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STRUCTURAL ANALYSIS OF BUS BODY FRAME USING FEA FOR STATIC AND DYNAMIC ANALYSIS

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Abstract - *Transports are the foremost method of road transportation. The appearance of the vehicle body depends primarily driving the execution requirement underneath varying sorts of stacking and managing situations separated from those of the street conditions. Furthermore, the model investigation, static baseline associate analysis of an enunciated urban transport body, completed with the FEM. A bus body in loading conditions while operating is exposed to various loading conditions which in many parts of the bus structure leads to stress, vibration and noise. The structure requires indispensable strength, stiffness and fatigue characters to withstand these loads. The objective of this work is to analyze the response of the structure during static and dynamic loading conditions. In order to analyze, the tool called ANSYS is used.*

Key Words **- Static Load, Dynamic Load, Bus Body Structure, ANSYS 14.5, FEM.**

1. INTRODUCTION

Automotive chassis is a skeletal frame on which individual mechanical parts such as motor, tires, rotate assemblies, brakes, coordinating and so forth are shot. The chassis is believed to be the most basic component of an automobile. [2]It is the most noteworthy element that gives quality and security to the vehicle under different conditions. Nature of transport chassis depends on upon the limit of transport. It can be tailor-made according to the requests and can be profited with components like transverse mounted motor, air suspension and also hostile to move bars. A produced all-around transport chassis provides numerous advantages such as high torque from low revs, excellent brake efficiency and more.

Transport chassis designed for urban sequences contrasts from the one manufactured for rural sequences. For transport frameless, chassis development is utilized. In this frame less chassis sort every one of the machineries is appended to the body. Every one of the elements of the frame done by the body itself. Because of elimination of long frame it is less expensive and because of less weight most economical too. Just disservice is troublesome in repairing. The concept of the internal transport skeleton structure is the basis of numerous transport innovations within transport enterprises. In the light of the outline thinking, it contains the structure of tubes with different cross territories that are planned inside decided shapes. The body of the vehicle can be sequestered into three areas; the undercarriage and engine, structural body, inside and outside parts. The contains transport body have six primary parts the left and right casing side, the front and back casing side, the top and base edge side. In that the top casing side is at some point called housetop outline side. [2]Furthermore, the base edge side is moreover called floor outline side. The right and left side are comparable however the left side is ordinarily made out of two voyager entryways. At that point again, the right side has two entryways the driver entryway and crisis entryway. In like manner, the both edge sides are displayed by mirrors and welded with sheet metal. They are concerned to be key parts. They should be strong. The parts should be explanatory tests by reproducing or physical testing in any event. Torsion and analysis. Regardless, the nature of this outline is influenced by the assembling. Reshaping tests are generally mimicked by FEA.

2. METHODOLOGY

The methods and methodology in order to carry out the bus body analysis and modeling of the same involves the below approaches or the procedure.

i. Geometric Modelling: The 3D Modeling are created using CATIA.

ii. Finite Element Analysis: The 3D Modeling made using CATIA is transferred to FEM software ANSYS14.5 and is meshed and that model is entitled as Finite elemental model

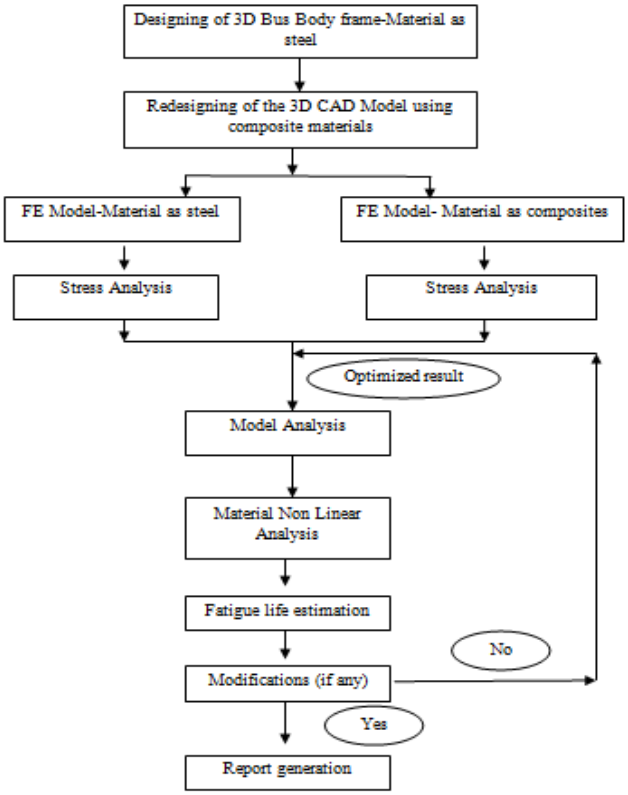

Fig - 1: Phases in Bus Body Analysis

iii. Suitable Boundary Conditions:
The meshed model is then applied with certain boundary conditions and steps of analysis are done using Ansys Software.

3. FINITE ELEMENT APPROACH

The FEM is a capable instrument for the numerical structure to get react in due request with respect to a huge segment of the issues experienced in building examination. From static, warm and warm trade, fluid stream, depletion related issues, electric and enchanting fields. [4]The bits of knowledge of finite element method can be used to these organizing issues. In this method, the zone over which the examination is considered is secluded into different finite elements. The addition of cut-off canters is used to decline the direct at an infinite field of canters to finite number of focus interests. These fascinations outline the finite elements. The elements are interconnected by focus canter interests. Every one of the elements is grouped and the basics of headway and concordance are to be satisfied between neighboring elements. An beyond belief blueprint can be picked up to the general methodology of direct logarithmic conditions, gave the stimulation behind restraint states of the true blue structure are fulfilled. Plan of these conditions gives us the gathered direct of the continuum. To be getting a correct procedure in the scope of quickly fluctuating parts, more number of humbler elements must be utilized.

4. ANALYTICAL STUDY

4.1. Modal analysis:

An analysis of measured information is a procedure in which the measured response functions of recurrence are broke down in order to locate a theoretical model that most closely resembles the dynamic behavior of the structure under test. This piece of the modal test is called experimental modal analysis, in spite of the fact that this term is frequently incorrectly utilized for the whole modal test. The procedure of information analysis continues in two phases.

i. Diagnosing the appropriate sort of model (with thick or structural damping). This option is frequently by and by limited by programming utilized for the modal analysis. Most of software bundles work with one kind of damping and give no decision to the client.

ii. Determining model selected for fitting parameters. This stage, additionally called extraction of modal parameters, is completed by bend fitting of the measured recurrence reaction capacities to the theoretical expressions.

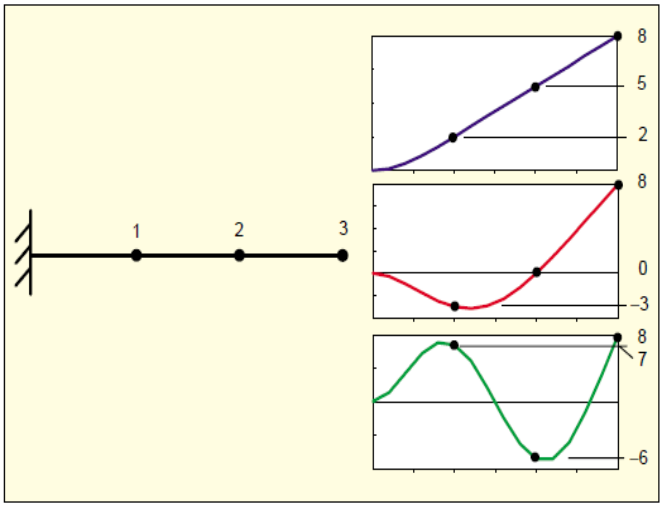

Fig - 2: shows modal analysis of beam

4.2 Material properties

The material selected for the design depends on the various factors such as, strength, ductile property, cost, availability and many more. Generally aluminum alloy type of steel is used for the construction of the structure of bus body as it can high strength to weight ratio and it has good corrosion resistance property compared to cast iron. In our design structural steel is used for the analysis and its material properties is show in the below table 1.

Table 1: Material Property of SS Steel

Sl.No.	Parameter	Value
1	Density	7850 ton/m3
2	Young's Modulus	2E+11 pa
3	Poisson's Ratio	0.3
4	Bulk Modulus	1.6667E+11 pa
5	Shear Modulus	7.6923E+11 pa
6	Coefficient of Thermal Expansion	1.2E5
7	Reference Temperature	220c

4.3. Geometrical Specification in Bus Body

The below table-2 gives the dimension of the bus used for the analysis

Table 2: General Bus Body Dimension

Sl. No.	Parameter	Dimension
1	Length	11.66m
2	Width	2.47m
3	Height	3.24m
4	Wheel Base	2.16m

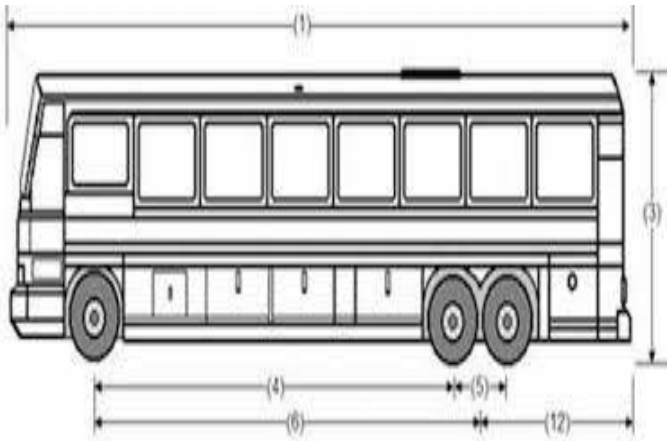

Fig -3: General Dimensions of Bus

4.5 GEOMETRIC MODELING

A. FEM MODEL: The first step in FEA is wire frame design as shown in fig-4.

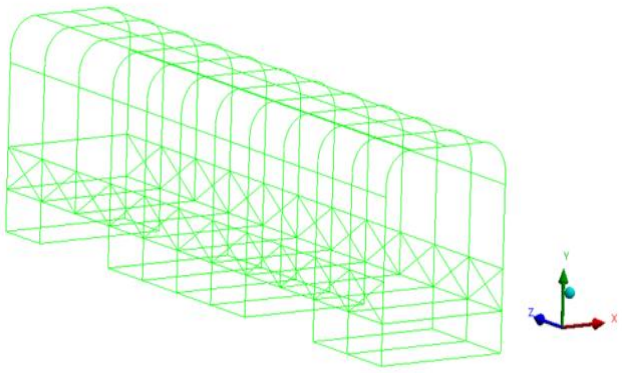

Fig - 4: Wire Frame Model of Bus

B. Bus Body Has Been Modeled Using CATIA V5.

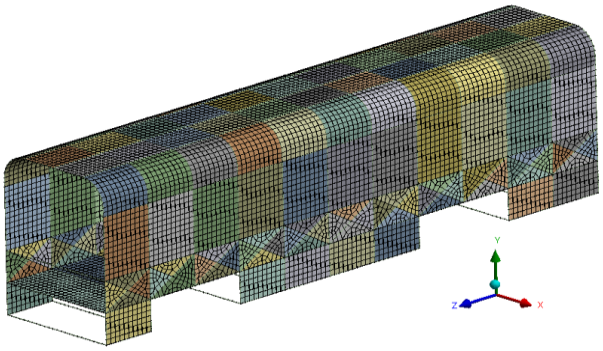

Fig - 5: Meshing Of Given Model

Figure shows ANSYS Meshing, which is a commonly automated high-performance product. It produces the most appropriate mesh for solutions. A mesh well suited for a specific analysis can be generated with a single mouse click for all parts in a model.

C. Applying Boundary Condition:

This step involves the application of boundary conditions. The bottom of the bus is fixed here for conducting the modal analysis phase. They are applied to fix the displacement or load on a specific model. The application of boundary condition on FEM model also prevents singularities in the model.

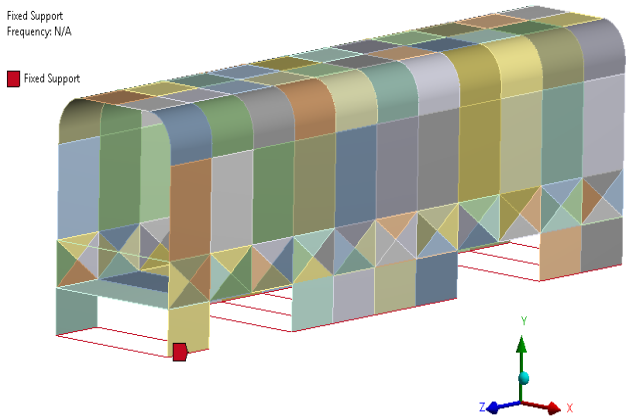

Fig -6: Boundary Condition Applied to the Structure

5. RESULTS AND DISCUSSIONS

A. Static analysis:

Static analysis aims to figure out the effects of study loading conditions on a bus body. Which are achieved by ignoring the inertia and damping effects.

B. Maximum Principal Stress:

The maximum principal stress are found out using ANSYS is shown in fig-7.

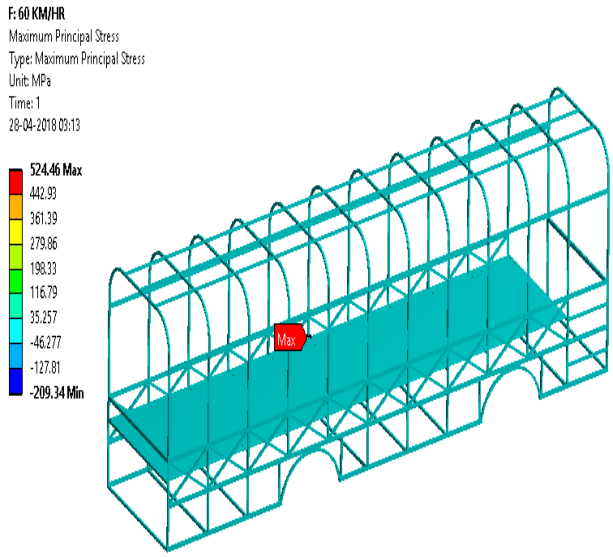

Fig -7: Maximum Principal Stress

C. Minimum Principal Stress:

The minimum principal stress are found on the bus body using Ansys and is shown fig-8.

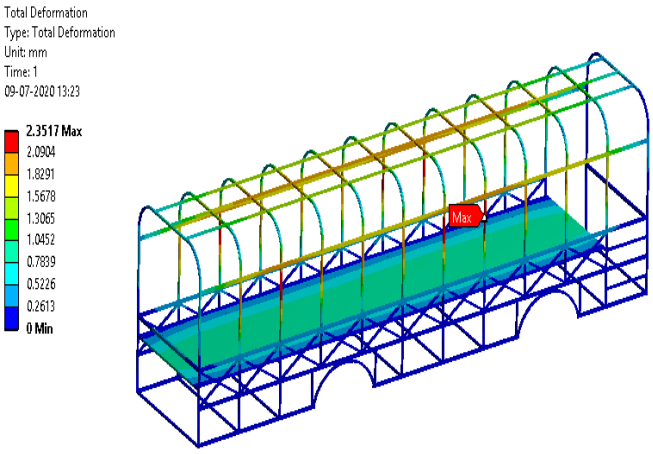

Fig -8: Minimum Principal Stress

D. Maximum Total Deformation:

The maximum total deformation using Ansys was carried out and shown in figure 9, it can be seen that the maximum deformation can be found in the top floor of the structure.

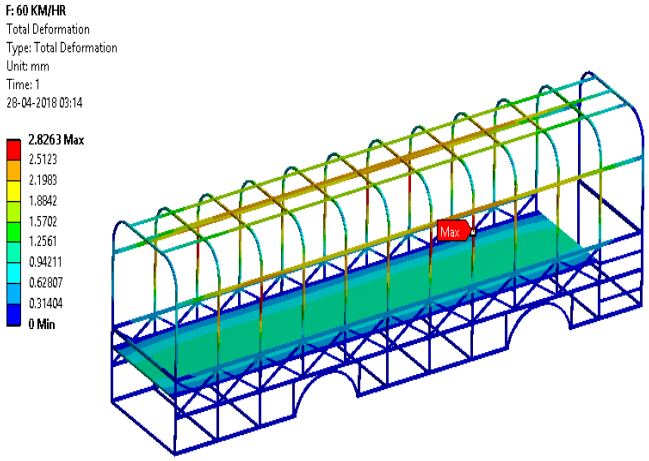

Fig -9: Maximum Deformation in the Structure

E. DYNAMIC ANALYSIS

In the preceding case the bus body structure was analyzed for static conditions. The results we got are for steady conditions. The findings that we have come up with are for secure operating conditions under their usual working environments, the buses are exposed to various forms of time-dependent loading (dynamic) (such as acceleration, braking and speed breaker etc.).

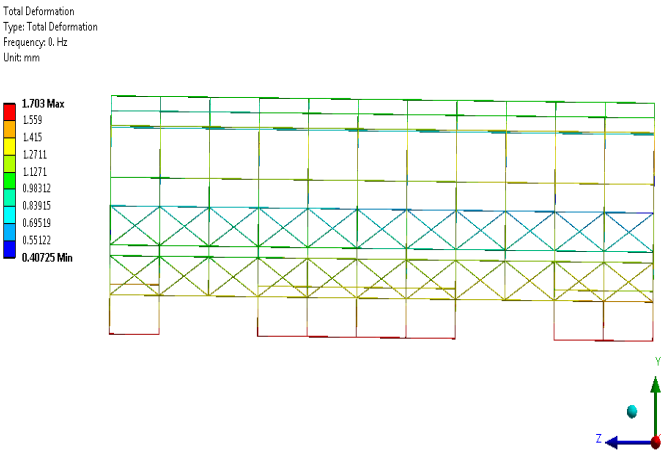

Fig -10: Dynamic Analysis of Bus Frame

6. CONCLUSIONS

The free model analysis and static structural analysis of an articulated urban transport body, with a cumulative length of 11.66 m, has been accomplished through Global Finite Elements Method. The structure behavior towards four distinctive loading conditions, illustrative of its run of the mill duty cycle, has been broke down: the action of gravitational acceleration, the braking at the upper deceleration limit of the vehicle,2g load and impact load condition to developed stress, strain and displacement. Sensitivity investigations in order to assess the transport body performances have been done in order to get dependable outcomes in terms of stiffness and displacements of the transport body.

- In order to determine the maximum stress, strain and deformation in bus body Linear static structural analysis has been carried out. It is observed that peak stress of 49.345Mpa, total deformation of 3.4677 mm is obtained along the hook.
- Fatigue analysis of bus body was done for 10,00,000 cycles of start-up and shutdown, the fatigue life outcome obtained is more than 1,00,000 cycles, hence the design is safe.
- Weight of 638.62 in bus body which is Optimization of bus body to improve the life and productivity.

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