A STUDY ON FLYOVER CONSTRUCTION WITH ECOTECHNICAL ROAD SYSTEM

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Abstract - Our project deals with planning and proposal of a flyover at Kallumthazham which is located at the heart of Kollam , Kerala and will become the center of attraction by the coming of Kollam bypass. This place is one of the most accident prone areas in the city. To reduce the traffic congestion at the region, a **flyover** connecting the bypass in the Mevaram-Kavanad side of Kollam city is proposed. The flyover at the region is introduced using echo-technic road system. Echo-technic road system is mainly focused on move towards a green infrastructure. It is a concept of an integrated infrastructure based on the most innovative technologies adopted inorder to control global air pollution due to traffic as well as water logging on road surfaces. These technologies can hence promote smooth transportation at the junction with reduced accident rates. As for air quality treatment, the main solution is the treatment of pollutants as close to the sources as possible. Therefore photo catalytic materials can be added to the surface of pavement and building material. The pollutants are neutralized by the action of light and then gets washed away by rain. Hence air pollution due to traffic can be controlled. Particles get charged and then grounded which can be cleaned periodically. For the successful completion of the project, we have mainly conducted the site survey and feasibility study of the region. Also; both traffic and rainfall data were collected. We further conducted tests for controlling air pollution and also for water absorption. For water controlling measurements, pavements with filtering type nature is to be provided. To prevent water logging, the pavements should be laid with permeable layers which act as a water absorbing or filtration unit beneath the top layer and hence the water will not be accumulated as such on the road surface.

***Keywords*- Flyover , Ecotechnic road system , air pollution test, water absorption test**

1. INTRODUCTION

A Flyover is a bridge constructed along an intersecting highway over an at-grade intersection. Flyover is one of the methods for solving traffic problems at-grade junctions on a highway including capacity, congestion, long delay and queue length. The area of the proposed flyover is at Kallumthazham, which is the intersecting point of two national highways NH66 bypass, Kollam and NH744 passing through the Kollam city, Kerala. Many educational institutions, hospitals and other important institutions of the city are located near to this region, As a result, high traffic density is likely to be occurred here especially during the morning and evening peak hours. From the traffic study conducted on the region, it was seen that the present system to be installed by the bypass authority, i.e. the traffic signaling will not work satisfactorily there. By the completion of Kollam bypass road, the situation is likely to get worse. Therefore, the introduction of flyover suits best for the situation. A flyover connecting the bypass and Mevaram road can effectively reduce the traffic congestion in the junction. By using Echotechnic road system, we aimed at a more environment friendly, safer pavement promoting safe passage for vehicles. Echotechnic road system mainly includes changes done in the pavements which can control air pollution, water logging on road surface and can increase the durability of the road as well as reduce fatal accidents on roads. For the control of air pollution, we use TiO_2 in the pavement which absorbs air dust and lets the atmosphere clean. By the use of permeable pavements, the water logging on road surface can be reduced thus prevent skidding of vehicles thereby reducing accidents. Due to the use of porous asphalt in the road section, water will not sustain in the surface of roads and thus durability of road surface can be assured.

1.1 OBJECTIVES OF THE PROJECT

- The overall objective of the flyover is to provide an equitable balance of safe and efficient movement of traffic through intersections.
- The public felt inconvenience to cross Kallumthazham junction. As a solution to ease the transportation problem, the introduction of a flyover was very necessary at the region.
- To minimise the global air pollution and disturbances due to traffic, an Echotechnic road system is implemented.
- The features of an Echotechnic roadway is such that there can be an easy flow of traffic in the region and the chances of accidents can be very much decreased.
- Due to the commencement of the flyover at Kallumthazham, there will an easy path between Alappuzha and Trivandrum. So emergency vehicles like ambulances can easily reach the medical hospitals at different cities.
- Moreover time can be very much saved due to the absence of traffic signal at the region.

1.2 SCOPE OF THE PROJECT

- The traffic volume of the region can be largely controlled since there is no signal system in the region.
- Delay at Kallumthazham intersection can be reduced due to the absence of signal system. intersection, time management can be done very efficiently and there will not be wastage of travel time.
- Due to the presence of certain materials in the pavement, air pollution can be controlled to a great extend

- Replacing the normal pavement with permeable or porous concrete can absorb water from the road surface and can let the top surface of the road clean and dry quickly.

2. CASE STUDY AT KALLUMTHAZHAM JUNCTION

Fig : 2.1 Kallumthazham Junction

3. TRAFFIC STUDY

It helps in geometric design and traffic control, which tend to safe and efficient traffic movement.
Traffic studies for collection of data are also known as traffic census. Traffic survey was made on 29/01/2018 and 30/01/2018, in the project site from 8:00 am to 10:00 am and 3:30 pm to 5:00 pm. This time was selected on the basis of the past traffic study as an average of peak hour. All the three junctions of the site observed and number of vehicles Passed was converted to PCU (passenger car unit)
Identification of the Peak Hours
The traffic flow along a road does not remain constant throughout a day or week but varies with both space and time. The peak hour represents the most critical period for operations and has the highest capacity requirements for a given location. Two peak hours of the day were identified from the traffic data collected respectively for Kollam- Punalur route, Kollam Meravam junction and Mevaram Punalur route .Traffic surveys were carried out from 6:30 am to 9:30 am and 3.30 to 6.30
Separation of the Traffic Flow
To cause minimum disturbance to the traffic along Kollam Kallumthazham road (the main traffic flow), a flyover was proposed.

ENTERING TO KOLLAM FROM 6.30 AM TO 9.30 AM

Sl	ENTERING TO KOLLAM						
	ENTERING	MEVARAM			PUNALOOR		
1	FAST VEHICLES	NO	PCU	PCU EQU	NOS	PCU	PCU EQU
	PASSENGERCARS, AUTORICKSHAW, PICKUPS	378	1	378	538	1	538
	MOTORCYCLE, SCOOTER	511	.5	255.5	678	.5	339
	AGRICULTURE TRACTOR,LIGHT COMMERCIAL VEHICLE	5	1.5	7.5	12	1.5	18
	TRUCK,BUS	42	3	126	77	3	121
	TRACTOR,TRUCK	0	4.5	0	0	4.5	0
	TOTAL FAST			767			118
2	SLOW VEHICLES						
	CYCLES	4	.5	2	2	.5	1
	CYCLE RICKSHAWS		1.5			1.5	
	HANDCART		3			3	
	HORSE DRAWN		4			4	

4. RAINFALL INTENSITY DATA

The objective of rainfall intensity collection is useful in the design of urban drainage works example storm sewers, culverts, and other hydraulic structure. The intensity of rainfall is the measure of the amount of rain that fall over time. Intensity of rain is measured in the height of water layer covering the ground in a period of time. It means that if the rain stays where it falls it form a layer of certain height.

These datas are used:

- Design of hydraulic structures , roads, urban drainage system
- Land use planning and soil conservation studies
  Management of municipal infrastructure including sewers ,storm water management, ponds and street curbs
- Design of safe and economical structures
- Risk assessment of dams and bridges
- Design of roof and storm water drainage system
- Flood plain management
- Soil conservation studies

DAILY RAINFALL(MM)												
STATION : KOLLAM												
YEAR:2016												
Date	1	2	3	4	5	6	7	8	9	10	11	12

01	0	0	0	0	0	6	0	3	0	0	4.5	0
02	0	0	0	0	0	20	27	0	0	0	5.1	0
03	0	0	0	0	0	4	5	0	0	0	2	0
04	0	0	0	0	0	0	3.5	4	0	0	0	0
05	0	0	0	0	0	0	4	12	0	0	0	0
06	0	0	0	0	0	17	7	12	0	4	0	0
07	0	0	0	0	0	38	0	0	0	0	0	0
08	0	0	0	42	0	66	12	0	0	0	0	0
09	0	0	0	0	0	69.5	22	7.2	0	0	2	0
10	0	0	0	0	20	14	9	0	0	0	0	0
11	0	0	0	0	0	67	16	0	0	0	0	0
12	0	0	0	0	2	75	9	8	0	0	0	0
13	0	0	0	0	7	25	26.2	0	0	0	0	0
14	0	0	0	0	9	0	0	5	0	10	0	0
15	0	0	0	0	7	1.2	7	3	0	0	18.5	0
16	0	0	0	0	3	0	24	4	0	33	0	0
17	0	0	0	0	37	12	0	0	0	7	9	0
18	0	0	0	0	163	3	0	12	0	0	0	0
19	0	0	0	0	57	45	0	0	0	0	0	0
20	0	0	0	0	25	4	0	0.2	0	0	0	0
21	0	0	0	0	2	22	0	0	0	2	0	0
22	0	0	0	3	2	6	0	1	0	18	0	0
23	0	0	15	0	2	10	6	0	0	0	0	0
24	0	0	0	0	12	1	52	0	0	0	0	0
25	0	0	2	0	39.2	0	10	23	0	0	0	0
26	0	0	0	0	8	0	0	6	0	0	0	0
27	0	0	0	0	6	5	0	1	0	0	0	0
28	0	0	0	0	15	16	0	0	3.4	0	0	0
29	0	0	1.5	0	2	5.2	0	0	0	0	0	0
30	0		7	0	5	18	0	0	0	0	0	0
31	0		0		2		0	0		2		0

5. ECHO TECHNIC ROAD SYSTEM

As rivers and mountains naturally reclaim the geographical composition of continents, so ground transportation systems dominate the physical planning of landscapes and cities. These man-made systems/barriers offer freedom of movement to people and goods in society on the one hand, while having almost irreversible consequences for communities and natural habitats along roads and railways on the other hand. The freedom to transport goods and people, generate economic prosperity and improve our standard of life is increasingly in conflict with the social wellbeing of the direct neighbors of the transport systems, especially in the densely populated urban and suburban areas. The social demand for cleaner, quieter and more energy-efficient road transport with minimum impact on communities and natural habitats, poses the challenge of closing the gap between these conflicting needs to all industries involved with road transport. By means of design, construction and use of materials, road-engineering sectors can contribute to environmentally friendly (green) infrastructure

6. ECHOTECHNIC ROADWAY

The impact of the motorway environment, due to either the traffic of existing infrastructure or new construction work, is generally mitigated by the need to comply with statutory obligations and local regulations. Therefore, one of Autostrade per l'Italia's (Autostrade) Research and Developments priorities has been the conceptual definition and development of innovative technological solutions are mainly addressed to the control/abatement of acoustic pollution which are also synergic and consistent with continuously improvements in the Company's overall environmental performance. Some of these studies and researches were developed, implemented and tested on the motorway in urban and suburban traffic conditions, during the European project NR2C, for research on innovative noise mitigating road infrastructures designed to perform different acoustic pollution abatement functions according to different road morphologies such as free fields, embankments and U sections. Echotechnic Road Systems (E.R.S.) is a modular concept of nuisance mitigating solutions concerning mainly an appropriate combination and integration of low noise pavement and anti-noise barrier subsystems. These were chosen with a view to the monitoring existing innovative pavements over time and the carrying out studies on the capacities of innovative developed noise reduction devices while taking into account infrastructure type and operating road scenario.

7.AIR QUALITY CONTROL

It should be point out that the responsibility for emissions to air produced by the vehicles on the road network does not lie directly with the road operators, as they are mainly responsible for infrastructure management including the traffic monitoring, but have no control over vehicle performance. Current legislation to reduce road traffic air pollution only addresses to vehicles and fuels. The Commission (EC, 2006b) has predicted that increases in the activities of heavy goods vehicles will continue to driveCO2 emissions upwards, despite the expected improvements in efficiency within the sector due to more

stringent limits on vehicle emissions. Moreover passenger transport continues to grow. Increased car usage and the limited number of passengers per car offset the improvements gained from improvements in vehicle efficiency. However, road transport-related emissions are not limited to CO2 and NOx as particulates and vapours are also released directly into the atmosphere by, for example, to tyre /road/brake dust whose output is directly related to real-time traffic and ambient meteorological conditions. Despite our incomplete knowledge of PM10 diffusion and the difficulties in their measurement, recently studies seem to be show that the major areas responsible for the critical situation of PM10 are urban and industrial zones and in order to control/abate them, but the countermeasures introduced by the local government authorities are more or less ineffective in controlling such emissions due to the transregional aspect of the phenomenon (pollutants dispersion and transport).

8. ROAD WATER QUALITY CONTROL

The flash flood washing of the road surfaces, other than the traffic accidents involving the spillage ofdangerous substances, can influence the roadside environment as the ground water quality is impaired as a result of rainfall runoffs onto the exposed carriageway. Usually the storm water thatinitially runs off a road carriageway is called the 'first flush'. As concerns new projects, reference must be made to the specific regulatory requirements contained in theenvironmental impact analysis whereby for completed projects or those under construction the provinces are required to set up and maintain a works archive. To optimise the countermeasure able to control interferences between road & water bodies were improved using infiltration and subdispersion systems included in the controlled points for the selective disposal of deposits installed in water-drainage closed systems. The relevant role of the pavement in surface water flow control (transportation & temporary storage) through lamination and first flush catchments were analysed, by monitoring of the flash flood washing, for the porous pavement in terms of peak flow reduction & discharge delay and water quality. Two approaches were considered to define an interception system. one was the reservoir pavement, approached trough the achieved results analysis, and the other was a special multifunctional precast culvert.

9. WATER RESERVOIR AND FILTERING PAVEMENT TYPE PAVEMENT

Due to the infiltration effect, the porous asphalt can substantially reduce the quantity of a large number of pollutants found in road runoff. The first flush road runoff water pollution were assess, updating a previous measurement campaign, after their collection at full scale on motorway sections on operation presenting two porous pavements, draining and eco-draining types, continuing a preceding study and focusing to define a more practical solution for water collection and processing subsystems. These solutions can be incorporated into the concept of a modular pavement or auxiliary systems for the roadside implemented in a simplified industrialised construction approach. The improvement of previous solution were pursued contributing to reduce the costs of the existing countermeasure to control interferences between road and water bodies for first flush road runoff water pollution and, possibly, traffic accidents involving dangerous liquid spillage (even if the statistical incidence of these last to produce an environmental damage is irrelevant due also to the preventive and management emergency procedure and actions of road operators).

For hydrologic and hydraulic characterization of the artificial basin contributor from recorded precipitation events data at two experimental monitoring sites,will be defined the lag-times to the precipitations of the artificial reservoir and the total capacity of outflow impoundment-lamination (water overflow). On the basis on rainfall data (from pluviometer) and on flow rate (from a piezoresistant probe), the porous asphalt exhibit a delay time (lag) and the capacity to absorb small rainfall, from 5 to 15 mm of rain (outflow coefficient of the first phases of the event 0,4-0,5, reduced to 0,2-0,3 if the outflow volume is not enough to saturate the layer). While if the event exceeds a certain threshold or a certain series of successive events the reaction will be immediate in so far as the draining mixture will be saturated (0,7-0,85 as outflow coefficient of the remaining phases of the event). In the second case with a higher flow rate the pollutant loads will be more diluted. The pores are only cleaned when one medium-to-intense rainfall event takes place (roughly above 5 mm/h).Concerning to the water sampling chemical analysis, the concentration data decrease comparing the first flush waters and the successive meteoric events samples.

The metal concentrations deriving from the water samples collected on two monitoring sites are in compliance with the national regulation limits regarding the standard quality of the surface water (D.lgs. 03.04.06/152). Metal concentration growing on the section subjected to a snow precipitation. Lead values are still presents, notwithstanding the use of green gasoline, slightly greater in one of two site. Chromium and nickel are present in low concentrations on both sites monitored. Copper and zinc metals are present in greater concentrations, instead of Cadmium concentrations which were above the detection limit in water samples. PAHs were always less than of the instrumental detecting threshold as the metals rhodium, platinum and palladium, major components of industrial catalytic systems. Each sampling cycle presents a mineral oil concentration relatively constant. Among the various events were still observed differences in the concentration of one or even two orders of magnitude. The dynamics of transport and disposal of the oil on the roadway surfaces would seem therefore be characterized by a certain slowness regardless of the amount initially present.

There was no differentiation between specific analysis on the fraction of solid samples of the first flush water and those taken later. For them also, because of limited quantities analysed, it was also necessary to make some analytical extrapolation to compute the final concentration. The data on particulates (suspended solids) based upon the filtration analysis did not return high values (i.e. in terms milligrams or generous extrapolations). The suspended solids analysis put in evidence the presence of different types of PAHs investigated. The mineral oil and heavy metals have been fairly relevant; the mineral oils present the concentrations in 91 The order of thousands of mg/kg. Similarly to the water analysis results, also on the particulates no rhodium, platinum and palladium were detected. Measured particulates concentrations are comparable with the results of the analysis carried out on the samples detected on the bottom of sewer ducts of some highly humanized and polluted area, while by average they are an order

of magnitude higher comparing to the results of the analysis carried out on particulates of natural stream. Simplified solution were proposed constituted by lightweight porous asphalt/concrete mixtures of a residual void content that decreases from the upper surface, and also made from unbounded lightweight artificial aggregates treated for the selective absorption of oily substances and wide-gauge polyester geo-grids for load sharing. The hydraulic flow of this solution [x length=20m, y width=2m, z depth=0,25m] has been simulated by means of numerical model based on the code of calculation. MODFLOW (U.S. Geological Survey). Were considered porous asphalt (z=0,04 m, K = 9,8*10-4 m/s, effective porosity ne= 0,15÷0,18) on lightweight porous asphalt (z=0.20m, 7-15mm, Rc>45 kg/cm2,K= 2.2*10-3 m/s, ne = 0.15÷0.18). Three vertical draining septa of 0,15 m height are inserted to slow down the phase of reservoir pavement emptying to the end of the possible event of spill off and infiltration.

The modelling has characterized the solution by a retention time which can vary from few hours to some days also depending upon the event type, precipitation intensity and type of dangerous discharged liquid type. The collection system characteristics studied for the reservoir pavement can guarantee the average pollutants abatement up to 50%.During the structural revision of the reservoir pavement, it was also to identify other approach to simplify the storage base and pavement by using a multifunctional prefabricated concrete culvert filled with material suitable for pollutant multipurpose treatments and recyclable (with prevalent polar surface activity hydro repellent and oil substance attracting) as water polluted control systems for standard protection

11. GENERAL ASPECTS

Emission from the transport sector has a particular importance on the overall air quality because of their rapid rate of growth: goods transport by road in Europe has increased by 54 % since 1980, while in the past 10 years passenger transport by road in the EU has gone up by 46 % and passenger transport by air by 67 %. The main emissions caused by motor traffic are nitrogen oxides (NOx), hydrocarbons (HC) and carbon monoxide (CO), accounting for 58 %, 50 % and 75 % respectively of all such emissions. These pollutants have an increasing impact on the urban air quality. In addition, photochemical reactions resulting from the action of sunlight on NO2 and VOC's lead to the formation of 'photochemical smog' and ozone, a secondary long-range pollutant, which impacts in rural areas often far from the original emission site. Acid rain is another long-range pollutant influenced by vehicle NOx emissions and resulting from the transport of NOx, oxidation in the air into NO3- and finally precipitation of nitrogen acid with harmful consequences for building materials (corrosion of the surface) and vegetation.

The European directives impose a limit to NO2 concentration of max. 40 µg/m³ NO2 (33 ppbV) averaged over 1 year and 200 µg/m³ (163 ppbV) averaged over 1 hour. These limits gradually decrease from 50 and 250 in 2005 to the final limit in 2010 [3].

Heterogeneous photo catalysis is a promising method for NOx abatement. As will be indicated in the last paragraph of this paper, different applications exist. Up till now, UV-light was necessary to activate the photo catalyst. However, recent research indicates a shift towards the visible light. This means that applications in tunnels and inside become more realistic. Especially the application in tunnels is worth looking at due to the concentration of air pollutants at these sites. Up till now, some applications of TiO2 at the mouths of the tunnels are known, like the application of TiO2 at the exits of the Göta tunnel in Göteborg, Sweden.

12. HETEROGENEOUS PHOTOCATALYSIS, A PROCESS FOR AIR PURIFICATION

A solution for the air pollution by traffic can be found in the treatment of the pollutants as close to the source as possible. Therefore, photo catalytic materials can be added to the surface of pavement and building materials. In combination with light, the pollutants are oxidized, due to the presence of the photo catalyst and precipitated on the surface of the material. Consequently, they are removed from the surface by the rain. In the deliverable D1.1 – section 4.3 the principle of photo catalytic materials is explained. In the case of concrete pavement blocks, the anatase is placed in the wearing layer of the tile which is approximately 8 mm thick. The fact that the TiO2 is present over the whole thickness of this layer means that even if some abrasion takes place by the traffic, new TiO2 will be present at the surface to maintain the photo catalytic activity. The application of the TiO2 in combination with cement leads to a transformation of the NOx into NO3-, which is adsorbed at the surface due to the alkalinity of the concrete. It is consequently washed away by rain.

13. TESTS CONDUCTED

Tests using TiO_2 for checking air pollution and water absorption test for fine and coarse aggregate were conducted. From these tests we came to the conclusion that by making certain changes in the materials for construction of pavements significant results can be brought up to the road surface. The main test we conducted are as follows:

- *Air Pollution Control Test Using Tio_2*
- *Water Absorption Test For Coarse And Fine Aggregates*

13.1 Air Pollution Control Test Using Tio_2

Air pollution is one of the most dangerous problems causing our environment. One of the key constituents of the pollutants is the smoke and dusts coming from the vehicles. Increased smoke from vehicles during day time can cause fog in the environment which reduces visibility of drivers and can cause accidents. In order to reduce the harmful effects, a photocatalytic material TiO_2 was laid in the pavement.

TiO2: an echo friendly material

TiO_2 is a photo catalyst which is a commonly available by product of ileminate, a naturally occurring mineral. It is manufactured through sulphate process in which any composition of iron is completely removed from it in order to retain its shining white colour. Also it is very less toxic as it can be used in almost all areas in our day to day life.

Materials required

- Cotton
- Dust, smoke
- TiO_2 paste
- Cigarette
- Vehicle exhaust

Test Procedure

Two samples of cotton of equal dimensions are taken. Both of them is fixed in a rigid base. On to one of the sample, a thick two coating of TiO_2 is applied. After this, let the sample dry for one to two hours. This dried sample, is exposed to vehicle exhaust, harmful cigarette and camphor smoke, dust and other pollutants. Equal amount of smoke was applied on both the samples for equal time.

Result Obtained

It was observed that the sample coated with TiO_2 appeared to be very clean and showed its shiny white appearance, while the one without coating appeared to be completely dusty. The coated sample absorbed the dust and smoke particles into itself and neutralises its charge. As a result, the pollutants will not retain in the atmosphere and cleans it completely. The coated sample is compared to that of the atmosphere around us.

Test sample for air pollution control

13.2 Water Absorption Test For Coarse And Fine Aggregates

Water content existing on road surface is nowadays one of the most prominent reasons for road accidents. Water gets accumulated on road as a result of rain, from pipelines on road surfaces. This will increase the chance of skidding especially during rainy season. This will eventually lead to increased accidents. In order to avoid this, permeable pavement is introduced which absorbs the water content and filtrates it to the water table.

Materials required

- Coarse aggregate
- fine aggregate
- 10mm IS sieve
- Weighing balance
- Pyconometer

Test procedure for coarse aggregate

A known weight of coarse aggregate is taken. It is taken in a container and fully filled with water. Its weight is noted. The coarse aggregate is taken out and is surface dried. Its weight is also noted. The sample is then placed in oven and is dried. Its weight is also noted.

Observations

Weight of aggregate taken = A

Weight of aggregate and water = B

Weight of surface dried aggregate= C

Weight of oven dried aggregate = D

Water absorption of coarse aggregate = (C-D)/ D * 100

Test procedure for fine aggregate

A known weight of fine aggregate is taken. A pyconometer is taken and filled with the fine aggregate and its weight is noted. Water is added up to sill level and its weight is notes. Now the pyconometer is emptied and filled completely with water its weight is also noted.

Observations

Weight of pyconometer = A

Weight of sand and pyconometer = B

Weight of sand, water and pyconometer = C

Weight of pyconometer and water = D

Water absorption of fine aggregate = (C-D)/D*100

RESULTS

It was observed that water absorbing capacity of fine aggregate is more than that of coarse aggregate. Using this result, coarse aggregate can be used for pavement construction as it helps in absorbing water and infiltrate it through the voids into the ground water table. This in turn help the surface of the road to remain dry and as a result slipping and skidding of wheels in the road can be prevented.

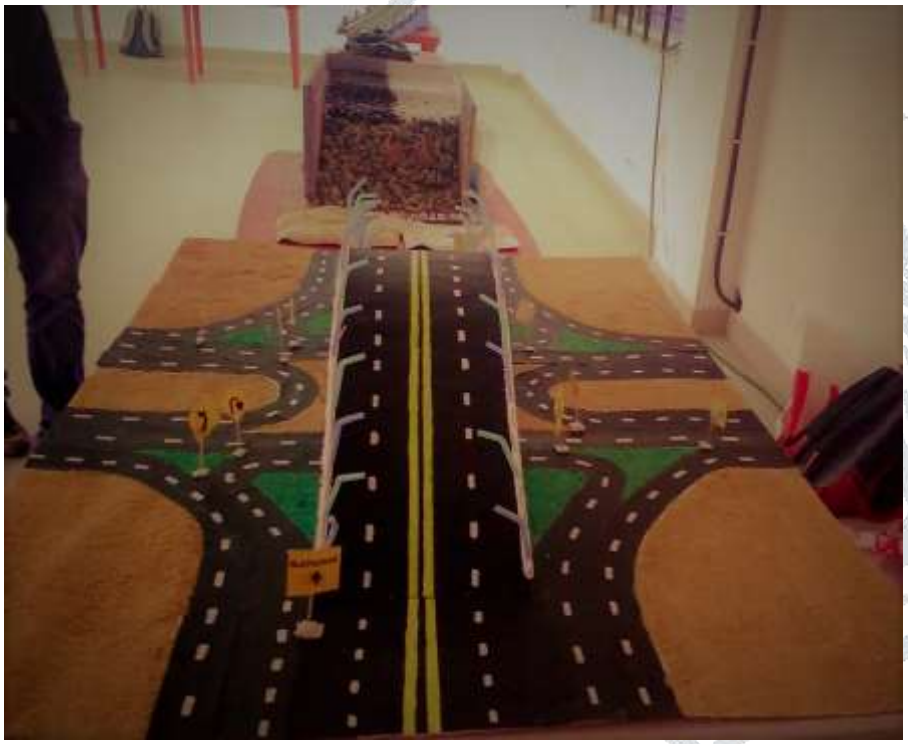
Also due to the use of porous asphalt in the layer underneath the bituminous layer, water from the top surface will not get collected there. It will directly lead the water to the underneath coarse aggregate layer. Thus during the temperature change, cracks will not be affected in the roads and hence durability can be increased.

14. CONCLUSION

Through our project, we came across a large area of study which included air pollution, its harmful effects, remedial measures etc. As per our study, if we add or replace the materials used in pavement construction with photo catalytic material, pollution can be reduced to a very large extend. Also by the use of coarser aggregate, the construction become more economical and the pavement will have more durability.

By the introduction of a flyover at Kallumthazham, the present scenario of the region will completely change. Traffic congestion of the junction will totally vanish and vehicles can move continuously without getting stuck in traffic signals. Time wastage can also be minimized. Emergency vehicles or ambulances connecting medical colleges can reach on time.

Thus we can conclude the flyover at Kallumthazham using echotechnic system is one of the best economical and environment solutions for the traffic density and congestion .



Kallumthazham flyover a miniature

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