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Reduction of Traffic by Proposing Flyover at Congested Area

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Abstract: *Traffic congestion has been one of the major issues that most metropolises are facing despite measures being taken to mitigate and reduce it. In the recent past, traffic congestion has emerged as one of the main challenges for engineers, planners, and policy makers in urban areas. Modern social and economic structures, shaped by car-oriented urban development and rapid growth in vehicle ownership, have established congestion as an inescapable reality of urban life. The growing impact of congestion is seen in terms of deteriorating urban air quality besides other adverse effects on quality of urban living. Our project deals with the Design of a flyover in an intersection. The location is at four roads junction at Lakshmi Mills, which is facing major traffic problems due to increase in number of vehicles. We have done a traffic survey and designed all the structural parts for this flyover.*

Keywords: Traffic congestion

I. INTRODUCTION

A junction is the general area where two or more roads join or cross. The importance of design of junction stems from the fact that efficiency of operation, safety, speed cost of operation and capacity are directly governed by the design. Junction is a major bottleneck, and the planned improvements will reduce traffic congestion considerably. The scheme is the result of several years of planning and design to find the best possible solution to reducing congestion and improving safety. The improvements will mean that car drivers, public transport users, cyclists and pedestrians will all find their journeys quicker, easier, and safer.

1.1 Selection of Site

The study area selected for the investigation is Lakshmi mills Junction in Avinashi Road.Avinashi Road is of the main gateway into the city by road as well as from North and Eastern parts of India. It starts from Uppilipalayam flyover near Grey town area and passes through the important neighborhoods of Peelamedu and Chinniyampalayam and finally Neelambur. This road is also home for Educational Institutions, Major specialty hospitals, corporate offices, Information technology parks, Shopping malls and Luxury hotels.

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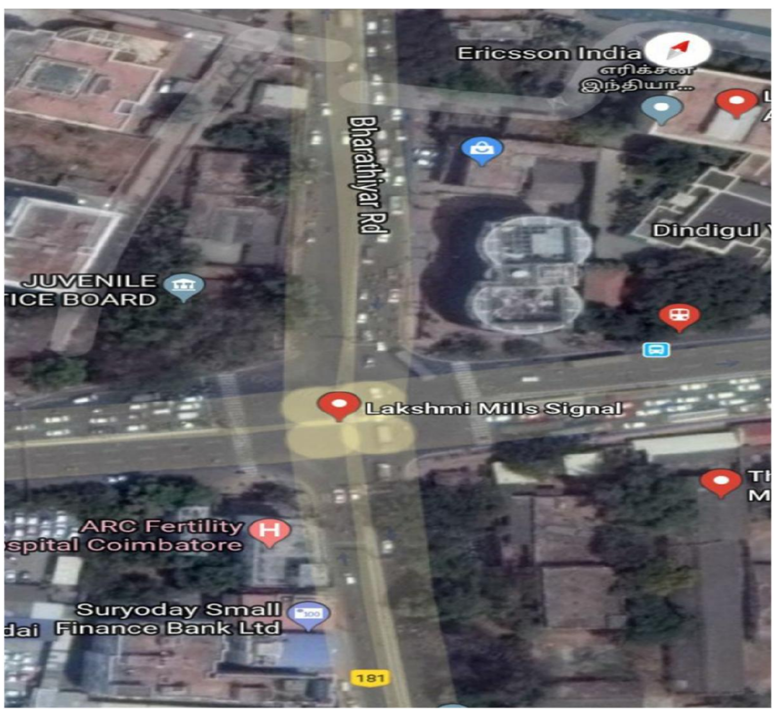

Today, this road has turned to be the most important arterial road in the city. This road is the gateway to vehicles from East and North-East Tamil Nadu and bound for Tirupur, Erode, Salem, Vellore, Chennai, Bangalore. In recent years, the road was widened into a six-lane.

Roads are the backbones of any industrial setup, but unfortunately, the road leading to Avinashi becomes a quite bit trouble especially during peak hours. The study is mainly focused to investigate the traffic congestion and propose a proper solution for it.

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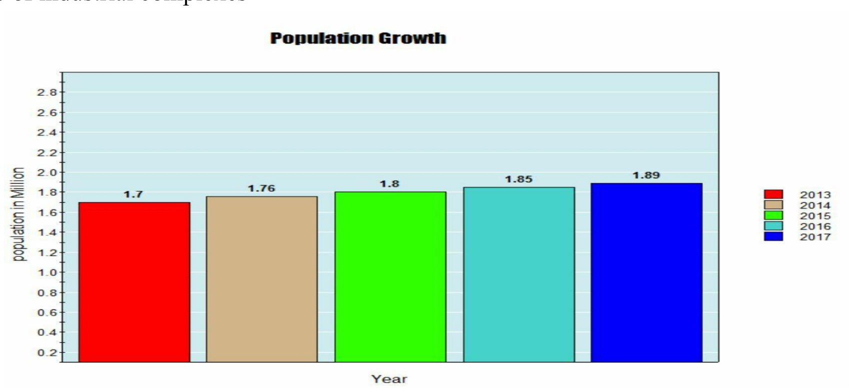
II. GROWTH OF POPULATION

The population has increased drastically from the last few decades due to the exponential growth of industries. Other reasons for the increase in population are

1. Migrants from other states in search of work
2. Attracted to good weather conditions
3. Presence of educational and scientific institutions
4. Presence of industrial complexes



2.1 Traffic Survey

Traffic survey was made from 07.05.17 to 14.05.17, in the project site for 24 hours.

All the four arms of the site was observed and the number of vehicles passed was converted to PCU's (Passenger car unit).

2.2 Traffic Projection

The passenger car unit of a vehicle type has been found to be depends up on the size, and speed of the vehicle type and environment. They are not dependent on the flow and road width.

As per IRC: 92-2000, the traffic volume limit is10000PCUs/hour. The capacity of junction was estimated at 6547 PCU's / hour. The design period is taken as 30 years. One year would be taken for the construction. So, traffic is projection. So, traffic is projected for 31 years.

2.3 Necessity of Flyover

For easy traffic flow of agricultural goods and industrial goods without traffic congestion flyover or over bridges is essentially to overcome the traffic congestion required.

2.4 Design Consideration Slab

Slabs are the plate elements which carry the loads primarily flexure. They usually carry vertical loads. Under the action of horizontal loads, due to a large moment of inertial they can carry quite large wind and earthquake forces, and transfer them to beams. A reasonable thickness of slab can act as a rigid diaphragm under the action of horizontal load the rigid diaphragm is plate whose all element displace equally in the direction of applied in plane loads. The slab with sufficient thickness acts as rigid diaphragm when in plane horizontal loads like wind or earthquake are acting on it due to its very large in plane moment of inertia. As a result, its constraints the connected column to deflect equally in given horizontal direction of wind or earthquake loads.

2.5 Beam

Beams carry loads from slab and also direct loads such as masonry walls and their self-weights. The beam may be supported on the other beams or may be supported by column forming an integral part of the frame. Beams are primarily the flexural members.

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COLUMN

Columns are the vertical members carrying loads from beams and from upper columns. The loads may be axial or eccentric. The importance of the column is greater than that of the beams and slab.

This is because, if one beam fails, it will be a local failure of one floor, but if one column fails, it can lead to collapse of a complete structure. The safety provisions adopted by the standards are therefore more for columns than for beams or slabs

FOUNDATION

Foundation is the load transmitting members. The loads from the columns and the walls to be transmitted to the solid ground through foundation.

LOAD AND STRUCTURE

The correct estimation of loads on a structure or a part of a structure leads the designer to the safe and economical design. It is very important that no load which is to be borne by the structure is over loaded.

Estimation of different types of loads expected to be borne by the structure throughout its design life. Different kinds of loads may be estimated by using respective Indian Standard Codes of practice.

Determination of worst combination of loads that may occur at one throughout the life of structure. The standard codes of practice give guidelines for this. All the loads are not expected at the same time for example, IS-875, wind and seismic force need not be considered as acting simultaneously. The earthquake is a rare phenomenon. It is therefore very unlikely that the maximum earthquake coincides with maximum of other occasional forces like wind, flood etc., therefore for the design purpose these are assumed not to occur simultaneously.

TYPES OF LOADS:

DEAD LOAD:

Dead loads are the load due to self-weight of structure or structural members. Dead loads and static loads remain reasonably constant throughout the life of a structure. The unit weight of different materials may be taken from IRC:21-2000 code of practice for design loads for the buildings and structures part 1 dead loads.

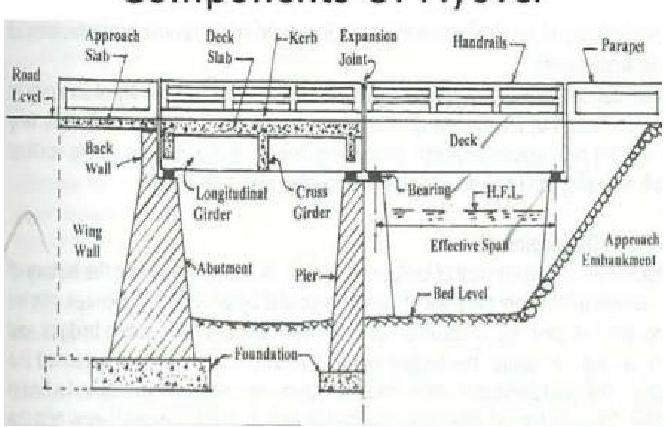
LIVE LOAD:

Live loads are loads which are not steady unlike the dead loads they can change their magnitudes. Live loads are comprehensively described in tables 1 and 2 IRC:21-2000 part 2 imposes loads.

IMPACT LOAD:

Impact load are the loads caused by the vibration of live loads.

Components Of Flyover



III. PRELIMINARY DESIGN

Clear roadway = 8 m
Assume five T-beams spaced at 2.5m c/c Width of bearing (assumed) = 0.8 m Effective span of T- beam = 20 m
Assume cross beams at 4 m centers.
M20 grade concrete according to IS : 456-2000 and Fe415 steel confirming to IS : 432-1982 will be used.

IV. DESIGN OF DECK SLAB

Slab is supported on the four sides by the beams. Thickness of the slab = 250 mm
Thickness of the wearing coat = 80 mm Span in transverse direction = 2.5 m c/c Span in longitudinal direction = 4 m c/c

Max.BM. Due to dead load:
Total weight = 8.2KN/m^2
Total dead load = 57.646KN
Moment along longer span = 0.992KNm
Moment along shorter span = 2.85KNm
Class AA loading track located for Max. BM on deck slab.
Track contact length taken from IRC:6-1996 bridge code section II BM. along shorter span = 31.18KNm
BM. along longer span = 10.32KNm
Live load BM due to IRC class AA wheeled vehicle: BM. Due to wheel 1:
BM. along shorter span = 16.28KNm BM. along longer span = 13.21KNm BM. Due to wheel 2:
Net BM along shorter span = 0.690KNm
Net BM along longer span = 0.37KNm
BM. Due to wheel 3:
Net BM along shorter span = 4.58KNm
Net BM along longer span = 4.01KNm
BM due to wheel 4:
Net BM along shorter span = 17.15KNm
Net BM along longer span = 3.05KNm
BM due to wheel 5:
Net BM along shorter span = 17.15KNm
Net BM along longer span = 3.05KNm
BM due to wheel 6:
Net BM along shorter span = 8.92KNm
Net BM along longer span = 1.59KNm
Total BM along shorter span = 67.18KNm
Total BM along longer span = 54.26KNm
Design of BM
Design BM along shorter span= 84.046KNm
Design BM along longer span = 66.30KNm

Reinforcement
Shorter span:
Use 16mm dia bars at 120mm c/c spacing as main reinforcement.
Longer span:
Use 16mm dia bars at 200 mm c/c.

Cantilever slab design Moment due to unit load:
Total max. moment due to dead load = 18.33KNm Moment due to live load:
Max. moment due to live load= 55.73KNm

Reinforcement:
Total moment due to DL. &LL. = 111.84KNm Area of main reinforcement:
Provide 16mm dia bars at 110mm c/c BM for distribution reinforcement:
Use 12mm dia bars at 220mm c/c

Design of cross beam
Dead load for design:
Total slab load = 6.25KN/m^2
Total load of cross beam = 11.88KN/m BM at a distance 1.475 = 16.28KNm

Check for shear:
Shear stress, τ_v = 1.56N/mm^2
From table 19 of IS456:2000 for Pt value Nominal shear stress τ_c =3.1N/mm^2
$\tau_v < \tau_c$ Hence safe.

V. DESIGN OF FOOTING

Axial load = 5000 kN
S.B.C. of Soil, q0 = 245 kN/m^2 Angle of repose, φ = 30°
Weight of soil, We = 20 kN/m^2
Concrete grade = M20 Steel grade = Fe 415

Load:
Load of column = 5000kN
Self-weight = 500kN Total load = 5500 kN

Reinforcement:
Ast = 6378.82 mm^2
Provide 28mm dia bars at 90mm c/c.

Check for shear:
τc = 3.1 N/mm^2
τv = 2.05 N/mm^2
$\tau v < \tau c$ Hence safe.

VI. DESIGN OF RETAINING WALL:

Height of embankment above ground level = 4.4m
Unit weight of soil = 20 kN/m^3
Angle of response = 30˚
Safe bearing capacity of soil = 245 kN/m
Co-efficient of friction = 0.5
Use M25 concrete and Fe415steel

Design of toe slab:
Provide 16mm dia bars at 220mm c/c

Design of Shear key:
Provide 16mm dia bars at 200mm c/c.

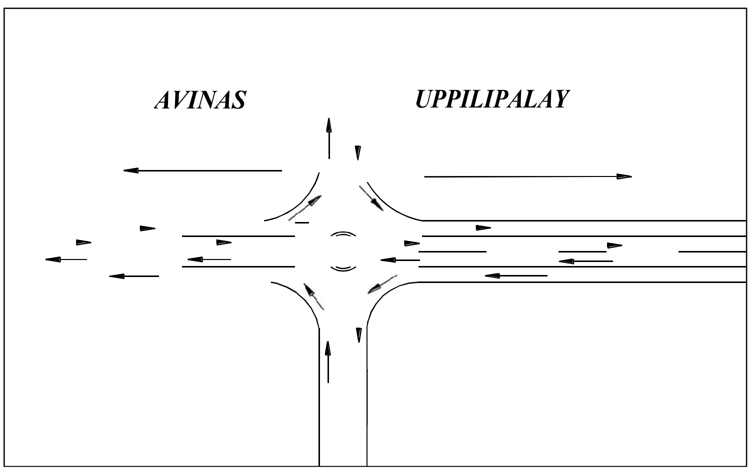
VII. CONCLUSION AND RECOMMENTATION

Implementation of a Roundana flyover requires more area in that place and so Corporation is planning to propose a long expressway flyover for a length of 6km between SITRA and LAKSHMIMILLS JUNCTION. The project deals with more economy and there may be reduction in the existing lanes for a complete length of the expressway which leads to further increase in the congestion. And so we are proposing a short length flyover and thus minimizing the complete reduction of lanes and to be economically feasible. The introduction of this short flyover results in:

- Reducing the travelling time of vehicles.
- Economical savings of fuel consumption.
- 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. Flyovers have many advantages, but shortcomings arise only because of some mistakes committed during the construction or due to improper planning, etc.

TRAFFIC FLOW AFTER CONSTRUCTION



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