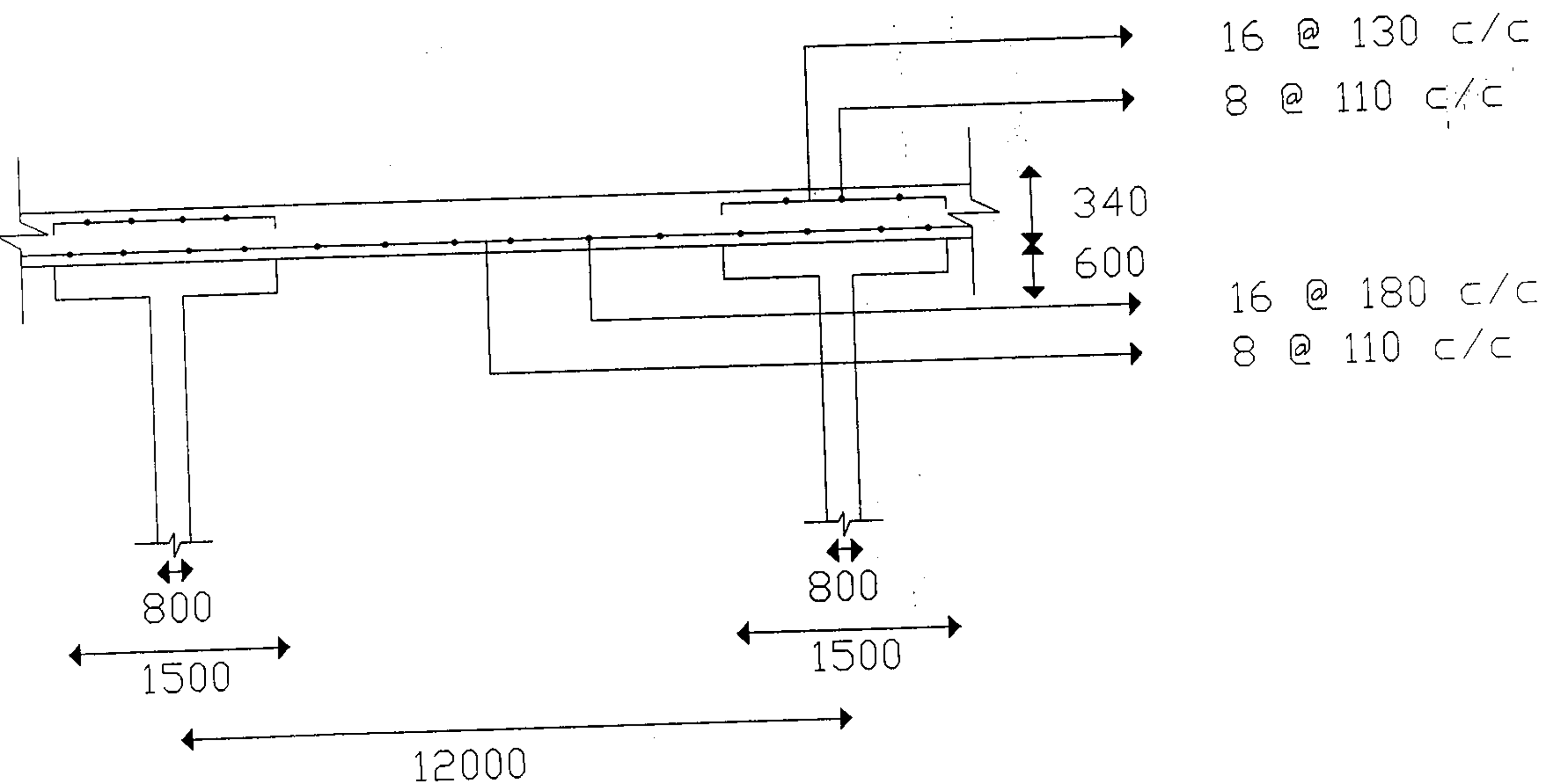


FIG 1.9 COLUMN REINFORCEMENT OF FLAT SLAB

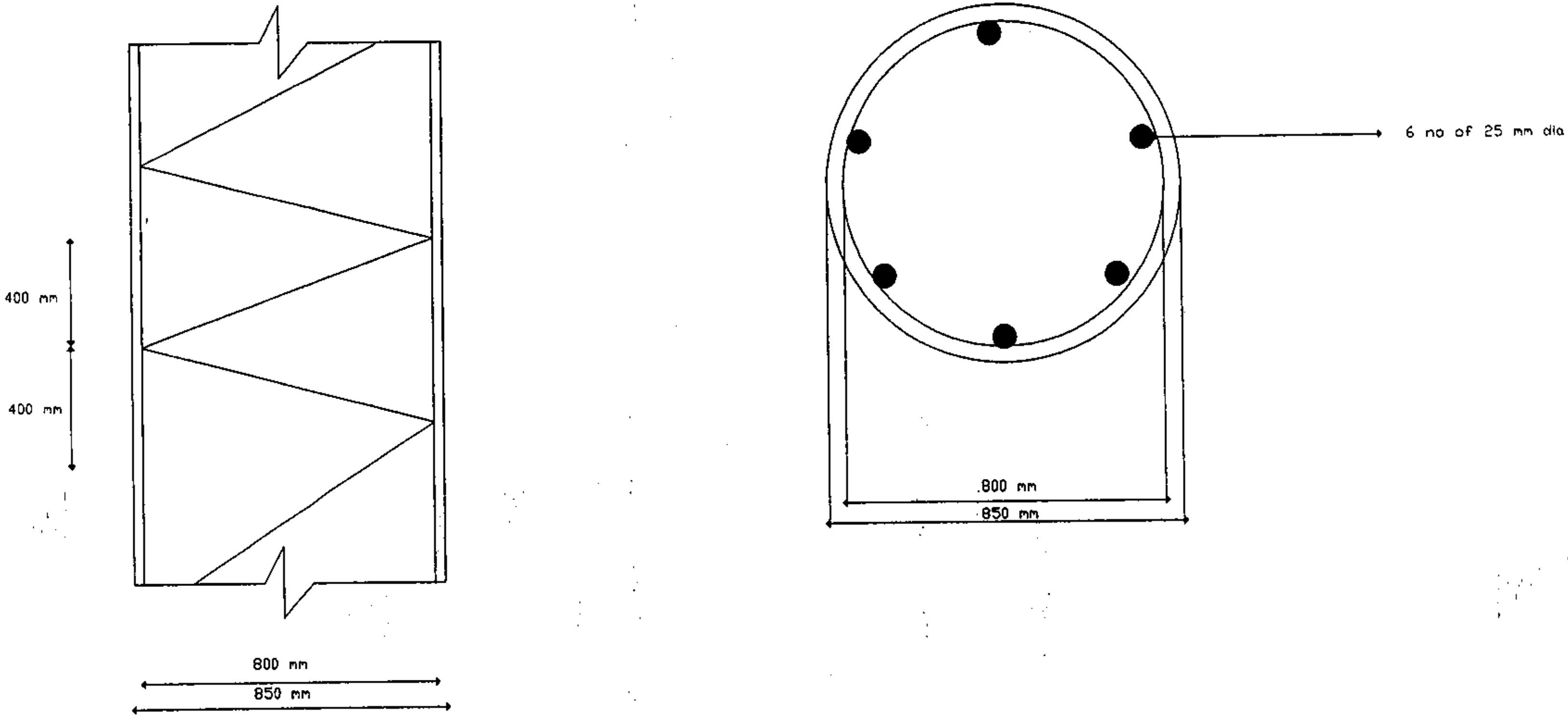


FIG 1.10 FOOTING REINFORCEMENT OF FLAT SLAB

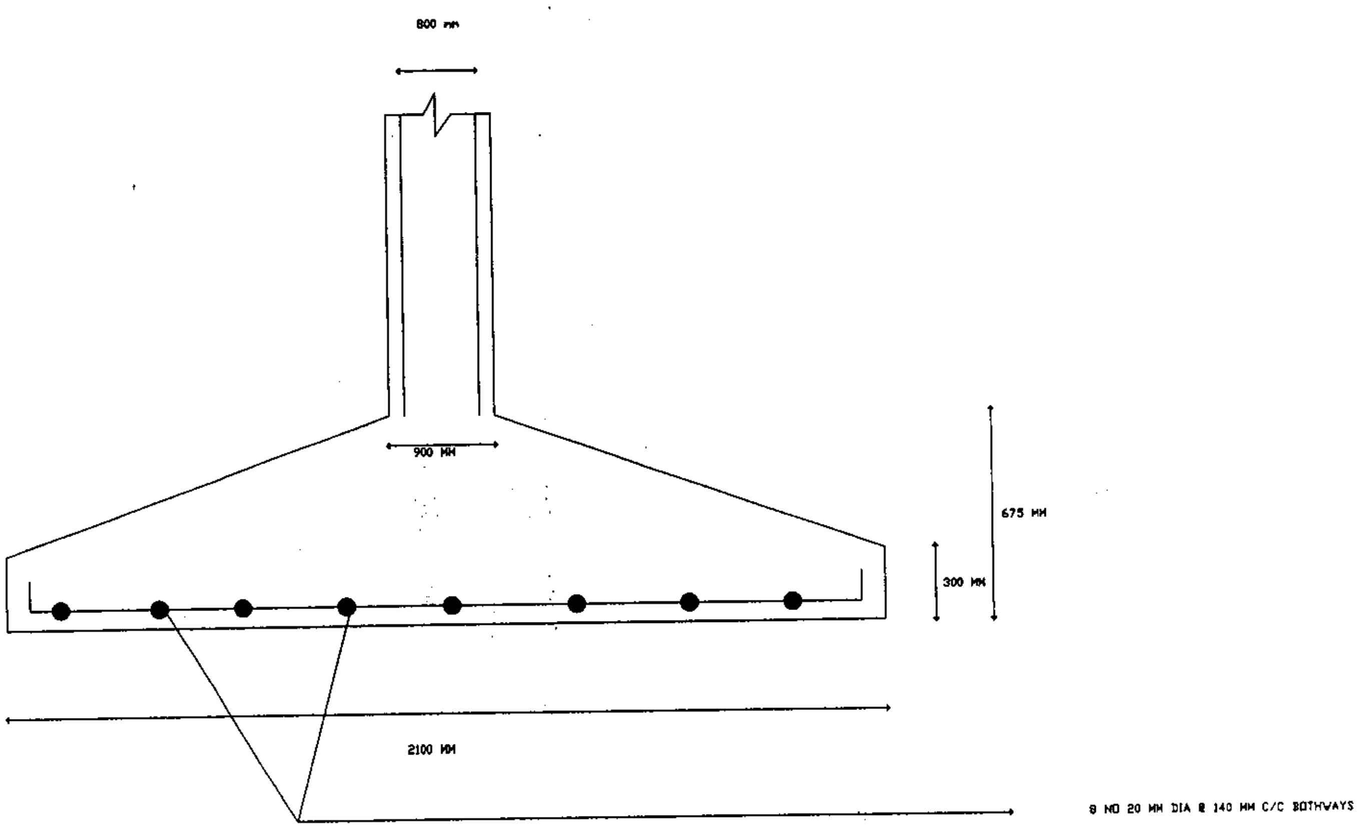


FIG 2.1 REINFORCEMENT DETAILS FOR ONE WAY SLAB

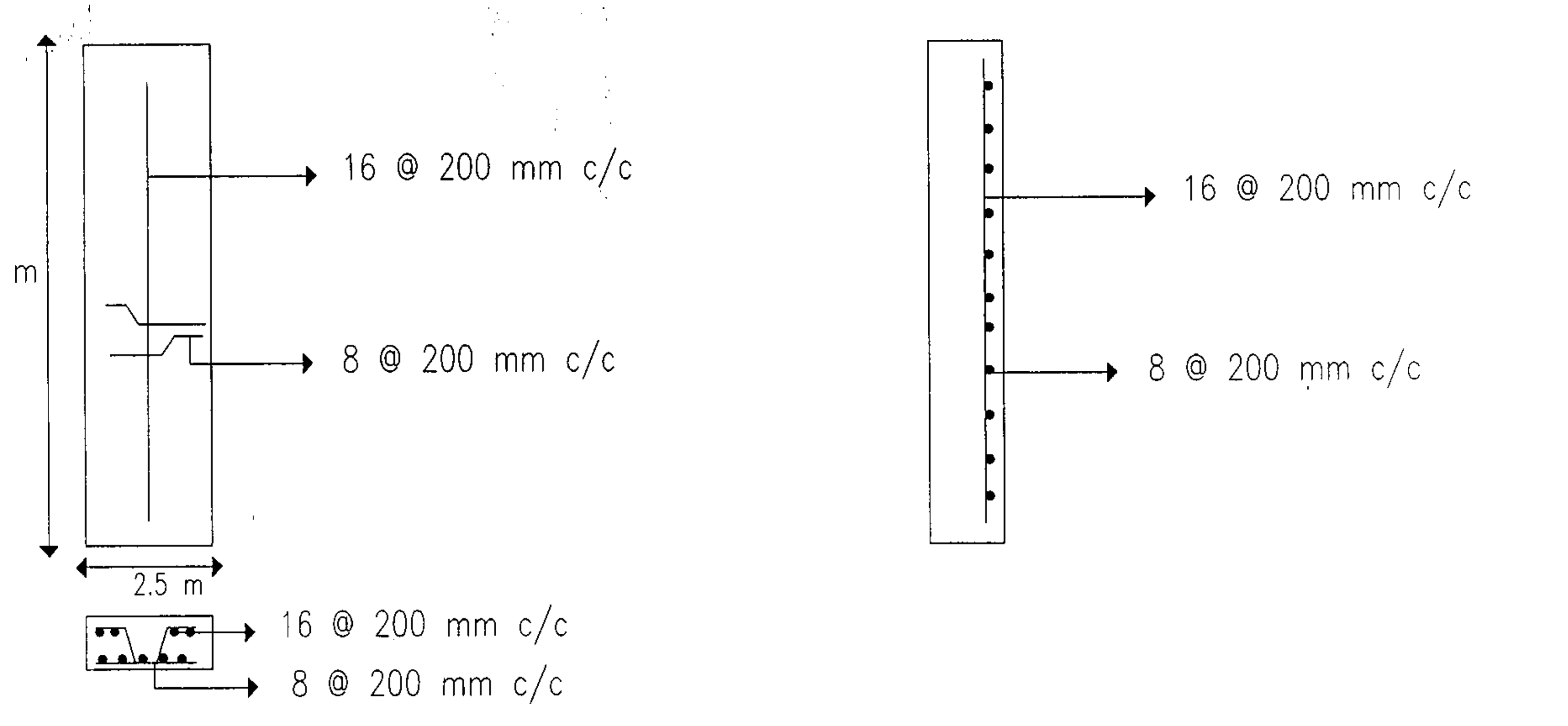
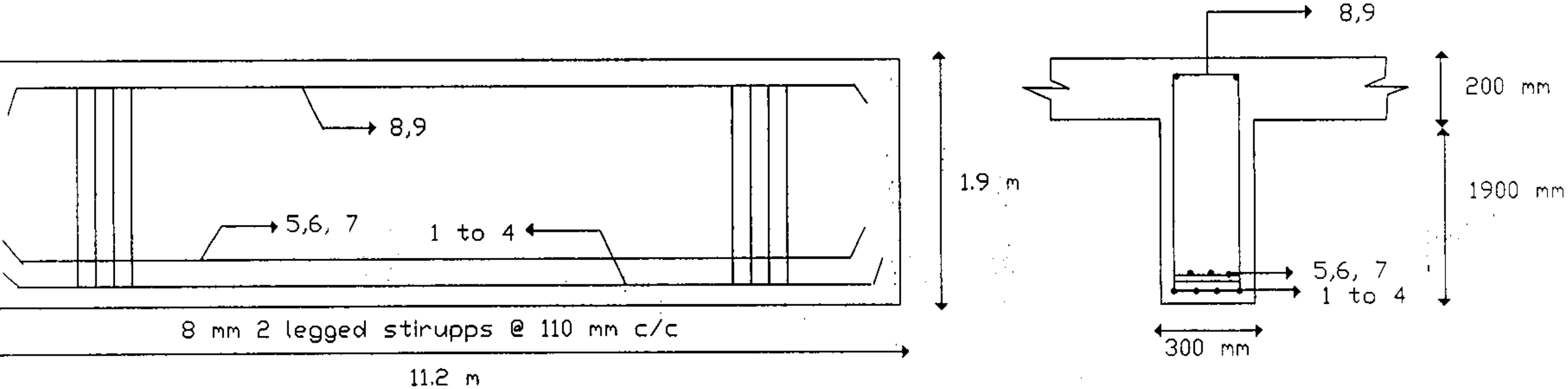
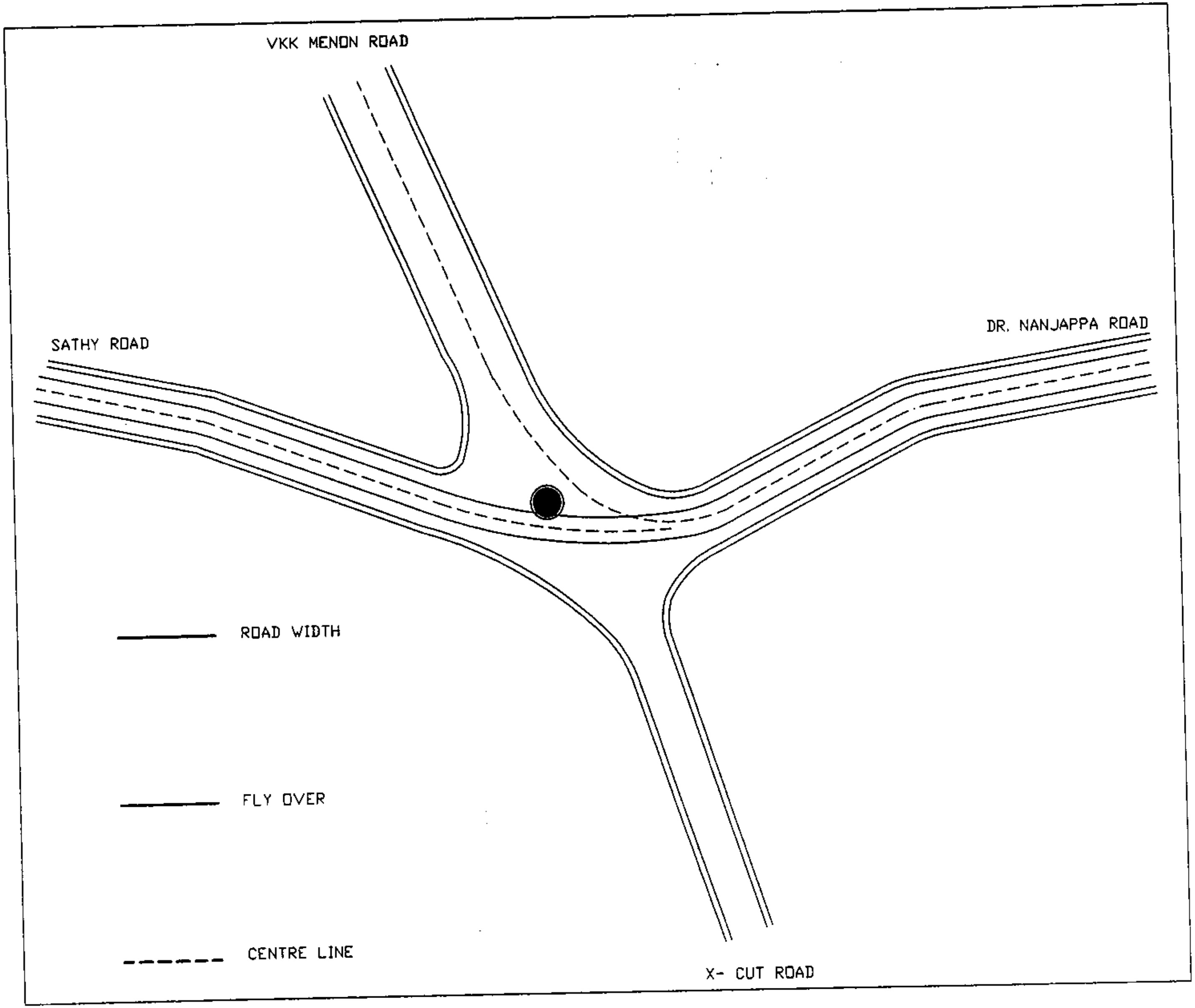


FIG 2.2 REINFORCEMENT DETAILS FOR CROSS BEAM

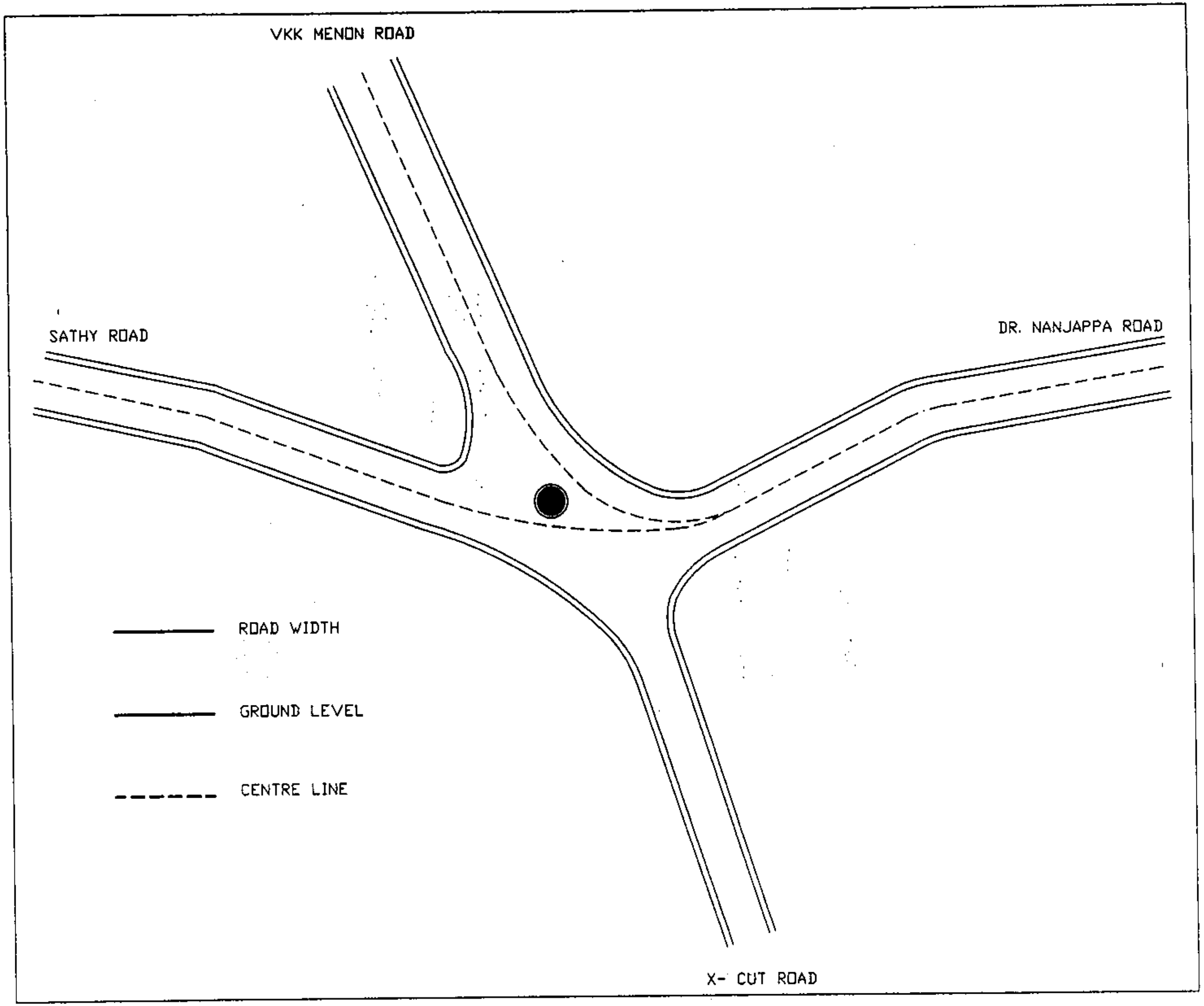


schedule of bars : 1 to 7: 7no of 25 mm dia
8,9 - 10 mm dia hanger bars

TOP LEVEL LANE



GROUND LEVEL LANE



UNDERGROUND LEVEL LANE