

Summary

Project Name: Backhoe Loader Cabin Roller over protection safety using Finite Element Analysis

Software: ANSYS Workbench

Scope: To ensure the safety of operator, FE Analysis is carried out for a Cabin which is subjected to various kinds of loads during machine extreme working conditions

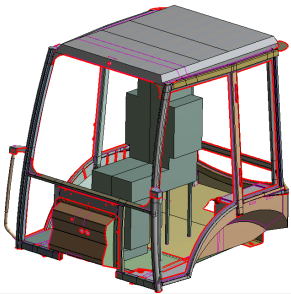
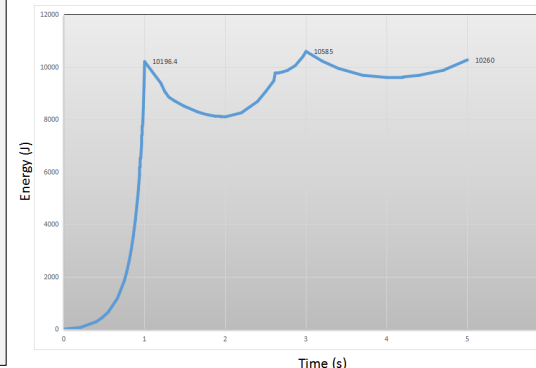
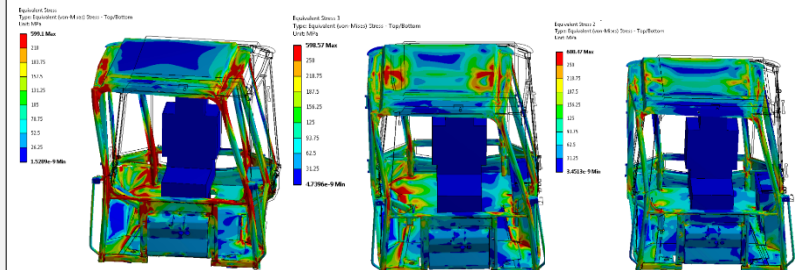
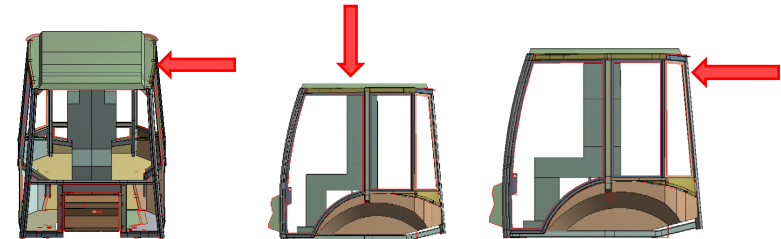


Table 1 — Force and energy equations

Machine mass m kg	Lateral load force F N	Lateral load energy U J	Vertical load force F N	Longitudinal load force F N
m_1	N	J	N	N
1) Grader earth-moving machine, dozer, loader, pipelayer and trencher type				
$700 < m \leq 4\ 630$	6m	$13\ 000\ (m/10\ 000)^{2.5}$	4.8m	
$4\ 630 < m \leq 59\ 500$	$70\ 000\ (m/10\ 000)^{1.2}$	$13\ 000\ (m/10\ 000)^{1.25}$	$10.61m$	$56\ 000\ (m/10\ 000)^{1.2}$
$m > 59\ 500$	10m	2.03m	6.6m	
2) Grader				
$700 < m \leq 2\ 140$	6m	$15\ 000\ (m/10\ 000)^{1.25}$	4.8m	
$2\ 140 < m \leq 36\ 010$	$65\ 000\ (m/10\ 000)^{1.2}$	$15\ 000\ (m/10\ 000)^{1.25}$	$10.61m$	$56\ 000\ (m/10\ 000)^{1.2}$
$m > 36\ 010$	6m	2.03m	6.6m	
3) Wheeled earth-moving machine, loader, tractor-dozers, pipelayer, landfill compactor, skid-steer loader, backhoe loader and trencher type				
$700 < m \leq 10\ 000$	6m	$12\ 500\ (m/10\ 000)^{1.25}$	4.8m	
$10\ 000 < m \leq 126\ 850$	$65\ 000\ (m/10\ 000)^{1.2}$	$12\ 500\ (m/10\ 000)^{1.25}$	$10.61m$	$48\ 000\ (m/10\ 000)^{1.2}$
$m > 126\ 850$	10m	2.03m	6.6m	
4) Tractor section of combined earth-moving machine, tractor scraper, articulated frame dumper				
$700 < m \leq 1\ 010$	6m	$20\ 000\ (m/10\ 000)^{1.25}$	4.8m	
$1\ 010 < m \leq 32\ 160$	$65\ 000\ (m/10\ 000)^{1.2}$	$20\ 000\ (m/10\ 000)^{1.25}$	$10.61m$	$79\ 000\ (m/10\ 000)^{1.2}$
$m > 32\ 160$	10m	2.68m	6.6m	

- Extensive FE modelling techniques are used to prepare the cabin to apply ROPS sequence loadings
- Stress v/s strain curve was adapted to all the parts used in cabin to predict the plastic deformation around deflection limited volume.
- ISO 3471 Standard is referred to determines the loading required based on the category of the machinery
- Critical regions in the cabin are identified after the analysis and reported the deformations around DLV, & stress intensities



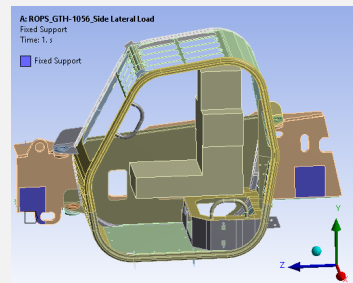
- 1sec- Lateral loading
- 2sec- Lateral unloading
- 3sec- Vertical loading
- 4sec- Vertical unloading
- 5sec- Longitudinal loading

Summary

Project Name: Telehandler Cabin ROPS simulation using Finite

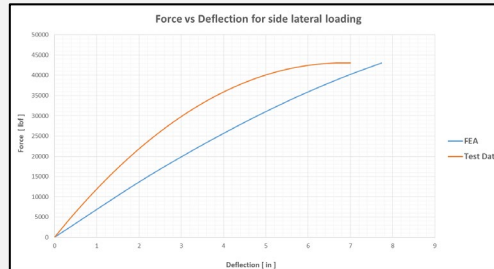
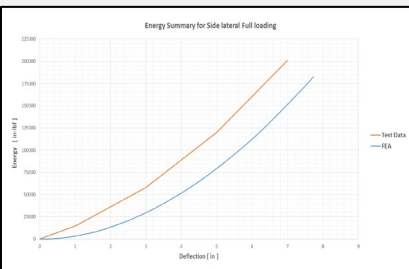
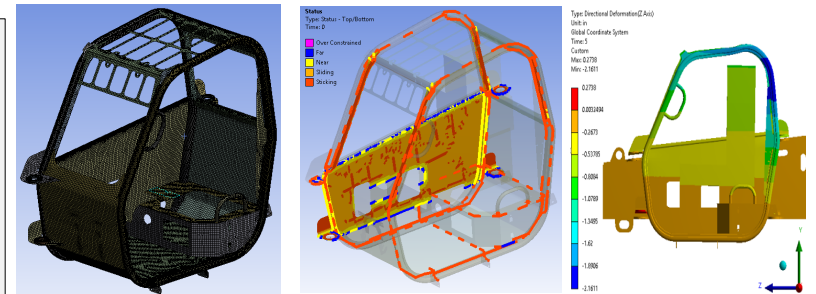
Software: ANSYS Workbench

Scope: To perform virtual destructive test (ROPS-FEA) as per ISO3471:2008 to compare with physical testing and to suggest design modifications at critical regions to withstand specified force and energy criteria.



Force & Energy criteria

LOADING SEQUENCE	REQUIREMENT	APPLIED
SAE ROPS Lateral Force	23,488 lbs.	43,051 lbs.
SAE ROPS Lateral Energy	197,155 in.-lbs.	200,812 in.-lbs.
SAE Vertical Load	69,988 lbs.	70,984 lbs.
SAE Front Longitudinal Load	18,790 lbs.	19,630 lbs.
ISO ROPS Lateral Force	104,480 N.	191,500 N.
ISO ROPS Lateral Energy	22,275 J.	22,689 J.
ISO Vertical Load	311,323 N.	315,753 N.
ISO Front Longitudinal Load	83,584 N.	87,319 N.



- ISO 3471 Standard is referred to determines the loading required based on the category of the machinery
- The graph shows the Strain energy developed and deflection in the Cabin for lateral full loading (testing v/s FEA)

