ANALYSING THE STRUCTURAL INTEGRITY OF DUAL RECTIFIER CONTAINER (DRC)

INTRODUCTION

DUAL RECTIFIER CONTAINER (DRC) is a transportable power Radar system which has to meet various working conditions such as *snow load, wind load, resonance failure and shock loads* during its working period. The objective of this work is to check that structural integrity of model to physically withstand the relatively infrequent, non-repetitive shocks encountered in handling, transportation, and service environments.

CAD MODEL AND FE MODELING

Three dimensional CAD model is imported in STEP format and assumed to be complete, corresponds to the development status to be analyzed and can be applied for further processing without need of additional corrective work. For the described objectives a computational finite element model is generated. The discretization is done by means of Finite Element Method (FEM). The finite element model contains 1284034 elements and 925073 nodes.

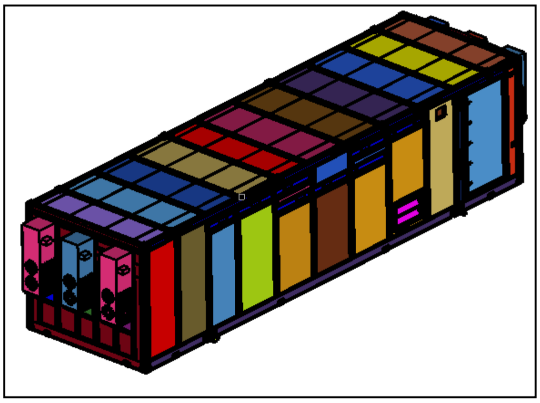

Fig 1 DRC - CAD model

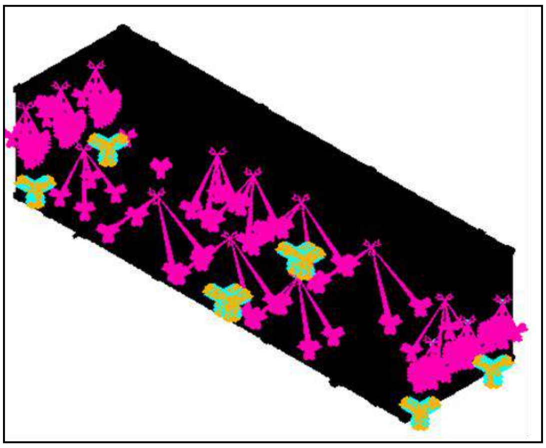

Fig 2 Meshed model

SNOW LOAD

Six Static structural analyses with acceleration are performed for 3 axes, and in 6 directions (+x/-x, +y/-y, +z/-z) .

WIND LOAD

Wind load analysis is performed by applying 300 km/hr on each panel (front, rear, road side, curb side)

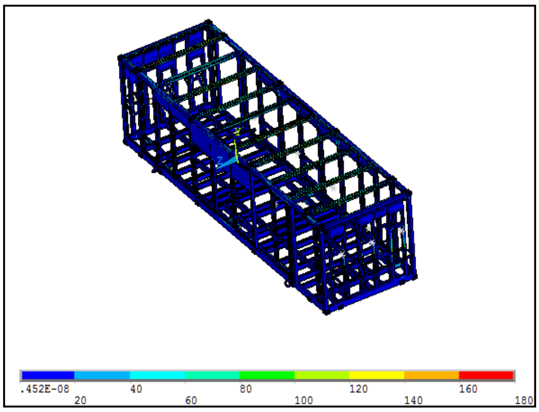

Fig 3 Static structural analysis: stress Plot in +X

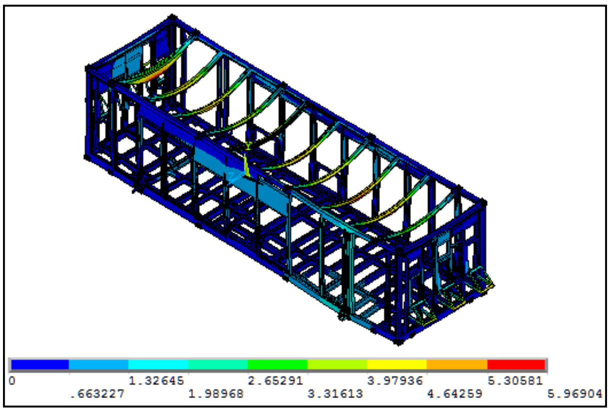

Fig 4 Static structural analysis: Displacement Plot in +X

FRONT SIDE

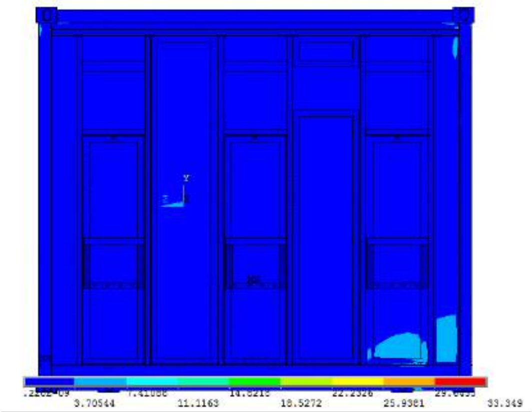

Fig 5 Static structural analysis with wind load
Von mises Stress Plot

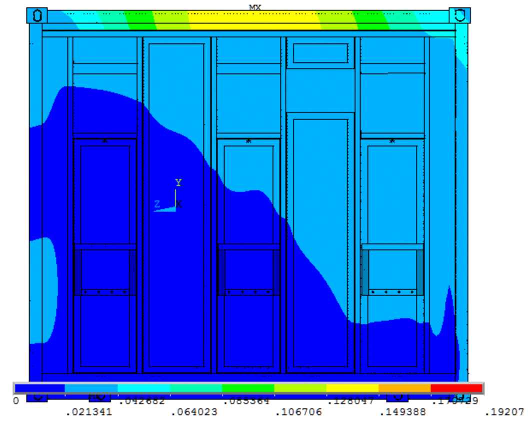

Fig 6 Static structural analysis with wind load
Displacement Plot

RESONANCE FAILURE

A Modal analysis is performed on the structure to evaluate the natural frequencies and corresponding mode shapes.

SHOCK LOAD

The shock load is a suddenly applied acceleration as a saw tooth pulse. And using a transient structural simulation the results were simulated. The shock analysis is performed separately for 3 axes, and in 6 directions; +x/-x, +y/-y, +z/-z. Shock load is simulated by a Saw tooth pulse, with 20g peak acceleration for duration of 11 milliseconds. The time dependent acceleration is defined as follows,

Acceleration = 20 x g x (t / 0.011)

Where, “g” is standard earth gravitational acceleration and “t” is time.

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Components	Bolt forces (KN)		
	X	Y	Z
Lifting lugs	3.432	0.6755	0.2239
Duct to frame	0.876	2.935	7.40
Plc to mounts	0.263	3.872	1.203
Lv panel to mounts	5.644	-92.384	-2.829
Mount Pads	-29.134	-6.932	-7.034

Table 1 Bolt forces in various components

Components	Weld force (KN)		
	X	Y	Z
Beam to channel one side	3.01	7.48	57.34
Channel to beam both side	-15.78	-28.39	-198.56
Channel to channel both	19.56	-73.01	301.04
Beam to beam one sides	8.01	98.62	349.75
Beam to beam both sides	73.34	-216.9	261.73

Table 2 weld forces in various components

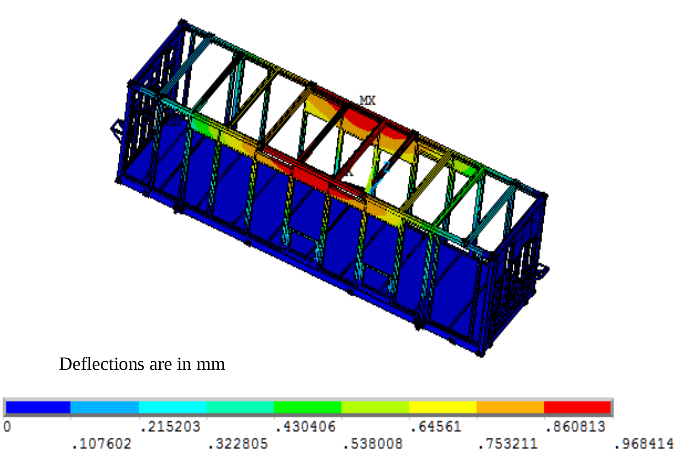

Fig 7 Modal Analysis: Mode-1(Frequency: 6.81 Hz)

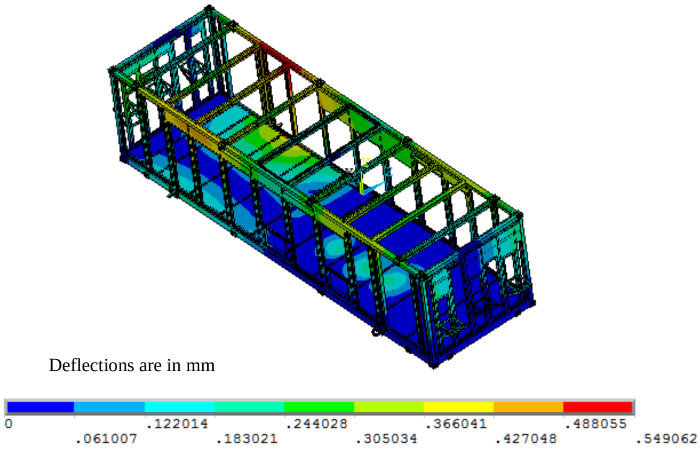

Fig 21: Modal Analysis: Mode-10(Frequency: 22.8 Hz)

Components	0.5 ms	1 ms	6ms	11 ms
Steel tubes	1.2	2.67	176.45	260.37
ISO corners	2.37	5.36	203.78	234.16
Sheet	1.03	4.23	211.98	213.57
Base	2.72	5.96	245.67	269.45

Table 3 Shock Load Case
Von mises stress (MPa) in various members +y direction

S.no	Analysis type	FOS	
		min	Max
1	Static structural	2.01	2.32
2	Wind load	2.04	12.57
3	Shock load	2.08	2.15

Table 4 Result summary

CONCLUSION

From the overall analysis it is observed that DRC assembly meets the acceptance criteria. And safety coefficient for the complete assembly model in all load cases are greater than 2 and also stresses are well below THE ultimate strength for all Static and Modal analysis cases, so the model is considered to be safe under different working conditions.