ANALYSIS AND EVALUATION OF THE BOX SWAP BODY VEHICLE AS INTERMODAL TRANSPORTATION PRODUCT IN ACCORDANCE WITH THE TS EN 12642 STANDARD

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ABSTRACT

Intermodal transport is done by air, rail, sea line and road according to time and cost criteria. Swap body tool is widely used in road transportation which is one of these types of cargo transportation. Clients want the Swap body tool to be inexpensive, high quality and robust. In order to respond to these customers' requests, serious research and development activities are required from the design stage to the final stage of manufacturing. One of the R & D stages is computer aided engineering analysis. Material, employee labor and time-saving modern technologies are of paramount importance. Advanced software is available for testing in a virtual environment under certain boundary conditions prior to physical verification. One of them is the Ansys program. In this study, the front, side and rear wall of the box swap body tool were tested in the Ansys program on the basis of TS EN 12642 standard.

Keywords: Swap body, intermodal transportation, analysis

1.INTRODUCTION

With the developing technology, the requirements of the logistics sector are changing day by day. The swap body which is an Intermodal Transport vehicle is a type of vehicle that can carry cargo within the vehicle and can be transferred from one transportation vehicle to the other transportation vehicle [1]. Although road, waterway and rail transport are alternatives in intermodal transportation, swap body is the most used vehicle. The water protection of the box swap body causes it to be lightweight and preferred for the transportation of valuable materials. These box vehicles are widely used in Europe. TIRSAN Solutions is a leading brand in Europe and the world with its various product and transportation solutions. Therefore, it has a long service life and has a wider net volume. In this study, the Ansys program was used for the R & D study to verify the box swap body tool, in other words, virtual tests known as simulation. These tests are validation studies of the design under certain conditions without the need for time and material. The forces specified in the TS EN 12642 standard are applied to the swap body vehicle in a virtual environment and analyzed so that the Code XL is appropriate. In this study, the conformity of the vehicle to TS EN 12642 standard was analyzed with Ansys program.

TS EN 12642 load safety in road vehicles, i.e. the body structure of commercial vehicles, is seen as a minimum requirement [2]. Therefore, it is called Code Xl definition according to TS EN 12642 standard.

2.METHOD

Ansys; It is a computer aided engineering program which provides analysis and simulations in engineering studies. The Ansys program enables effective studies in different disciplines such as mechanical, structural analysis, computational fluid dynamics and heat transfer. The Ansys program, which is one of the most used CAE (computer aided engineering) programs in our country as well as all over the world, uses the finite element method. Separate analysis of the objects in complex geometry, which are very difficult to analyze in one piece with finite element method. The results obtained from the analysis of a finite number of elements are combined to obtain a single and consistent analysis result [3].

Flow rate (MPa), modulus of elasticity (MPa) and poison ratio of the material types used in the Ansys program have been calculated (no details have been specified since it is a trade secret).

In this study, the swap body tool's side, front and rear wall forces under the conditions specified in the TS EN 12642 standard were examined by using the finite element package program design optimization. It is calculated from the conditions specified in the Code Xl definition in TS EN 12642 standard in order to examine the forces in effect in the Ansys program.

2.1 Front Wall Analysis

According to the TS EN 12642 standard, the front wall must comply with the definition of Code Xl and the vehicle must withstand a load capacity of 0.5 P for half the weight.

The front wall analysis was performed with the Anys program by placing the box on the container carrier vehicle with the swap body tool. (The details are not specified because it is a trade secret.)

In the analysis, the front wall should be subjected to a force evenly distributed over the entire surface. The unloaded swap body tool is secured by the container sachet from the connecting areas. The front wall of the vehicle has a capacity of 15 tons, half of which is 30 tons, and its pressure resistance is simulated. Total deformation was obtained in mm by applying 0.5 P with Ansys program to the front wall. The results are shown in Figure 1.

According to TS EN 12642 standard, the formula that should be used to calculate the force acting on the front wall is as follows;

$$F = \frac{0{,}5\ P}{\geq 0{,}75 HxB}$$

(F = force, H = total height of the front wall, B = total width of the front wall). Micro stresses in the front wall was measured with Van Misses stress thanks to the force calculated with the formula. The results shown are shown in Figure 2.

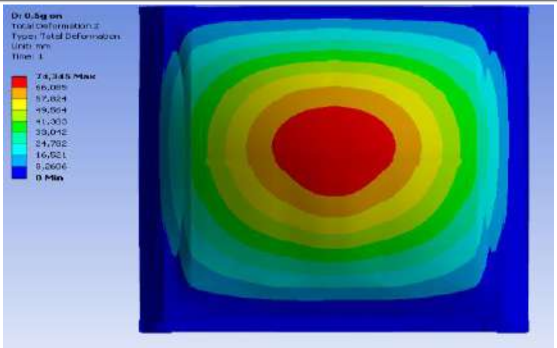

Figure 1: Total Deformation in the Front Wall

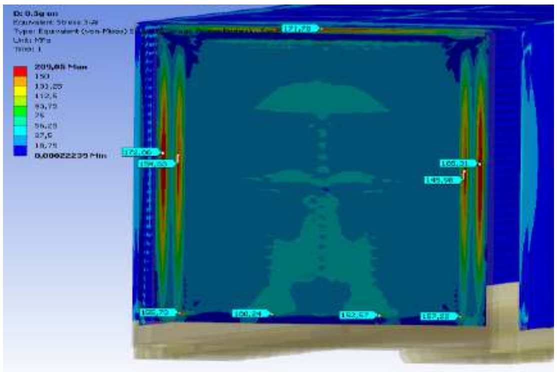

Figure 2: Van Misses Stress

2.2 Side Wall Analysis

According to TS EN 12642 standard, the weight of the vehicle must be 0.4 P in order to comply with the definition of Code Xl. Side wall analysis was performed by using the Anys program on the container carrier vehicle with the box swap body tool as done in the front wall analysis. (The details are not specified because it is a trade secret.)

In the analysis, the side wall was subjected to a force evenly distributed over the entire surface and the gravitational acceleration effect was taken into account. The unloaded swap body tool is secured by the container sachet from the connecting areas. The car's load capacity of 30 tones of cargo, which is 40% of the 12-ton pressure is simulated. Total deformation was obtained in mm by applying 0,4 P with Ansys program to the side wall. Figure 3 shows.

According to TS EN 12642 standard, the formula that should be used to calculate the force on the side wall;

$$F = \frac{0{,}4\ P}{\geq 0{,}75 HxB}$$

(F = force, H = total height of the front wall, B = total width of the front wall). Micro stresses in the side wall was measured with Van Misses stress thanks to the force calculated with the formula. The results shown are shown in Figure 4.

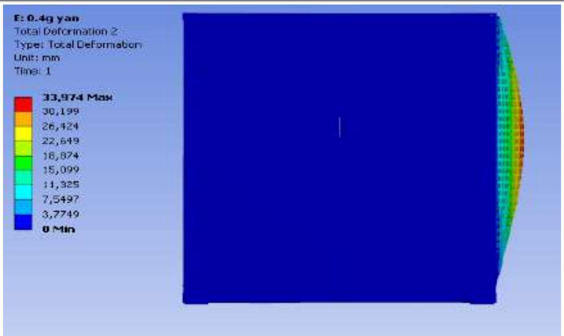

Figure 3: Side Wall Total Deformation

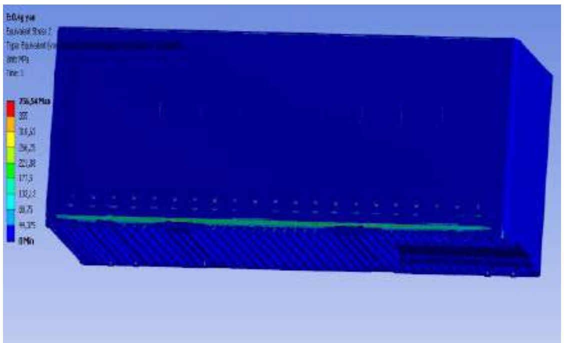

Figure 4: Side Wall Van Misses Stress

2.3 Rear Wall Analysis

According to TS EN 12642 standard, the load bearing capacity of the vehicle must be 0.3 P in order to comply with the Code Xl definition of the rear wall.

The rear wall analysis was performed by placing the container swap body tool on top of the container carrier vehicle as done in the side and front wall analysis. (The details are not specified because it is a trade secret.)

In the analysis, the rear wall should be subjected to a force evenly distributed over the entire surface. The unloaded swap body tool is secured by the container sachet from the connecting areas. Carrying capacity of 30 tons of 30% of the load, which is 30% of the pressure, the application of pressure simulated.

Total deformation was obtained in mm by applying 0.3 p with Ansys program to the rear wall Figure 5 shows. The formula to be used to calculate the force acting on the rear wall according to TS EN 12642 is as follows;

$$F = \frac{0{,}3\ P}{\geq 0{,}75 HxB}$$

(F = force, H = total height of the front wall, B = total width of the front wall). Micro stresses in the rear wall was measured with Van Misses stress thanks to the force calculated with the formula. The results shown are shown in Figure 6.

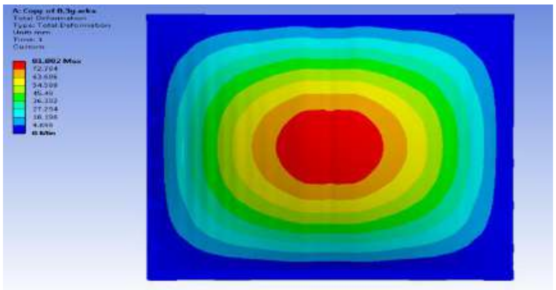

Figure 5: Rear Wall Total Deformation

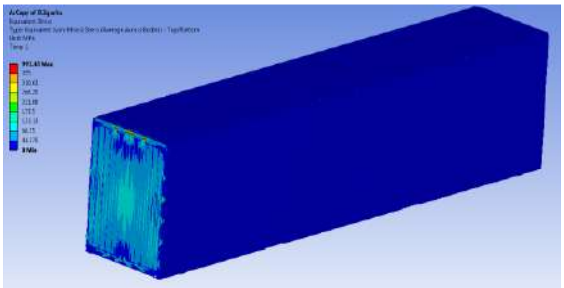

Figure 6: Rear Wall aVan Misses Stress

3.CONCLUSION

In this study, after the material selection is done on the front, side and rear wall of the box swap body tool, according to the definition of CODE XL specified in the TS EN 12642 standard, the desired forces are applied and analyzed by Ansys program. In the analysis, deformation and deflection analysis was performed. With this study, the results obtained after the optimization study should be evaluated according to the specification of CODE XL specified in TS EN 12642 standard by taking into consideration the life of the loaded or unloaded front, side and rear wall with the selected material. The working life of the box swap body tool should be evaluated by considering the life of the front, side and rear wall. The operating life of the box swap body tool can be determined from the fatigue diagram of the front, side and rear wall.

With this study, it has shown a new way to perform virtual tests in accordance with TS EN 12642 standard in terms of CODE XL definition. By applying this method in a similar way to many products, it will contribute greatly to the future studies.

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