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FEASIBILITY CHECK AND ANALYSIS OF A FLYOVER OVER A RAILWAY CROSS

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Abstract – *Heavy traffic congestion is observed in Guruvayoor town. One of the main reasons for this is the closure of railway gate for the passage of trains at Guruvayoor- Choondal road. In order to solve this problem, planning and constructing a Flyover over the railway crossing may be a suitable option. A traffic flow survey is done in order to determine the traffic volume in the area and a questionnaire survey is done to check the necessity of the flyover in the area. Analysis of the flyover is performed in SAP2000 software and the elements are designed manually.*

Key Words: Fly over, Railway crossing, Guruvayoor, SAP2000 software, traffic survey.

1. INTRODUCTION

A flyover is a grade separated structure that connects road at different levels in order to reduce traffic congestion. It helps in making the roads accessible for day to day traffic. As the traffic on roads increases day by day and we have only limited space in both the dimensions, there is only one option left that is to go to the third dimension and is done by constructing flyovers. There are various types of flyovers depending upon the location and purpose.

Guruvayoor is a municipal temple town in Thrissur district, Kerala. Guruvayoor Sri Krishna Temple located in Guruvayoor, is the fourth largest temple in terms of the number of devotees visiting per day. Guruvayoor Railway Station lies in the Thrissur- Guruvayoor section in which Guruvayoor is the last station. Heavy traffic congestion is observed in the Guruvayoor town during the rush hours of the day. A railway crossing at the Guruvayoor- Choondal is one of the major causes of the traffic congestion in the area. At railway crossing where there is high traffic congestion in terms of the frequency of trains passing by or the traffic on the road, in both the cases the flyover is a viable option along the road. Hence the flyover becomes indispensable in this area.

The reasons which emphasise the need for a fly over in the area are:

- The closing of the road to allow the trains to pass almost 30 times a day for about 5 to 10 minutes leads to a great amount of traffic congestion.
- Several accidents have been recorded in this area due to rushing of the driver to cross the railway line during the gate closing time.
- The timing of the train cannot be changed as a result even emergency ambulances are required to be waited for a long time.
- The road users are stuck in traffic for hours.

1.1. OBJECTIVES

- To propose a flyover design to reduce traffic congestion.
- To check the feasibility of the flyover in the area by questionnaire survey and traffic survey**.**
- To model and analyze the bridge components using SAP2000 software.
- To design the flyover elements manually and to detail the components.

1.2. SCOPE

- Flyover reduces the traffic congestion by providing an alternative route in the area.
- Traffic survey for one day was conducted to find the intensity of vehicles during the peak and off- peak hours in the day.
- Flyover for two lanes were proposed so that it reduces the traffic congestion.
- Flyover is designed for medium traffic.

2. METHODOLOGY

The methodology adopted for this project are as follows:

- Site selection
- Reconnaissance survey and data collection. It includes questionnaire survey, traffic survey and soil survey
- Preparation of plan of the flyover
- Modelling and analyzing the flyover in SAP2000 Software
- Designing the elements of the flyover.

3. DATA COLLECTION AND ASSESSMENT

Data's were collected from the fields in order to understand the actual problems faced by the people in the area. It helps in finding the feasibility of a fly over across the railway cross in solving the problem. A questionnaire survey and traffic volume survey is conducted in order to get a clear idea about the problems in the area and the traffic flow present in the area.

3.1. QUESTIONNAIRE SURVEY

Questionnaire survey was conducted for both the road users and the shopkeepers in the area. The questions were asked which helps in identifying the actual situation in the area. It helps in finding the problems and to find feasible solutions for the problems faced by people in the area.

The survey of the road users were done when they were held in traffic jam during the closing of the gate. Most of the users were school going students, office workers and temple visitors. The survey conducted between the shopkeepers of the area helps in knowing the accidents occurred in the area.

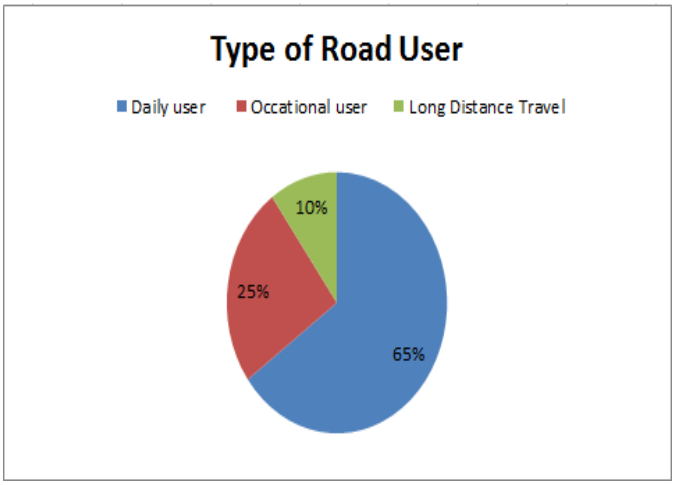

Fig-1: Type of road users

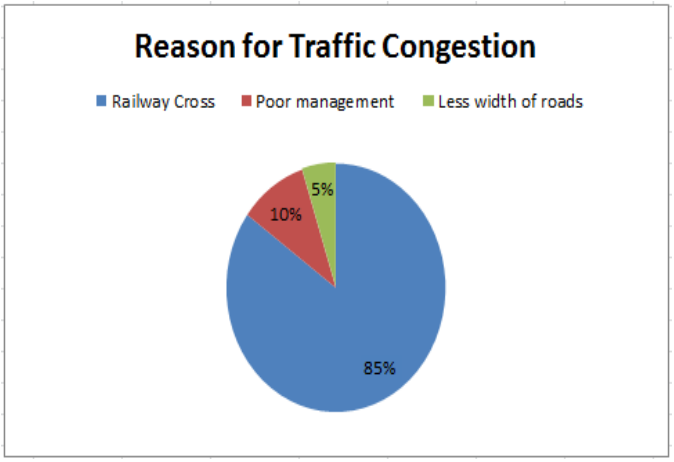

Fig-2: Reasons for traffic congestion

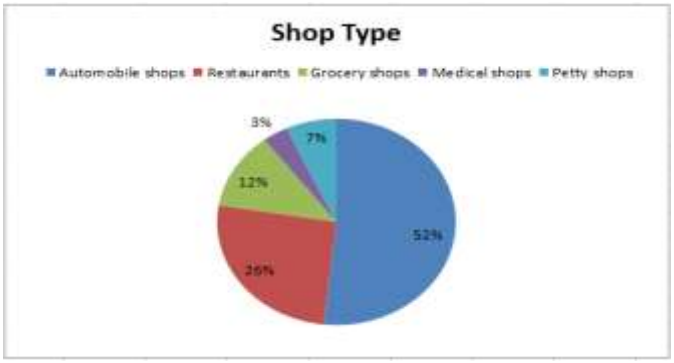

Fig-3: Type of shops

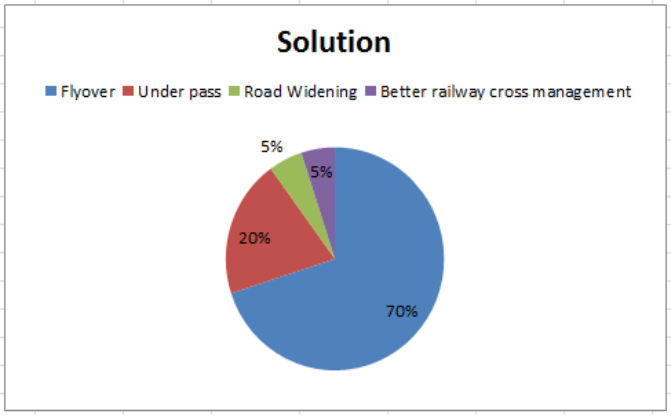

Fig-4: Solution for the problems

3.2. TRAFFIC SURVEY

The most common method of collecting traffic flow data is the manual method, in which a person is assigned to record traffic as it passes.

Traffic volume count was taken from Guruvayoor to Choondal and Choondal to Guruvayoor road. Traffic volume count was taken manually and by using video photography method. As the traffic is composed of different classes of vehicles, it is important to convert it into equivalent Passenger car units. The flow is expressed as PCU_S per hour or PCU_S per day.

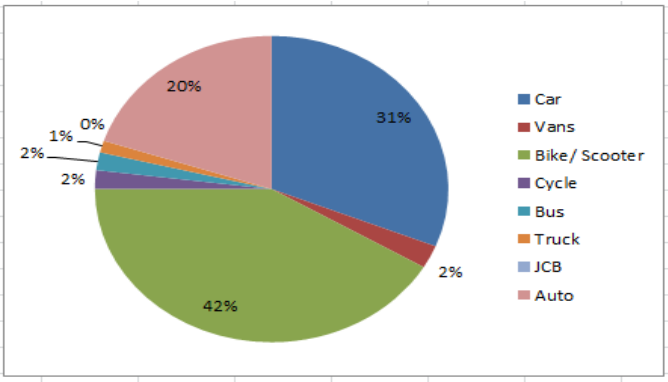

Fig-5: Vehicular distribution (Morning peak of Choondal to Guruvayoor road)

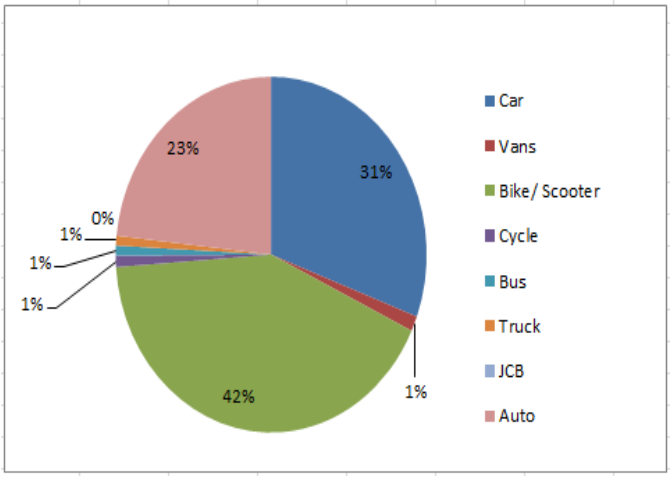

Fig-6: Vehicular distribution (Morning peak of Guruvayoor to Choondal road)

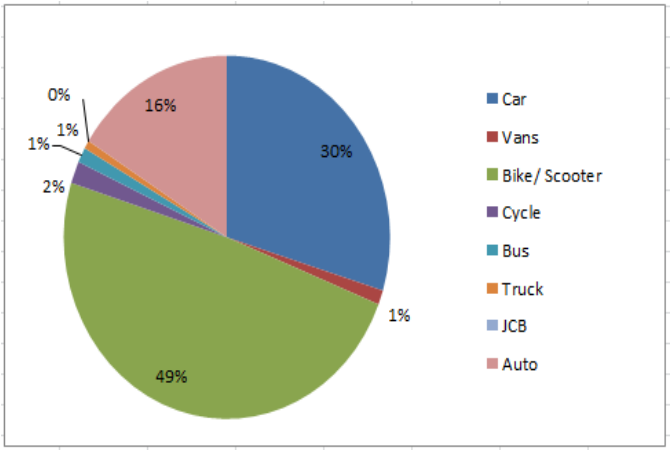

Fig-7: Vehicular distribution (Evening peak of Choondal to Guruvayoor road)

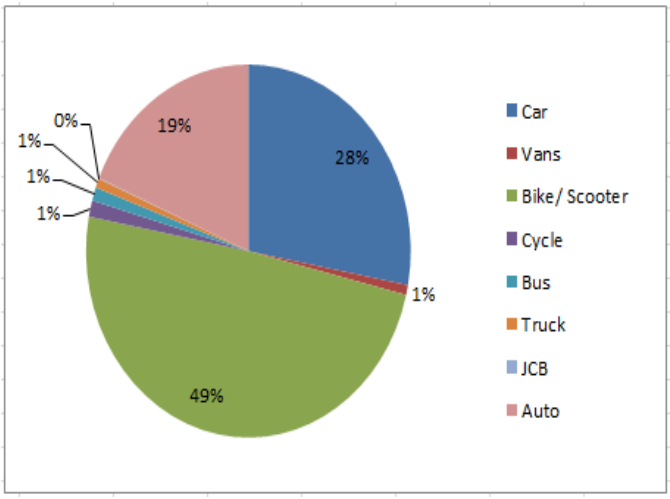

Fig-8: Vehicular distribution (Evening peak of Guruvayoor to Choondal road)

4. MODELLING

The structural details of the flyover across railway cross is modelled by using the finite element software SAP2000. Accurate modelling of the important properties of various structural elements of the flyover is very important in non-linear analysis of the structure.

4.1. DIMENSIONS OF COMPONENTS

DECK SLAB

M25 Grade
Fe 500
Total width = 9.75m
Footway width = 1.125m
Roadway width =7.5m
No of lanes = 2 lanes
Width of each lane = 3.75m
Modelled as shell element

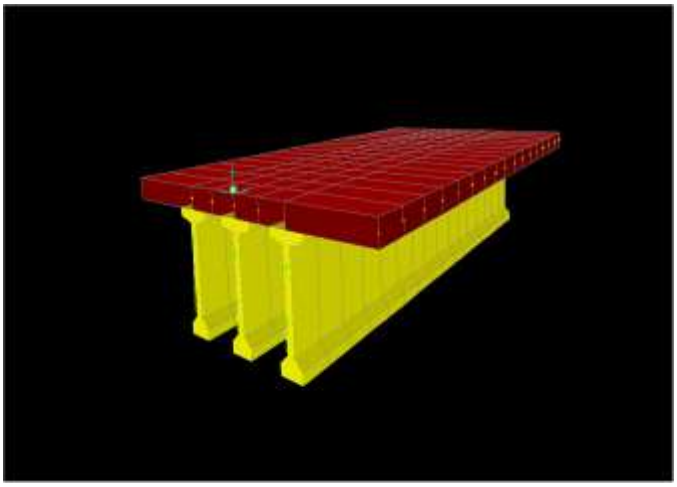

Fig-9: 3D view of deck slab

PIER COLUMN

Circular pier column
Diameter =2m
M20 Grade
Fe 415 steel
Modelled as frame element

PIER CAP

Hammerhead pier cap
Length = 7.83m
Width = 3.2m
Thickness = variable
M20 grade
Fe 415 steel
Modelled as frame element

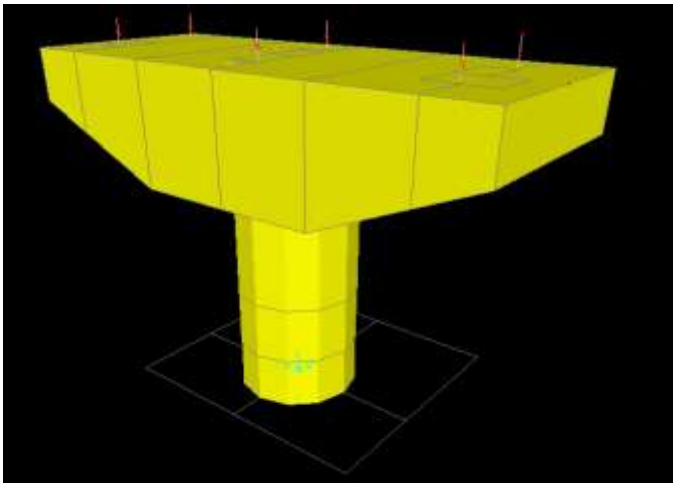

Fig-10: 3D view of pier and pier cap

PILE

Circular pile
Diameter = 1m
Depth =18.5m
M20 grade
Fe 415 steel
Modelled as frame element

PILE CAP

Triangular pile cap
Thickness = 1.5m
M20 grade
Fe 415 steel
Modelled as shell element

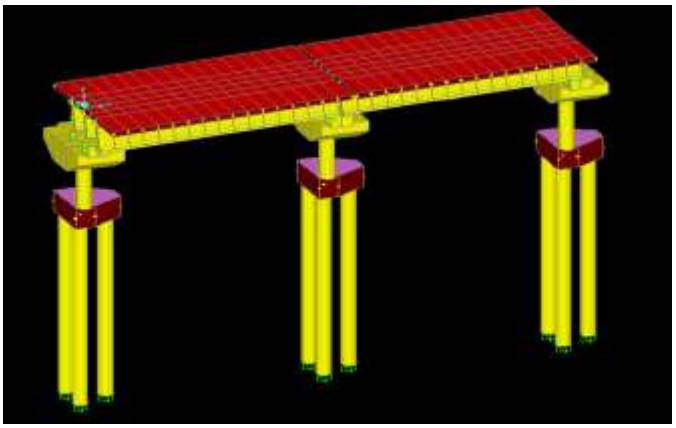

Fig-11: 3D view of 2 span of the bridge

4.2. LOADS

- **Dead loads**: The dead loads of the structure is considered as the self-weight of the various components of the flyover.
- **Live loads:** The bridges live loads can be considered in the form of moving loads and impact loads, IRC: 6-2014 is used to calculate all the load values.

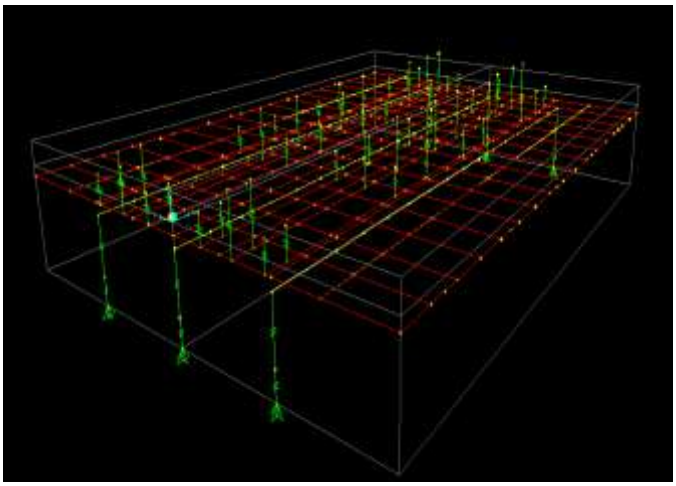

Fig-12: Braking and centrifugal force

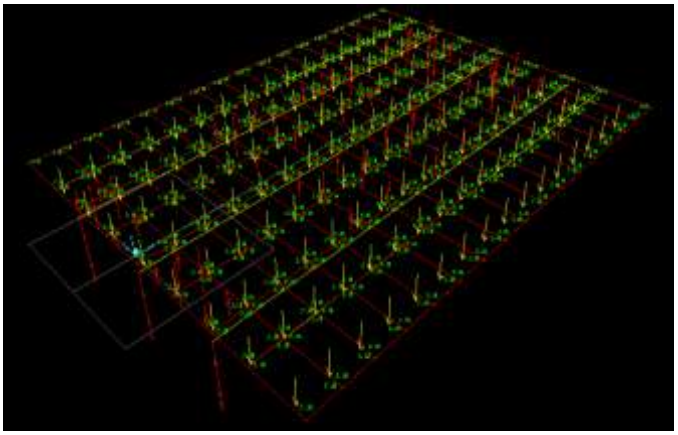

Fig-13: Seismic live load

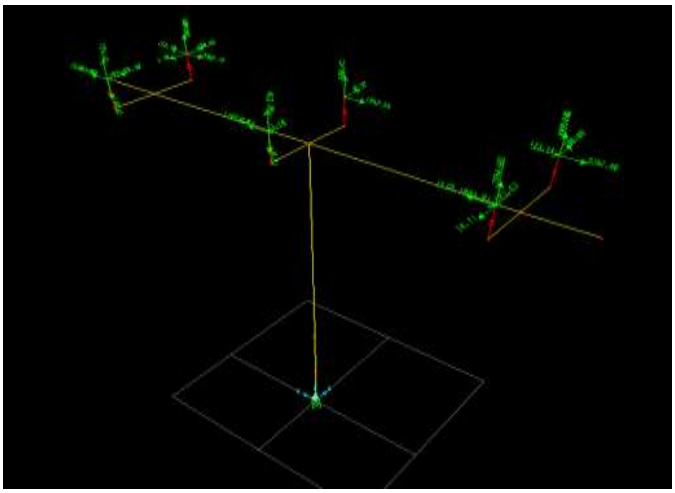

Fig-14: 3D view of loaded pier

5. ANALYSIS AND RESULTS

A static analysis is done in order to determine the deflections, stresses, strains, and forces in structure caused by loads that do not induce significant inertia and damping effects. Steady loading and response conditions are assumed; in which, the loads and the structural responses are assumed to vary slowly with respect to time. Static loads are applied according to IRC-6 in the analysis.

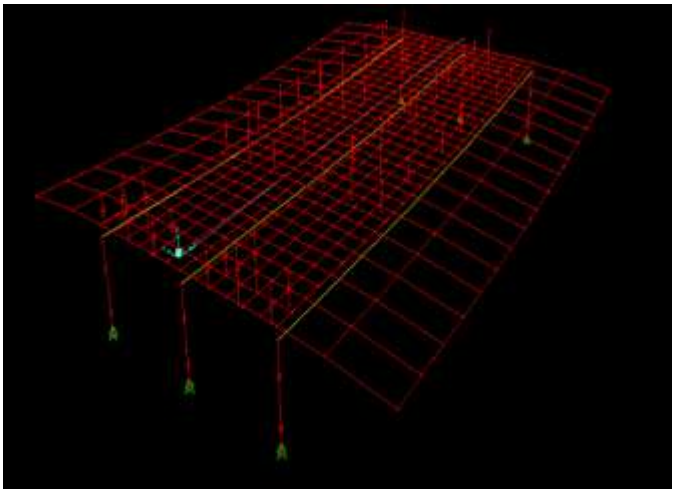

Fig-15: Deflected shape of the structure

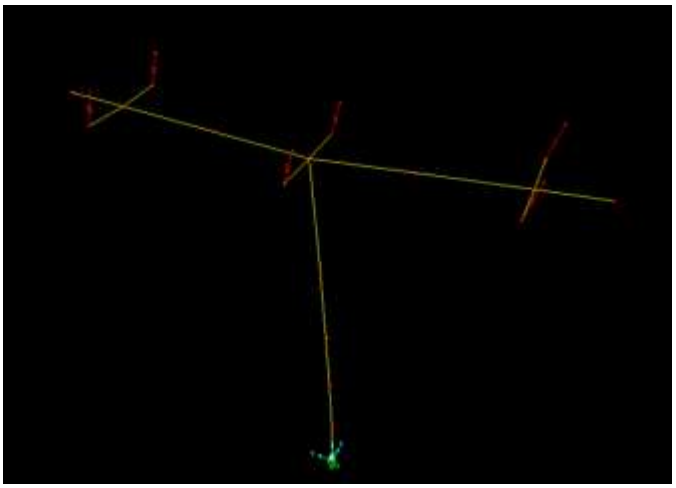

Fig-16: Deflected shape of pier

CHECK FOR DEFLECTION

Maximum deflection for dead load = 5.79mm
Maximum deflection for live load = 7.23mm

Maximum deflection limit

- Dead load =28mm
- Live load = span/ 800
  =12.18m

6. CONCLUSIONS

- An alternative route is provided so that the traffic congestion is avoided.
- The questionnaire survey conducted between the road users and the shopkeepers helps in finding the actual problems faced by the people in the area and a way to solve it.
- The traffic survey conducted in Guruvayoor-Choondal road helps in finding traffic flow in the area.
- It helps in getting a preliminary idea about the site.
- Both the surveys helps in finding the necessity and feasibility of the project in the area.
- The structure is modelled and analyzed in SAP2000 software.
- The deflected shape of the structure and bending moment of the structure is obtained.

7. REFERENCES

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