

Investigation of Blasting Effects to an Ancient Castle

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Extended Abstract

This paper is related with the examination of the blasting induced vibration to an ancient castle, approximately 500m away from a quarry located in Manisa, Turkey. The study was implemented by conducting firstly a signature blasts to analyse the behavior of wave propagation and then three group blasts consisting of 14, 22 and 35 blastholes. Drill hole diameter was 89mm. Bench heights were changing between 14.5-20m. Charge per delay for the two group blasts were 65 kg, and for the third one, 85 kg. Figure 1 illustrates the situation of the quarry before blasting operations.



Fig. 1. The situation of the quarry before blasting operations.

The blast induced vibrations were measured close to the ancient castle (Figure 2) by two three-component seismographs (Blastmate).



Fig. 2. Ancient castle close to the quarry and one of the seismograph location.

Table1 shows the distances between the quarry blasts and the measurement locations.

Table 1. The distances between the quarry blasts and the measurement locations.

Blast #	Distances to measurement locations (m)	
	First measurement location	Second measurement location
Signature blast	514,61	477,80
Group blast#1	456,79	420,35
Group blast#2	491,39	454,81
Group blast#3	522,08	485,19

The measured vibrations given in Table 2 were evaluated according to the DIN 4150 norms having very sensitive critical values for historical places. As it is clearly seen in the table that, both of the group blasts induced vibrations peak particle velocity values are below the critical values of 5mm/s according to the DIN 4150 norms. Therefore, it can be said that, if the blasting operations of the quarry were conducted as in this case, there will not be any harmful effect to the ancient castle.

Table 2. Vibration results measured at two measurement locations.

Blast #		Transversal component (first / second measurement locations)	Vertical component (first / second measurement locations)	Longitudinal component (first / second measurement locations)
Signature	Peak particle velocity (mm/s)	0,603/0,730	0,270/0,587	0,714/0,587
	Frequency (Hz)	13,7/5,1	12,7/6,3	7,3/12
	Max. acceleration (g)	0,0331/0,00663	0,0265/0,00497	0,0265/0,00663
	Max. displacement (mm)	0,00697/0,0171	0,00381/0,0120	0,0137/0,0116
Blast # 1	Peak particle velocity (mm/s)	1,19/1,40	0,873/0,825	1,83/2,02
	Frequency (Hz)	23,8/18	25,6/26	20,5/24
	Max. acceleration (g)	0,0331/0,0199	0,0331/0,0166	0,0398/0,0331
	Max. displacement (mm)	0,0122/0,0205	0,00532/0,00822	0,0137/0,0125
Blast # 2	Peak particle velocity (mm/s)	0,702/0,988	0,540/0,524	0,984/1,14
	Frequency (Hz)	16,7/16	20,9/20	15,3/13
	Max. acceleration (g)	0,0265/0,0116	0,0265/0,00829	0,0331/0,0166
	Max. displacement (mm)	0,00682/0,00950	0,00480/0,00752	0,00890/0,00957
Blast # 3	Peak particle velocity (mm/s)	1,06/1,22	0,556/0,683	1,03/1,03
	Frequency (Hz)	17,7/13	24,7/22	10,3/8,3
	Max. acceleration (g)	0,0398/0,0133	0,0265/0,0116	0,0398/0,0166
	Max. displacement (mm)	0,0110/0,0170	0,00505/0,0142	0,0119/0,0169