Journal of Acoustical Engineering Society of Iran, Vol. 2, No. 2, 2015

Investigating the acoustical and vibrational response of a reinforced concrete safe room under air blast effects

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Abstract

Capturing the true response of a structure, such as a reinforced concrete safe room, under the effects of explosive loads, and also, the evaluation of induced damages to the structure, will give a better vision to the engineer in the design process. In this paper the acoustical and vibrational response of such a structure under the effects of air blast is investigated by employing the concrete damaged plasticity model available in ABAQUS software. The sensitivity of the safe room to explosive mass and stand-off distance of explosion source is also investigated. Moreover, the behavior of any of the RC walls at the nearest to the explosion source is evaluated. For this, maximum deflection at wall center and maximum reacting forces at the wall supports are considered. Furthermore, hearing safety of residents in the safe room is evaluated by measuring the acoustical response at the room center. The results obtained for maximum deflection indicate that by increasing the explosive mass, the maximum deflection increases. Of course, this increase has a descending slope which is due to crushing of concrete. The results of maximum reacting forces at wall supports also verified the results of maximum deflection. The results of maximum acoustical response at room center show that although there is a linear correlation between acoustical response at room center and explosive mass, but an increase in stand-off distance makes it to be nonlinear.

Keywords: Acoustical response, Vibrational response, Air blast, Concrete damaged plasticity model, Safe room

pp. 32-44 (In Persian)

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[DOR: 20.1001.1.23455748.1393.2.2.5.0]