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HUMAN SAFETY: COMPOSITE ROAD DIVIDER

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ABSTRACT

Advance composite material is the one of the attractive material in all engineering materials. It's have light weight, high strength, high elastic strain energy storage capacity, good impact strength and toughness behavior etc.So researchers are applying various applications in aerospace, automobile and structural parts etc. Road divider is the one of the application of advance composite material. The road traffic safety (RTS) management system is focus on serious injury and death due to road accident and always tries to reduce.Many methodology and technology is developing to reduce accidental effect on human body as well as vehicle. The composite road divide have high elastic strain energy storage capacity and good impact strength compare to concrete road divider. Its have much more shock absorber capacity to reduce the impact force and avoid the serious injury and death.

I. INTRODUCTION

The road traffic safety (RTS) management system is focus on serious injury and death due to road accident and always tries to reduce. They many types divider, way indicator board and color symbol are use. Best-practice road safety strategies focus upon the prevention of serious injury and death crashes in spite of human fallibility. Many methodology and technology is developing to reduce accidental effect on human body as well as vehicle. Divider is the one most important things to safe derive in her way but some time vehicle are hit on divider and injured or death because generally road divider made from concrete, its do not have any impact force reducing capacity. FRP composite materials have high elastic strain energy storage capacity, good impact strength and toughness behavior. So we apply the glass fiber composite road divider, it is reduce the impact force at accident time and avoid the serious injury and death.[9]

1.1 Composite Material

The composite material made from composed of at least two or more than two element. Which mixed together to produce new material have different property come through element improving the composite material property. Most composites combine of fiber reinforcement material with matrix material add to increase the strength as well as stiffness. The reinforcement is basically fiber and matrix is liquid. Combine together made solid structure [3]

The composite are divided into three categories:-

a) PMC (Polymer matrix composite)

b) CMC (Ceramic Matrix Composite)

c) MMC (Metal matrix composite)

a) Polymer Matrix Composite

The resins as epoxies and polyesters have not very high mechanical properties, so it is limited use for manufacture of structures. The other material is reinforcement in the form of fiber, it have higher tensile and compressive properties in solid form. These properties are not readily apparent. So a bundle of fiber is increase the performance of the material properties. The fiber can only exhibit tensile property along the fiber length [3].

II. LITERATURE REVIEW

2.1 Lawrence J. Broutman and A. Rutem: In this paper the researcher study on impact strength and toughness of fiber composite material. The high strength and the higher energy associated with a higher rate of loading is an advantages since it serves as safety factor for high rate loading. A deeper understanding of the mechanism of energy dissipation can lead to construction of material to optimize the energy absorption.[12]

2.2 S. S. Cheon and D. G. Lee: In this work, the impact energy absorption characteristics of the glass epoxy composites and the glass polyester composites were investigated by the instrumented Charpy impact test method with respect to the fiber volume fraction[11]

2.3 S.Sivasaravanan and V.K.Bupesh Raja: The impact test results of nano composite materials improved with addition of nano clay in epoxy matrix. This test was performed by izod testing machine, it was found that addition of 5wt% of nano clay shown very good results compare to other percentage of nano clay, average value of 5wt% of nano clay is 10.75 J/m when compare to other combination of nano composite materials.[10]

2.4 Ali Hallal1, Ahmed Elmarakbi, Ali Shaito and Hicham El-Hage: This paper presents an overview of recent automotive applications of advanced composites. A summary of available composites that could be used in automotive industries is presented. This work mainly deals with new research and studies done in order to investigate the present and potential use of composites for automotive structural components (e.g. tubes, plates, drive shafts, springs, brake discs, etc.).[4]

2.5 K. H. Ghlaim: In the past years, the use of composite materials in the aircraft industry, among others, has grown immensely. Composite systems offer an advantage over traditional aircraft materials (metals) because they tend to exhibit higher strength/weight and stiffness/weight ratios than metals, thus making the aircraft lighter and improving performance.[5]

2.6 Road Accidents

Road Traffic Accidents (RTAs) have emerged as a new health challenge in the world which not only leads to injuries, disabilities and loss of precious human lives but also imparts a substantial economic burden on the family concerned and the nation as whole. After Ms. Mary Ward, who was the first documented victim of automobile accident that took place on August 31, 1869, the global road traffic fatalities count has raised to about 1.2 million/year. RTAs are the eighth leading cause of death in the world and are expected to rise to the fifth position by the year 2030, if adequate measures are not taken. Road traffic injuries account for about 38 million disability-adjusted life years (DALYs) lost worldwide. In India one person dies every four minutes as a result of RTAs. In 2010 about 133,938 fatalities occurred in India as a result of RTAs which were 5.5 % more when compared with the previous year.[8]

- 51 cases of road accidents took place every one hour during 2014, wherein 16 persons were killed.
- During 2014, a total of 4,50,898 cases of 'Road Accidents' were reported which rendered 4,77,731 persons injured and 1,41,526 deaths.
- Deaths due to 'Road Accidents' in the country have increased by 2.9% during 2014 (1,41,526) over 2013(1,37,423).
- Tamil Nadu (67,250 cases), followed by Maharashtra (44,382 cases), Karnataka (43,694 cases), Madhya Pradesh (39,698 cases) and Kerala (35,872 cases) have reported the maximum number of road accidents accounting for 14.9%, 9.8%, 9.7%, 8.8% and 8.0% respectively of such accidents in the country.
- Maximum fatalities in road accidents were reported in Uttar Pradesh at 11.5% followed by Tamil Nadu (10.7%)and Maharashtra (9.6%) during 2014.
- 26.4% victims of road accidents were riders of 'two wheelers' and trucks/ lorries, cars and buses have accounted for 20.1%, 12.1% and 8.8% respectively of road accidental deaths.[8]

III. ROAD DIVIDERS

Dividers are usually provided to earmark the segregated movement of a particular type/ category of traffic, such as, segregating through carriage way from a service road for local traffic, segregating light and heavy traffic, segregating through traffic from turning traffic and dedicated BRT corridor and corridors for non-motorized transport (cycles, rickshaws etc.). The dividers can be within form of low height central verge, curb, railing, etc. which can be either permanent (steel, concrete etc) or flexible/ movable, shift table such as rubberized cones, precast curbs and electrically/ mechanically operated shif table divider railings.[6]

Figure No. 1 Road divider

3.1 Types of Road Dividers

3.1.1 Rigid Barriers

Rigid barriers are typically of concrete construction. They retain their shape and position when hit by a vehicle, leading to severe impacts. They have the advantage of a small footprint, since they do not deflect. This is particularly important for median installations where the barrier is close to the traffic lane, as shown in Figure No. 2

Figure No. 2: Examples of rigid median barriers

3.1.2 Semi-Rigid Barriers

Semi-rigid barriers are the most common alternative to rigid barriers, as they normally lead to less severe collisions. They are typically of steel construction.

Semi-rigid barriers have two main functions:

- They prevent errant vehicles from leaving the roadway, and
- They absorb the energy of the impact by deformation.

Figure No. 3: W-Beam Semi-Rigid Barriers

3.1.3 Flexible Barriers

Typical examples of flexible barriers are cable barriers and safety fences. Flexible barriers cause the least damage to vehicles and pose the smallest risk of injury to vehicle occupants, compared to all other barrier types. The main disadvantage of flexible barriers is that they require more space behind them, since they can deflect by up to three meters. The slope in the area of deflection should also be flat enough to ensure that the vehicle is redirected safely.

Figure No- 4: Flexible cable barriers

3.1 Finite Element Analysis

In FEA (Finite Element Analysis) we analysis the maximum stress generate on road divider after some weight fall on road divider. We calculate the impact load acting on road divider in experimental section. This impact load acting on road divider the stress is generating, the resultant stress is found by FEA software ANSYS-15. First concrete road divider model is create on ANSYS, select the element type solid 8 node brick and given the material properties. Mesh the body by meshing tool (fine meshing).After mesh boundary condition apply, the base area is fixed by all degree of freedom. The front of the road divider is acting impact force and solves the pre-processing stage. Then we show the result in post processing stage.

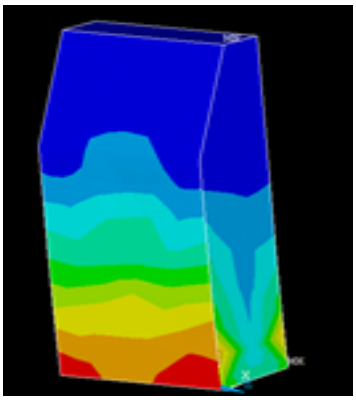

Figure No.5Meshing the concrete road divider and maximum stress of the concrete road divider

As similar we analysis the maximum stress generate at various stage of load. After concrete road divider analysis than composite road divider is proceeding. In composite road divider the dimension is same and thickness of the job 5 mm. The model is creating at ANSYS. The element type and material is define and meshed.After mesh same procedure flow and found the maximum strength generate on composite without rubber road divider. As flow the same step for composite with rubber and with thermocol road divider. We observe that the concrete road divider is generate maximum stress at full load condition, it occur be crack. But composite road divider have much more strength and very low strength is generated. That means composite road divider act low impact load. Show in table no. 2.

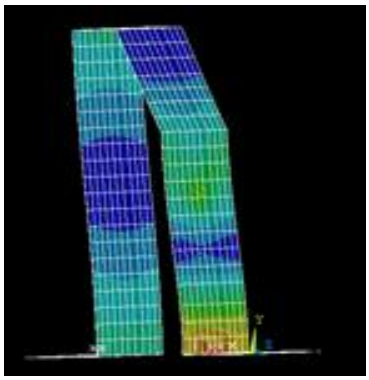

Figure No. 6: Mesh the composite without rubber road divider and maximum stress of the composite without rubber road divider

Product	Impact Force (N)	Strength (N/mm^2)
Concrete Road divider	221.48	1.69
Composite road divider with 5 mm	67.11	4.65

Table No.2: Strength of the Road Divider

IV. CONCLUSIONS

Every day many human are death or injuries in road accident cases. Most of the accident, vehicle are hit the road divider and damage the vehicle as well as itself. The concrete road divider have brittle material, it's no more stiffness and toughness. When the human is fall on road divider possible maximum injuries, in this condition we provide the composite road divider it's have good stiffness and toughness properties. The composite road divider is absorbing the shock and slowly relies; this is the attractive properties to selection for road divider. The composite road divider is design three types with rubber pad, without rubber pad, with thermocal composite road divider. This composite road divider is compare with concrete road divider and found that the composite road divider relies maximum impact force. The concrete road divider does not relies the impact force and full impact force is apply, so injuries probability is increase. In that cases if we use the composite road divider the injuries chances will be reduce.

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