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Research Using Flexible Retaining Wall Solution Protecting the Works Impacted by Blast Loads

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Abstract

This paper uses field experiments to determine ground acceleration caused by the explosion in event of using the flexible retaining wall solution to protect the works. From the field experiments, it is recommended to use the flexible retaining wall solution to reduce the impacts of the explosion on the mining projects being currently used.

Keywords: Acceleration; Blast Wave Pressure; Trench

Introduction

Currently, in some remote islands, near-shore islands and coastal areas, the need to build new works on the island for purpose of national defense and security and socio-economic development is ever-increasing, particularly the use of explosive energy during the construction process is often difficult due to the proximity to the area where the works are currently exploited and used. Therefore a solution protecting the works before the explosion is a flexible retaining wall as it is easy to build the flexible retaining wall and it is highly economically and suitable for the work construction method [1-4].

Forewords and Test Place and Contents

Forewords

Using field experiments, determining the ground acceleration value in front of and behind the retaining wall, and ground acceleration value in corresponding locations without the retaining wall as the explosion is situated in front of the retaining wall in cases of the explosives on the ground and under the ground.

Test Place and Model

Test place: Explosion test site, Thach Hoa Commune, Thach That District, Hanoi City.

For the amount of explosives (C = 200 g) placed on the ground and the amount (C = 200 g) placed under the ground at 200 mm, the dimension of the retaining wall: Length L = 2m; Width R = 1m; Depth H = 1m (Figure 1 & 2).

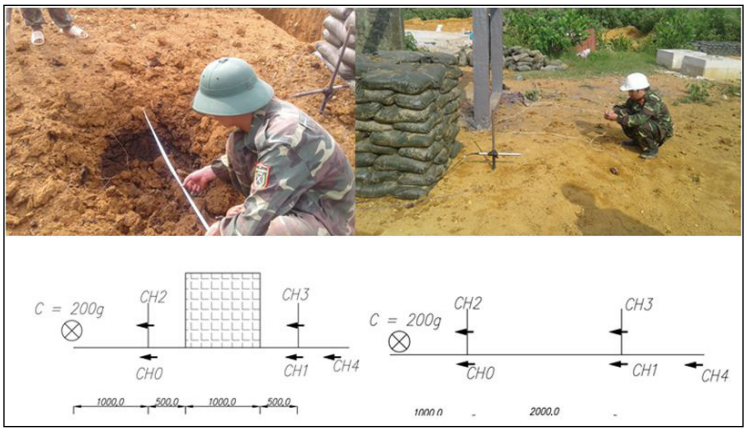

Figure 1: Test diagram for explosives on the ground

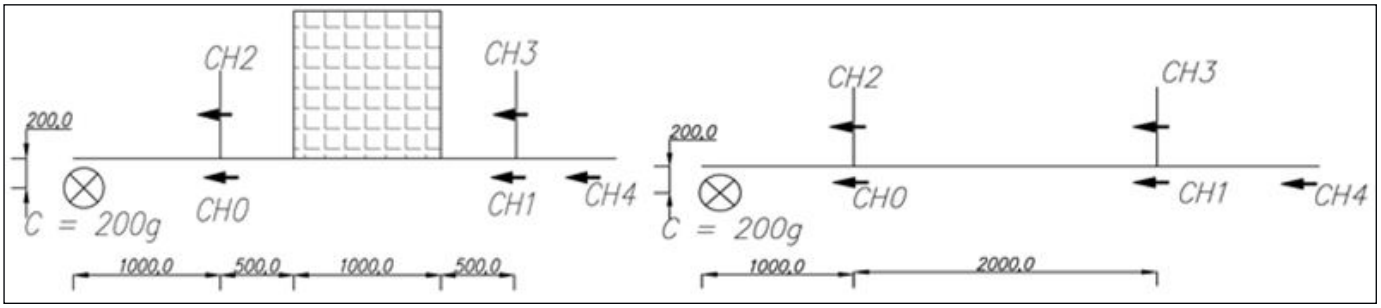

Figure 2: Test diagram for explosives under the ground

Test Instruments

Figure 3: Test instruments

Test Steps

Step 1: Set up 02 meters for ground acceleration values (CH0 and CH1).
Step 2: Determine the distance from the explosives to the meters, to the retaining wall.
Step 3: Check the operating conditions of the instrument before measurement, the safety conditions when testing the explosion.
Step 4: Conduct explosion, check the signal receiver on the computer.

Test Results for the Explosives on the Ground

Using the flexible retaining wall

Test 1

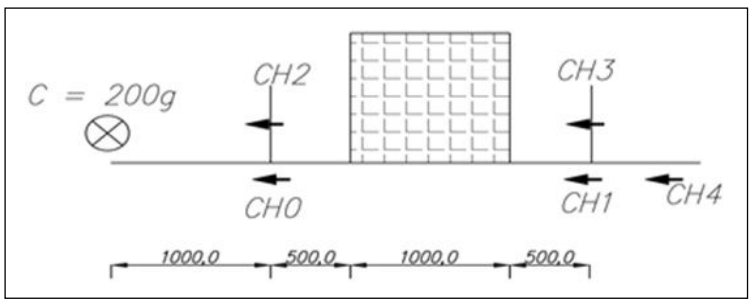

Figure 4: Test layout

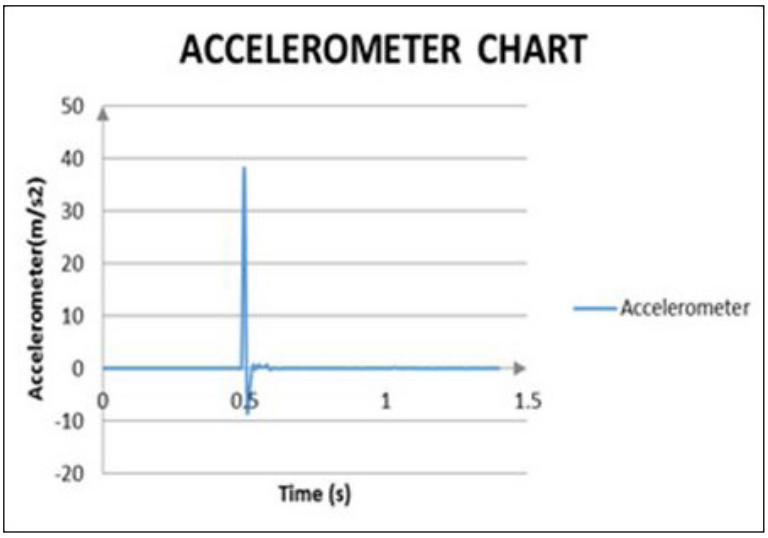

Figure 5: Chart of acceleration meter CH0

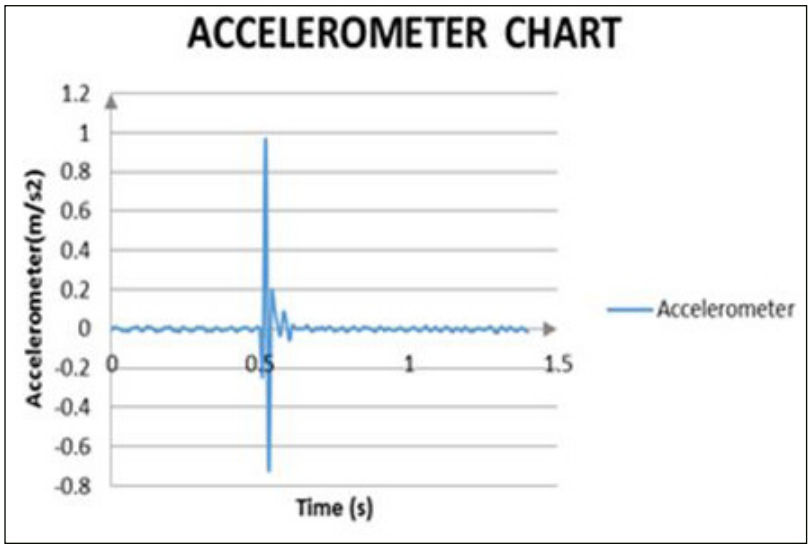

Figure 6: Chart of acceleration meter CH1

Test 2

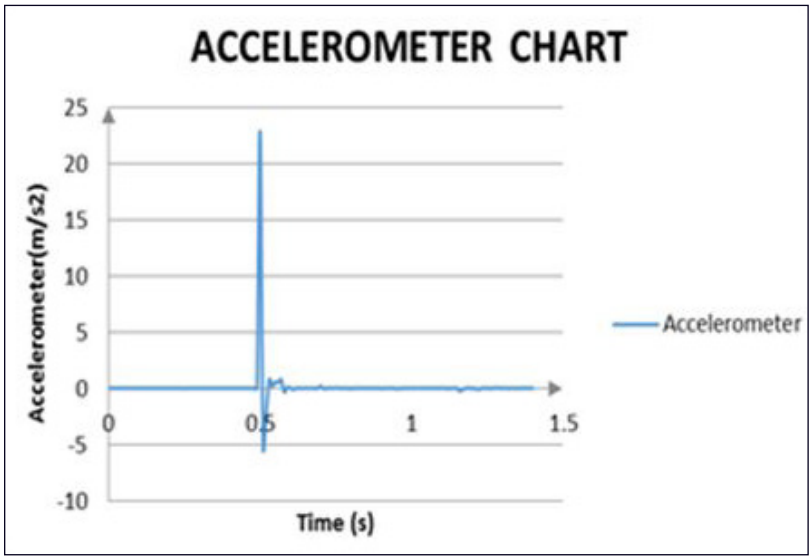

Figure 7: Chart of acceleration meter CH0

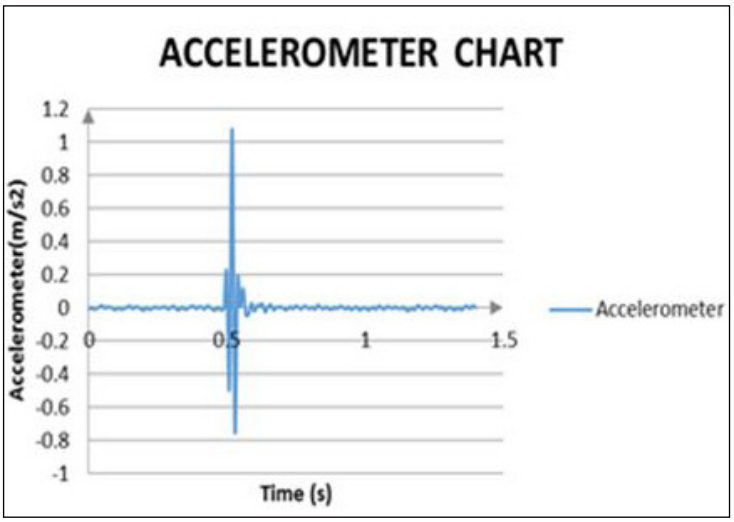

Figure 8: Chart of acceleration meter CH1

Test 3

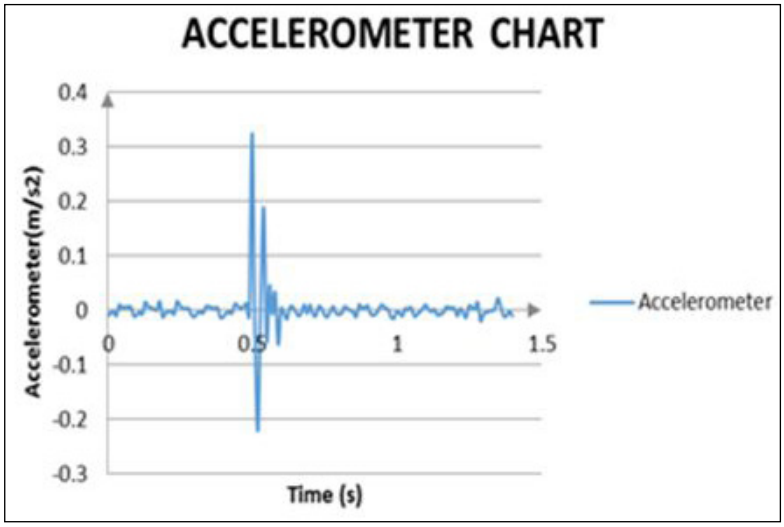

Figure 9: Chart of acceleration meter CH0

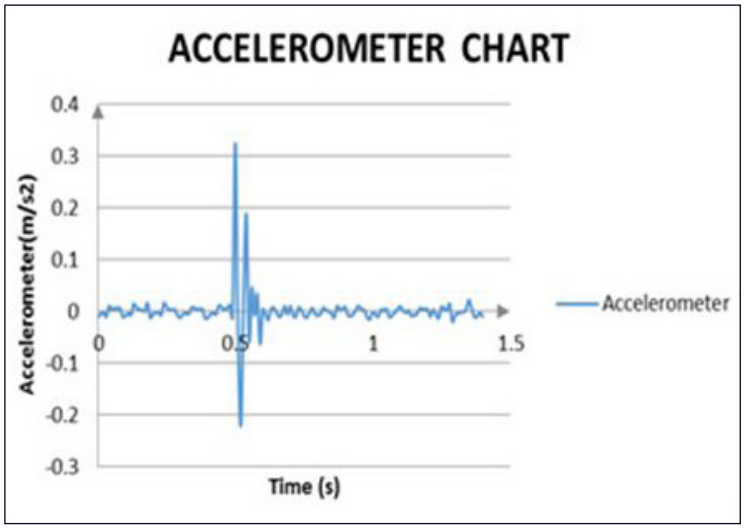

Figure 10: Chart of acceleration meter CH1

No using the Flexible Retaining Wall

Test 1

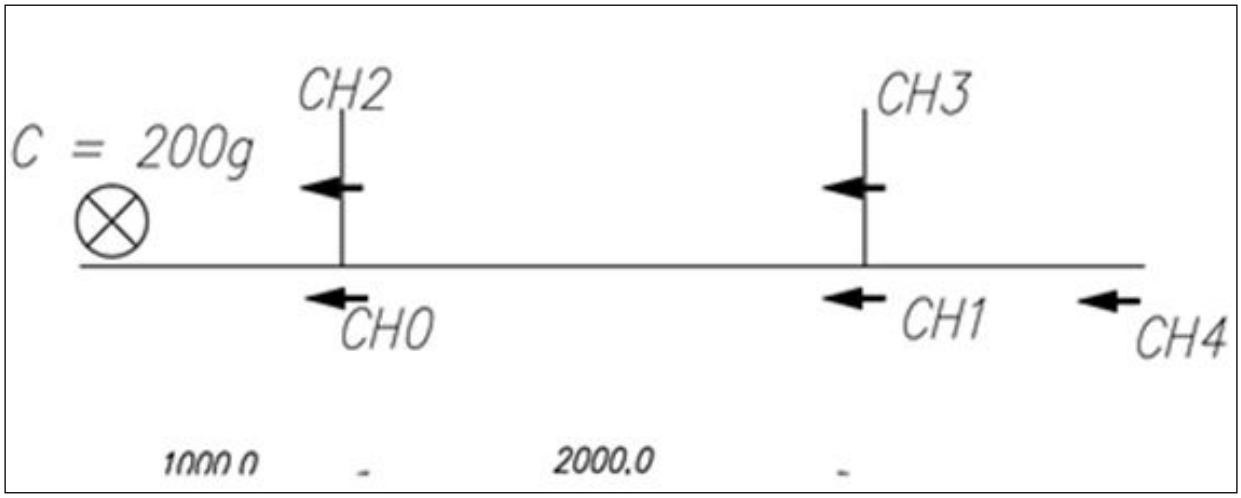

Figure 11: Test layout

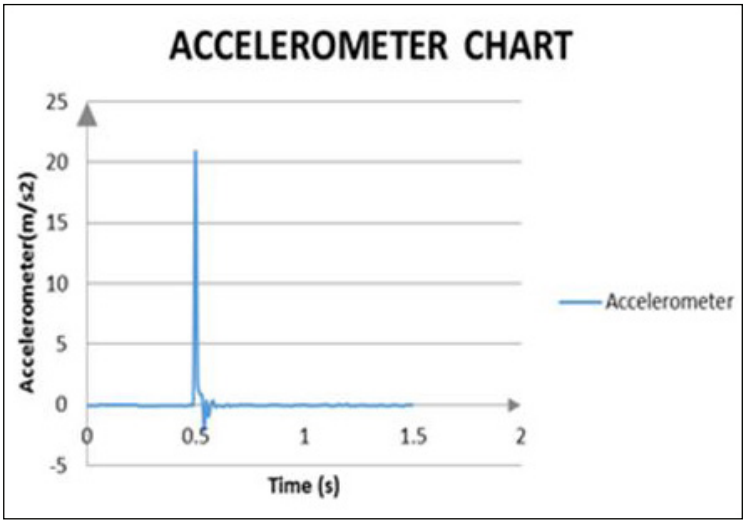

Figure 12: Chart of acceleration meter CH0

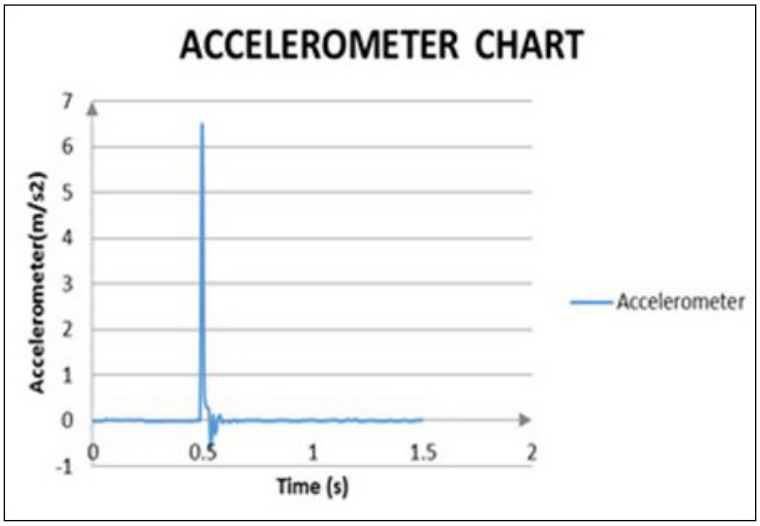

Figure 13: Chart of acceleration meter CH1

Test 2

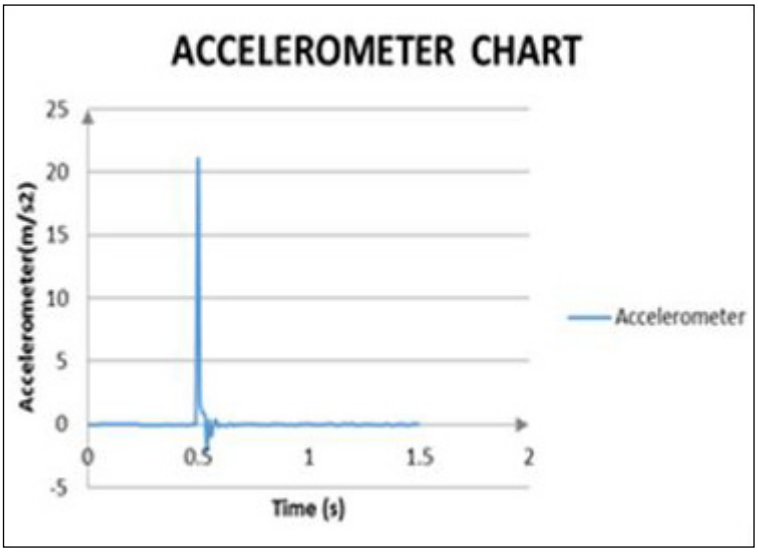

Figure 14: Chart of acceleration meter CH0

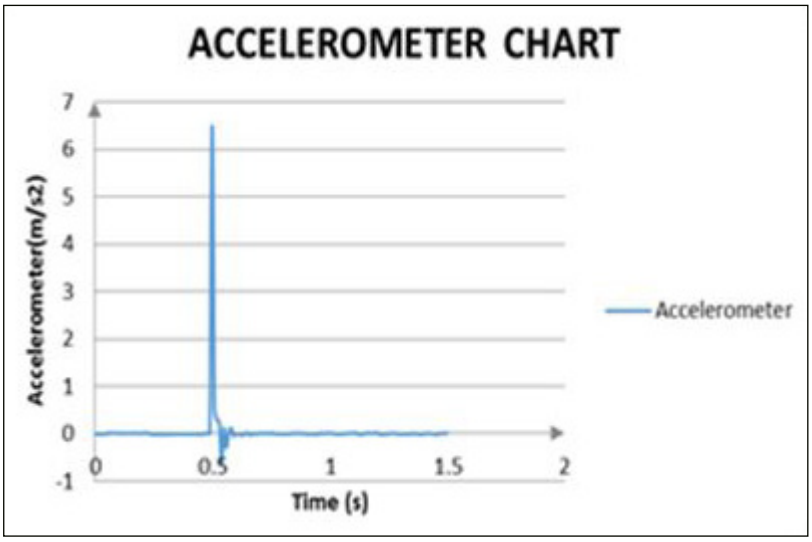

Figure 15: Chart of acceleration meter CH1

For the Explosives under the Ground

Using the Flexible Retaining Wall

Test 1

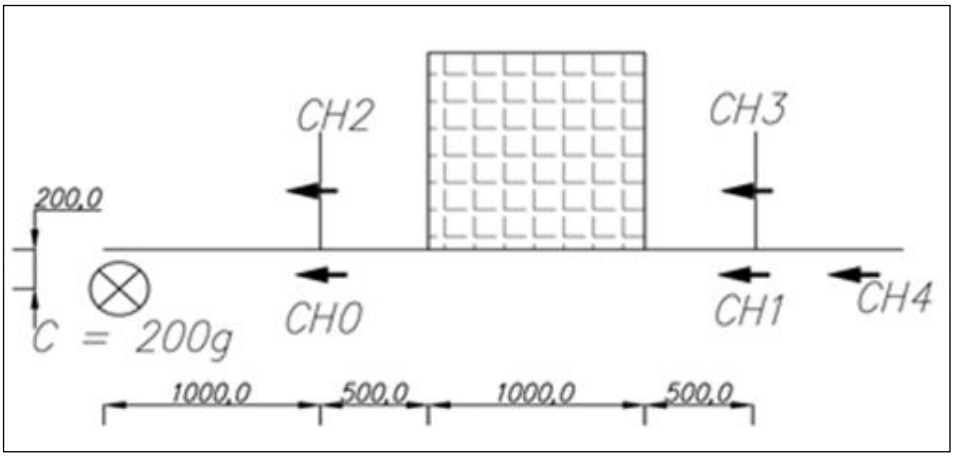

Figure 16: Test layout

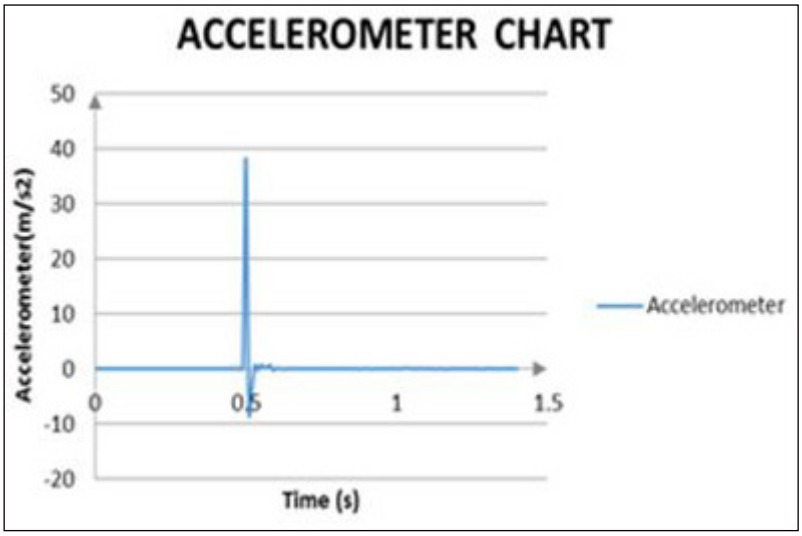

Figure 17: Chart of acceleration meter CH0

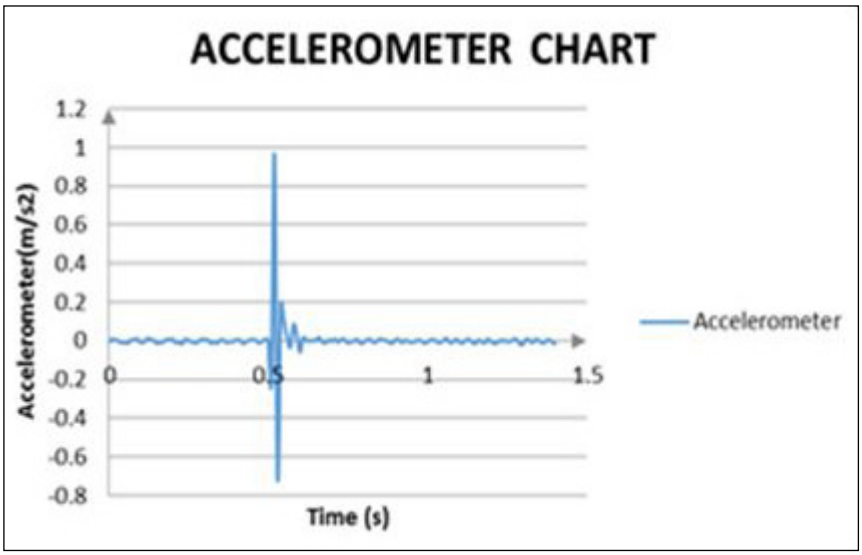

Figure 18: Chart of acceleration meter CH1

Test 2

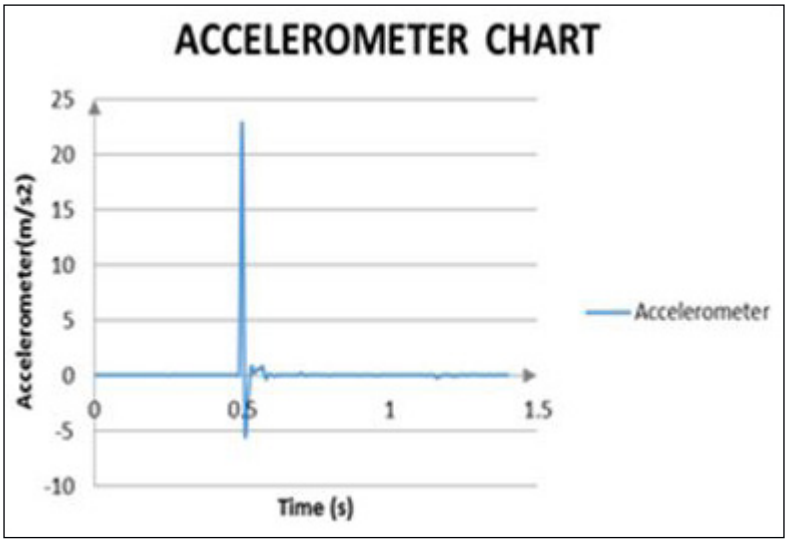

Figure 19: Chart of acceleration meter CH0

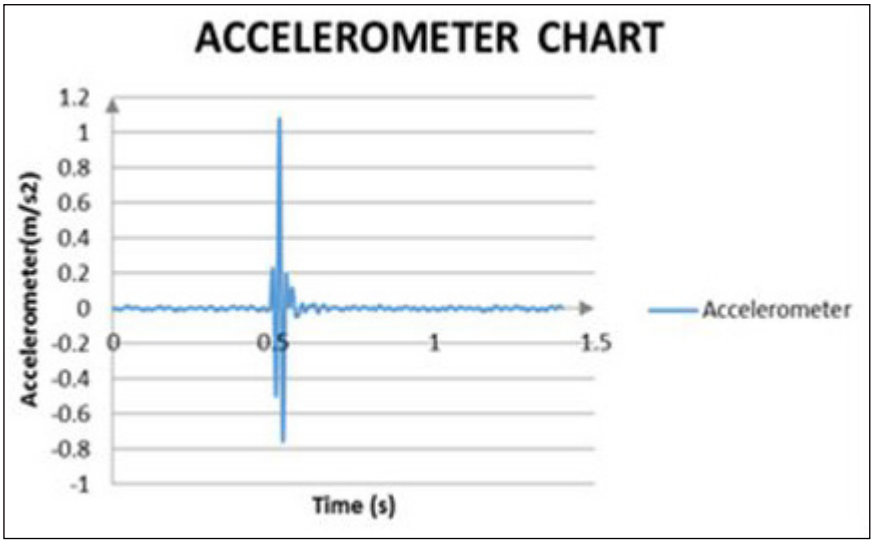

Figure 20: Chart of acceleration meter CH1

Test 3

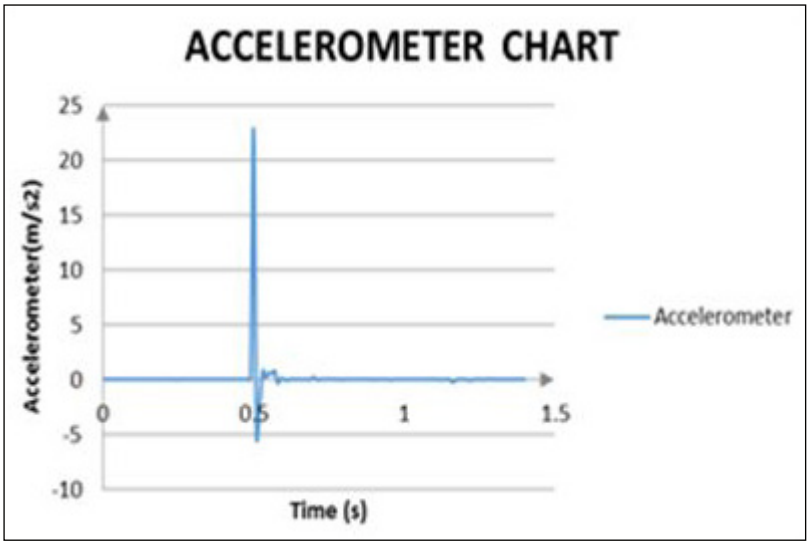

Figure 21: Chart of acceleration meter CH0

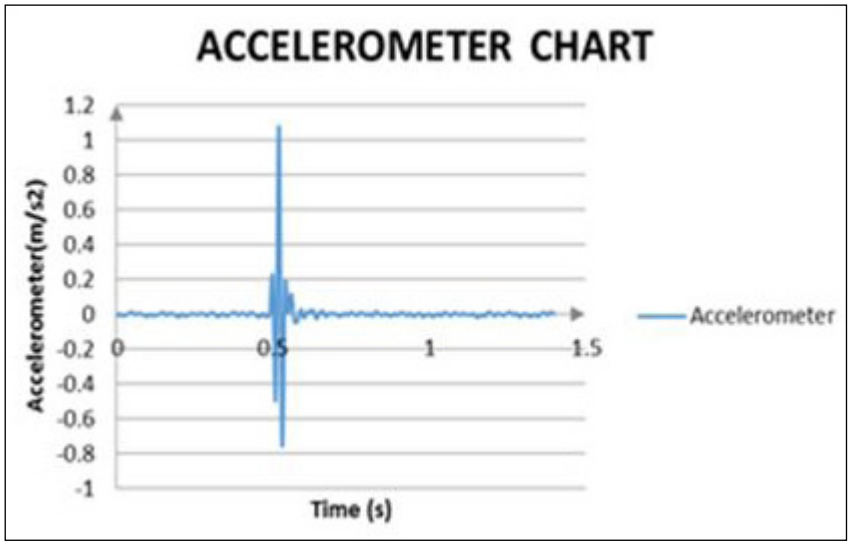

Figure 22: Chart of acceleration meter CH1

No using the Flexible Retaining Wall

Test 1

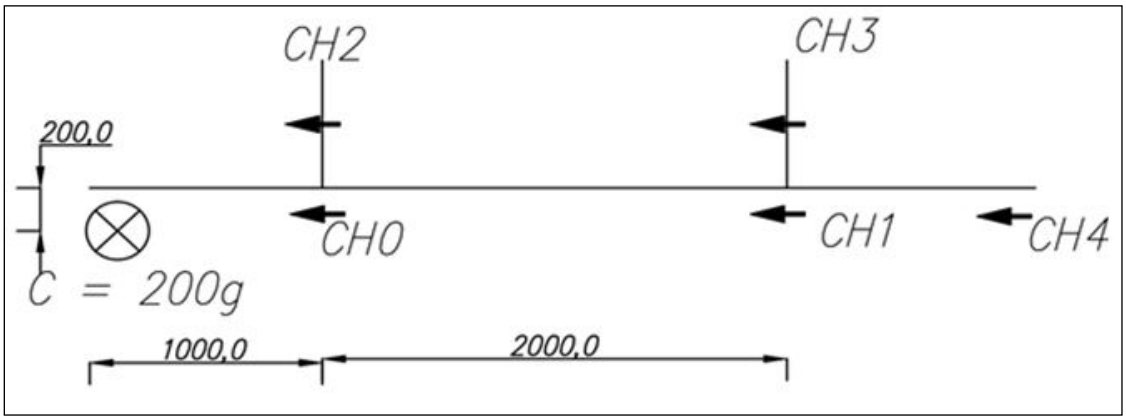

Figure 23: Test layout

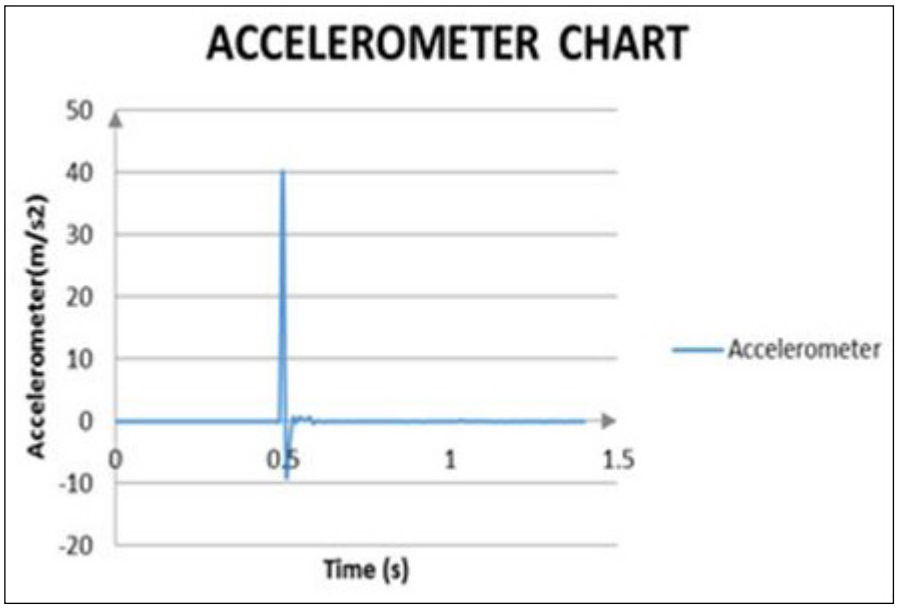

Figure 24: Chart of acceleration meter CH0

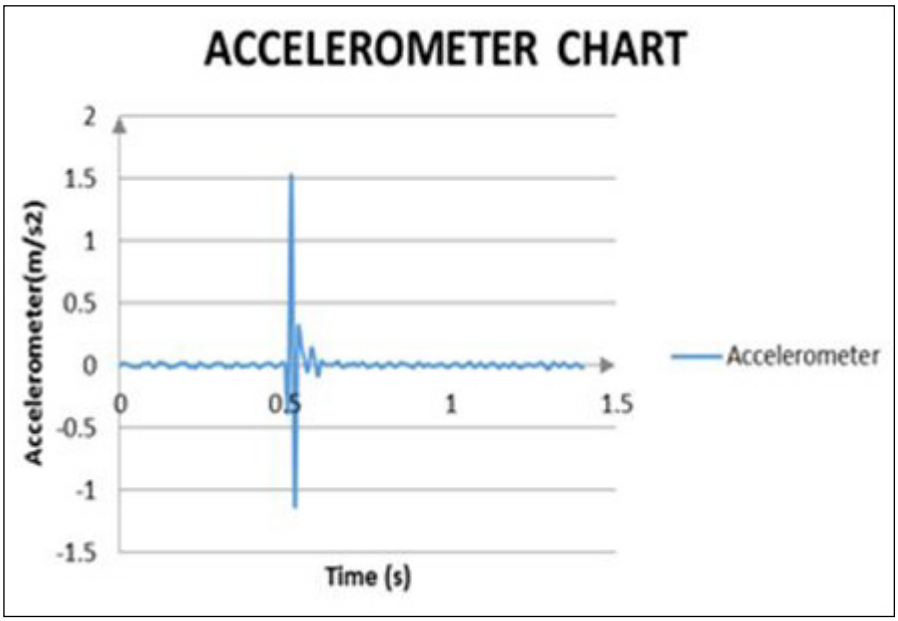

Figure 25: Chart of acceleration meter CH1

Test 2

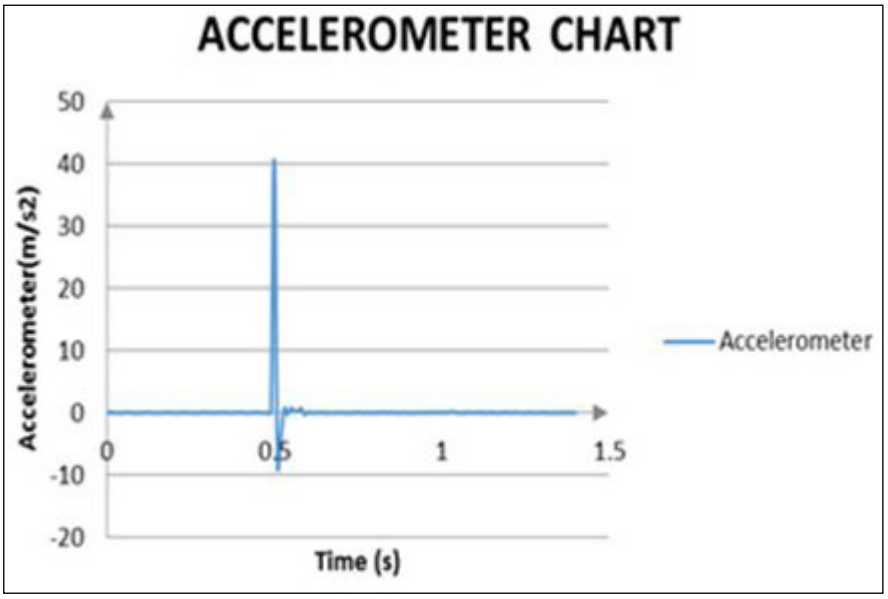

Figure 26: Chart of acceleration meter CH0

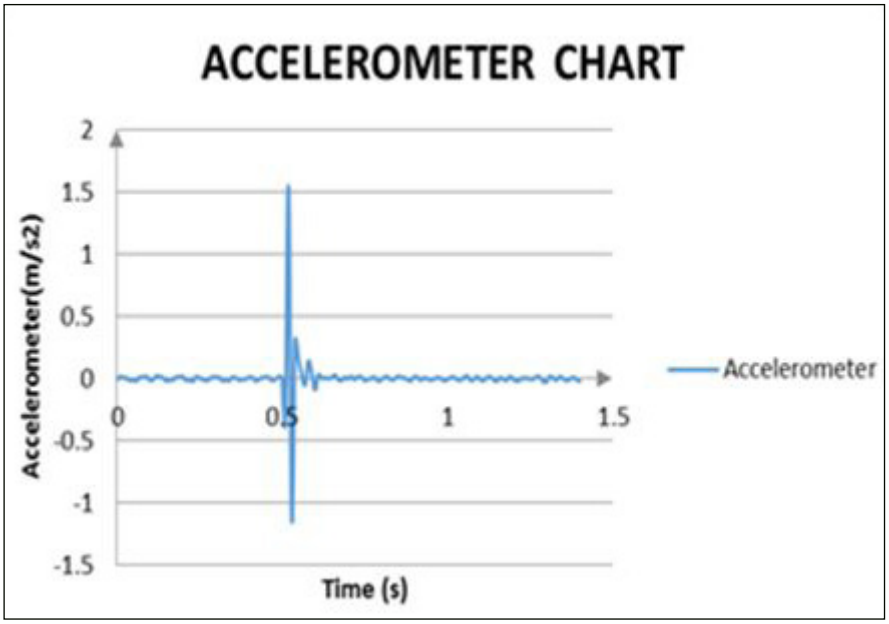

Figure 27: Chart of acceleration meter CH1

Summary of Results

For the Explosives on the Ground

Using the Flexible Retaining Wall

No.	Test	Acceleration value (m/s^2)		Subtraction of acceleration measurements (m/s^2)	Percent %
		Meter CH0	Meter CH1		
(1)	(2)	(3)	(4)	(5)	(6)
1	1st	20.15	1.50	18.65	92.55
2	2nd	20.00	2.00	18.00	90,00
3	3rd	20.15	1.75	18.40	91,31
Average		**20.10**	**1.75**	**18.35**	**91.29**

Table 1: Acceleration measurements

No using the Flexible Retaining Wall

No.	Test	Acceleration value (m/s^2)		Subtraction of acceleration measurements (m/s^2)	Percent %
		Meter CH0	Meter CH1		
(1)	(2)	(3)	(4)	(5)	(6)
1	1st	20.15	6.60	13.55	67.24
2	2nd	20.25	6.70	13.55	66.91
Average		20.20	6.65	13.55	67.08

Table 2: Acceleration measurements

Remarks: For the amount of explosion placed on the ground

When using the soft retaining wall solution, the value of ground acceleration behind the retaining wall has been reduced. The reason for the acceleration of the ground behind the retaining wall is nearly 23% lower than when there is no retaining wall due to the fact that when the explosion wave spread in the soil meets the gravity retaining wall, the energy consumption of the propagation wave in the environment is consumed. Therefore, the acceleration of ground impact on the currently exploited works will be reduced, helping the building to be stable, reducing the impact of shock waves causing cracking of structures after explosions. Specific results are shown in Tables 1 & 2 above. Therefore, the use of barrier solutions to protect the building due to the impact of the explosion on the work is highly feasible, reducing the cost of service for low construction measures [5-8].

For the Explosives under the Ground

Using the Flexible Retaining Wall

No.	Test	Acceleration value (m/s^2)		Subtraction of acceleration measurements (m/s^2)	Percent %
		Meter CH0	Meter CH1		
(1)	(2)	(3)	(4)	(5)	(6)
1	1st	39.50	0.85	38.65	97.85
2	2nd	40.00	1.05	38.95	97.37
3	3rd	40.5	0.95	39.55	97.65
Average		40,00	2.85	39.05	97.62

Table 3: Acceleration measurements

No.	Test	Acceleration value (m/s^2)		Subtraction of acceleration measurements (m/s^2)	Percent %
		Meter CH0	Meter CH1		
(1)	(2)	(3)	(4)	(5)	(6)
1	1st	40.05	1.50	38.55	96,25
2	2nd	40.10	1.51	38.59	96,23
Average		40.075	1.505	38.57	96.24

Table 4: Acceleration measurements

Remarks: For the amount of explosion placed in the ground

When using the soft retaining wall solution, the ground acceleration value behind the retaining wall has been reduced. The cause of the acceleration in the ground behind the barrier is significantly reduced compared to the absence of a retaining wall because the explosion when the wave propagated in the environment met the gravity barrier caused the energy consumption of the propagation wave in the environment land. Specific results are shown in Tables 3 & 4 above. Therefore, the use of soft barrier solutions to protect the building due to the impact of the explosion on the building has been effective.

Conclusion

Experimental methods show that the acceleration value received behind the retaining wall has been reduced compared to when there is no retaining wall. The cause of the acceleration is due to the fact that when the explosion wave spreads in the soil environment meeting the soft retaining wall; it consumes the energy of the propagating wave. Therefore, the use of barrier wall solutions to protect existing buildings when the waterfall is used when using explosives for construction brings high economic efficiency is applied more in areas with construction ground limit.

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