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BLAST ANALYSIS OF RC RETAINING WALL WITH SANDWICH PANEL

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Abstract – *Blast loads are considerably affect the response of structure. The Retaining walls are the important structures that are used for various civilian and military applications. The blast action on retaining walls causes damages to property, personnels and adjacent structures. For the purpose reinforced concrete Retaining wall is modelled using CREO parametric software and imported to ANSYS 16.0 software to prefer Explicit analysis. Most common cantilever Retaining wall is choosed for the analysis. The construction of Retaining wall is changed from conventional method to advanced Sandwich method. Corrugated Kevlar is the material used for Sandwiching. A comparison of Normal Retaining wall and Sandwich Retaining wall is performed by Explicit analysis under low intensity blast of 1kg and high intensity blast of 1500kg TNT.*

Key Words: Sandwich technique, Explicit Analysis, Normal Retaining wall, Sandwich Retaining wall, Kevlar, TNT Blast

1. INTRODUCTION

Protection of civilian structures from the threat of terrorist activities is one among the foremost essential challenges for structural engineers currently. Reinforced concrete are used currently for residential, industrial and mass structures. The mass structures includes Retaining wall, dams, water tanks etc. A Retaining wall is a structure designed to sustain the earth or any other material behind it. Retaining walls are encountered and constructed in various fields of engineering such as dams and water way structures, military fortifications, Railways, Residential areas, Roads, Harbours, Subways, Tunnels, Mines etc. There are different Types of loads were acting on Retaining walls. One of the important load is impact load such as blast loads. The blast behaviour of Retaining wall by using a sandwich material between the retaining wall is necessary to study. In this paper, the Blast analysis of Retaining walls with and without Sandwich panel was performed under TNT blast.

2. NUMERICAL MODELLING

The modeling and analysis of reinforced concrete Retaining wall is done in this thesis using CREO parametric software and ANSYS 16.0 software. The model is a Retaining wall having 3000mm Height. The blast load (TNT) of 1kg and 1500kg is placed at a standoff distance 1m away from the Retaining wall.

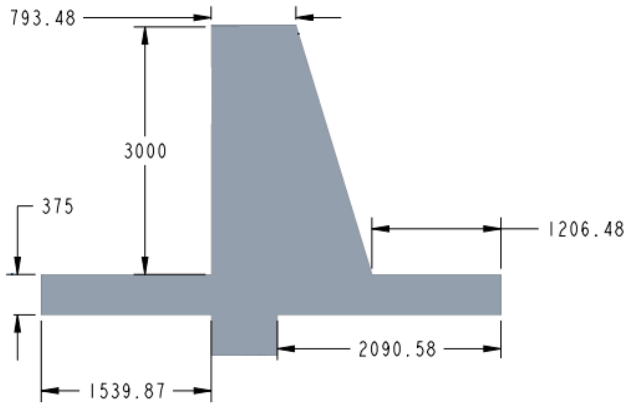

Fig -1: Model of Normal Retaining wall with Dimensions in mm

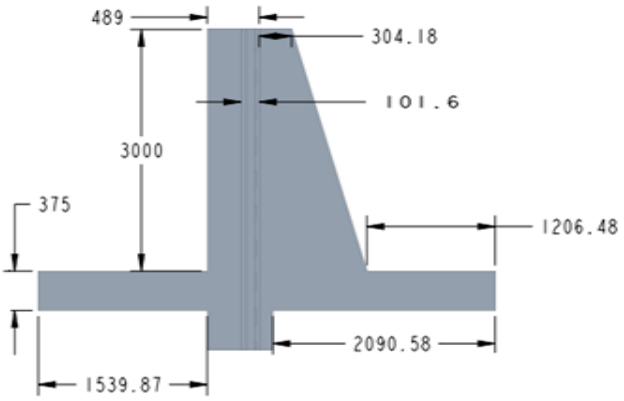

Fig -2: Model of Normal Retaining wall with Dimensions in mm

3. EXPLICIT ANALYSIS

Dynamic analysis can be used to find dynamic displacements, time history, and modal analysis. Dynamic loads include people, wind, waves, traffic, earthquakes, and blasts. Dynamic analysis for simple structures can be carried out manually, but for complex structures finite element analysis can be used to calculate the mode shapes and frequencies. In this thesis finite element analysis were done by ANSYS software. For explicit analysis TNT explosive is used. It is a standard high explosive which is chemically safe and easy to cast. TNT mass were set at 1Kg and 1500kg to

examine the influence of explosive mass to damage degree of RC Retaining wall. TNT is placed at a standoff distance of 1mm away from the Retaining wall. Analysis were done in order to find out most effective construction method against blast loading, by comparing Normal and Sandwich Retaining wall. Corrugated Kevlar is the sandwich material used in this analysis. Max deformation of RC Retaining wall with and without sandwich panel were analyzed.

3.1 Retaining walls under 1kg TNT Blast

Deformation due to 1kg TNT blast was analyzed by using ANSYS 16.0 software. The model of Normal and Sandwich retaining wall was imported from CREO parametric software.

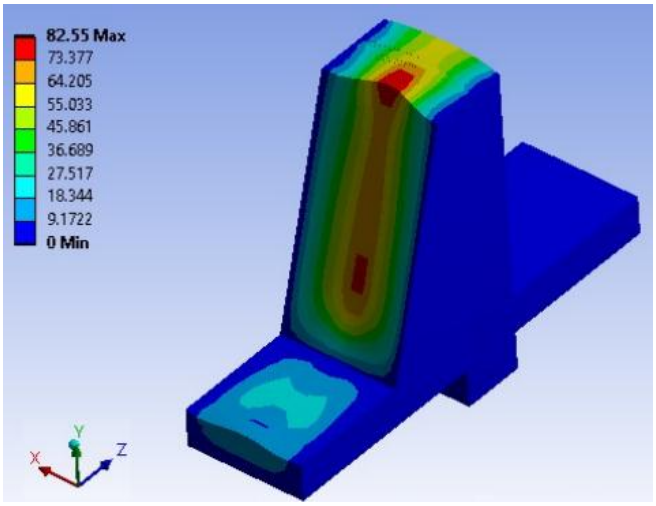

Fig -3: Deformation diagram of Normal Retaining wall under 1kg TNT blast

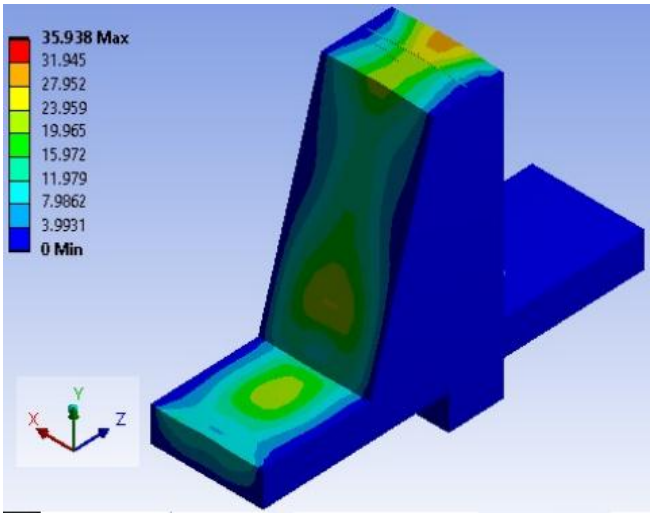

Fig -4: Deformation diagram of sandwich Retaining wall under 1kg TNT blast

3.2 Retaining walls under 1500kg TNT Blast

Deformation due to 1kg TNT blast was analyzed by using ANSYS 16.0 software. The model of Normal and Sandwich retaining wall was imported from CREO parametric software.

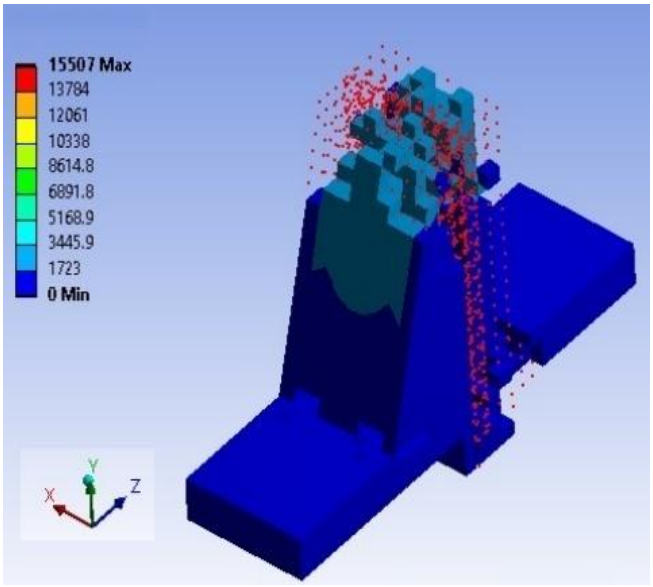

Fig -5: Deformation diagram of Normal Retaining wall under 1500kg TNT blast

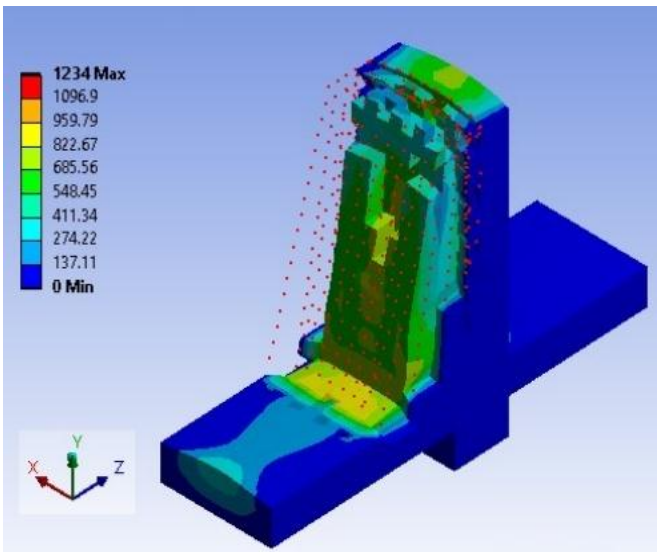

Fig -6: Deformation diagram of Sandwich Retaining wall under 1500kg TNT blast

2. RESULT AND DISCUSSIONS

In this thesis, Explicit analysis using ANSYS is used to study the impacts on Normal and Sandwich Retaining wall .Table-1 and Table-2 shows maximum deformation occurred in Normal and Sandwich Retaining wall under 1kg and 1500kg TNT blast.

Table -1: Maximum deformation under 1kg TNT blast

Name of Model	Deformation (mm)
Normal Retaining wall	82.35
Sandwich Retaining wall	35.938

Table -2: Maximum deformation under 1kg TNT blast

Name of Model	Deformation (mm)
Normal Retaining wall	15507
Sandwich Retaining wall	1234

From Table-1 the Sandwich retaining wall has lower deformation due to 1kg blast and from Table-2 also, the Sandwich retaining wall has lower deformation under 1kg blast

5. CONCLUSIONS

A numerical investigation was conducted by using ANSYS software mainly to study the maximum withstanding capacity of Retaining wall with and without sandwich panel. Explicit analysis of Normal and sandwich Retaining wall conducted under High and Low intensity Blast of 1kg and 1500 kg. Deformation was the parameter considered to finalize the result. From the results obtained the Sandwich Retaining wall has limited deformation in case of both blast impacts. So by comparing with Normal Retaining wall, Sandwich retaining wall has better bearing capacity to blast impacts.

6. SCOPE FOR FUTURE WORK

The Sandwich Retaining wall can be analyzed with different sandwich materials and loading conditions.

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