Stability Analysis of Personnel Transfer Chamber Launch and Recovery System Trolley

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1. Introduction

The PTC recovery system is installed on a ship or an offshore structure to launch or recovery equipment and cargo. The trolley lowers or lifts the umbilical cable connected to the PTC to the work depth. It is then operated in conjunction with the operating speed. In this report, evaluation of structural stability from trolley is performed using F.E.A. (Finite Element Analysis). ANSYS ver. 19.1, worldwide F.E analysis program is used for this analysis

2. Analysis model description

Trolley consists of trolley structure, main wire sheave block, umbilical cable guide, bell rail, traveling cylinder, rail locking cylinder, pliers cylinder and leg locking cylinder. It was shown in fig.1~ fig. 2

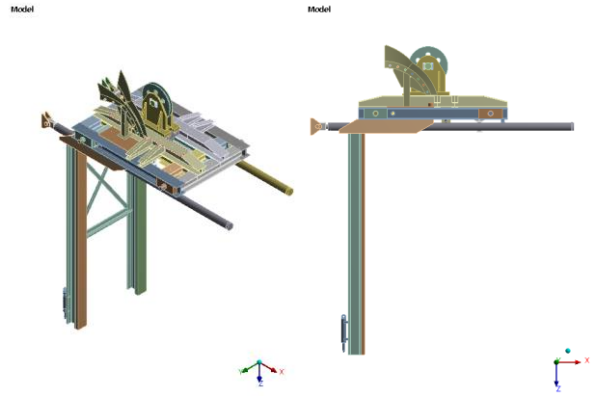

Fig.1 Overall view of trolley

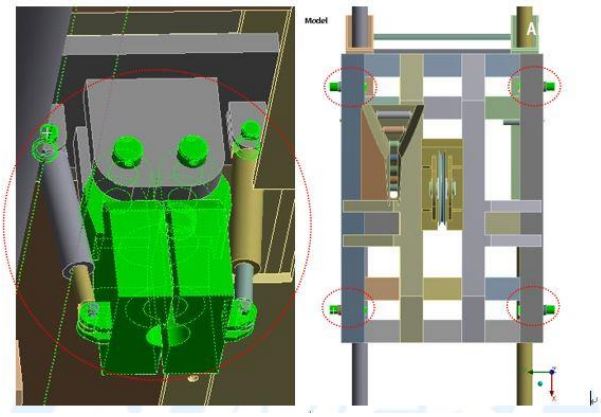

Fig.2 Analysis point of trolley

3. FE model and boundary condition

The finite element model of trolley is composed by solid elements. The number of nodes and elements are presented in the table 1. Overall view of Element model for trolley are presented in fig.3~ fig. 4

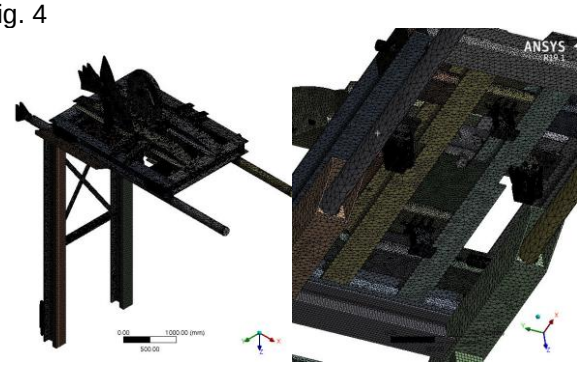

Fig.3 Finite Element model of trolley

It was the use of a solid 185 (8-node structural solid) element provided by ANSYS.

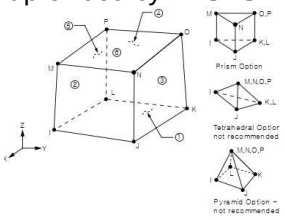

Fig.4 Finite Element of type (Solid 185 in ANSYS)

Table 1 Element & node numbers

Component	Node numbers	Element numbers
Trolley	759,139	2,245,621

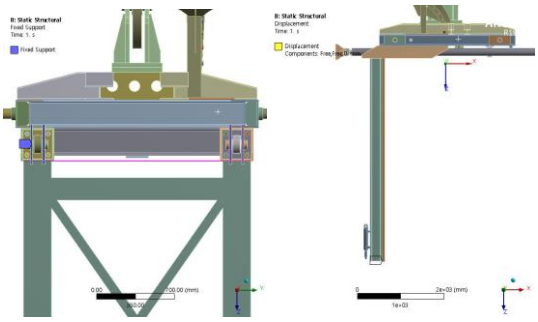

Fig.5 Boundary condition for trolley

4. Load condition

In the analysis, 2 types of loads are considered. The load applied to the trolley is shown in table 2 and Fig. 6

Table 2 Load combination

LOAD 1	PTC Weight	9.5ton	Load factor:1.5
	Applied load	139792.5 N	
LOAD 2	Trolley weight	8 ton	

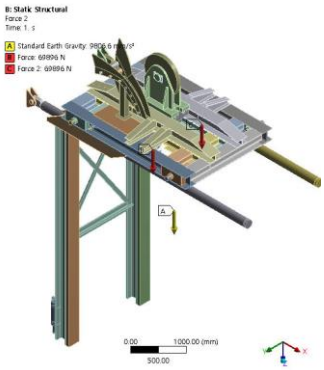

Fig.6 Applied load for Trolley

5. Analysis result

The results of the structural analysis for trolley shows the maximum stress though the all load cases. The maximum stress of the pliers cylinder pins is 198.62MPa.This show the structure is satisfied the stress criteria. And, it is considered that the bending of the trolley will not occur as a result of the analysis using the load. The results of the analysis are attached in fig.7 ~ fig.8.

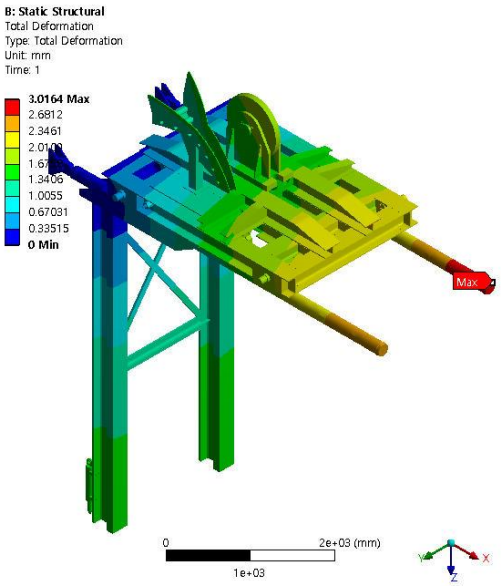

Fig.7 Result of Total deformation (Unit: mm)

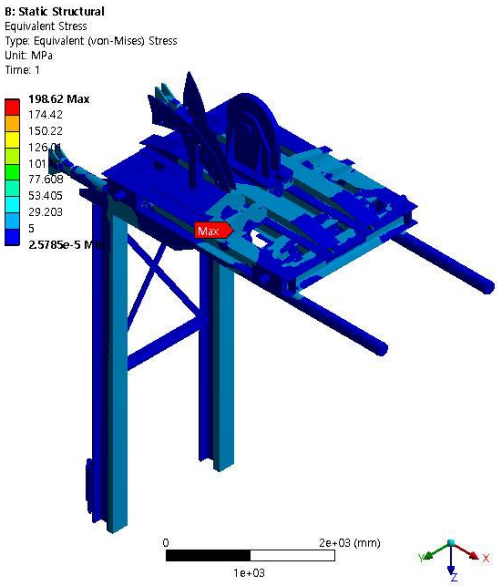

Fig.8 Result of Eqv. Stress (Unit: MPa)

6. Conclusion

In this paper, the evaluation is conducted about structural stability. Based on given drawing of trolley, structural analysis is performed. Boundary conditions are given in the same way as the actual behavior and loading conditions are used according to '4.Loading Condition'. All analysis results are satisfied with the eqv. Stress criteria.
As the result, trolley is able to withstand the load. Therefore, the structure is satisfied to structural strength.

Acknowledgment

This paper is supported by Korea Institute for Infrastructure Technology Advancement grant funded by Ministry of Trade Industry on Energy, Infrastructure and Transport. (P0002161, The localization development of launching and recovery system based on ICT)

References

[1] Seungchan Kim, Sangki Lee, Moonkil Jeon, Taegyu Hwang and Jeonghwan Kim, Structural Stability Evaluation of Personnel Transfer Chamber Launch and Recovery System Winch Utilizing Finite Element Analysis, Proceedings of the 5th World Congress on Mechanical, Chemical and Material Engineering(2019), DOI: 10.11159/icmie19.120
[2] ANSYS ver.19.1 help files