

## **Investigation on vibration Effects of Moving Train in Desert Area**

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**Abstract:** One of the important issues of railway in desert regions is the filling of spaces between the grains from fine particles by windy sands. Windy sands as polluters of ballast layer cause to increase the track stiffness therefore will incur serious damages to sleepers, pads, rails and vehicles. In this paper according to change of track stiffness, subject of environmental vibration transfer due to train-induced has been studied. In order to, firstly the field studies of windy sand in Iran have been investigated and then the railway track in two-dimensional plane strain by using software of ABAQUS has been analyzed and track vibrations have been examined by changing the values of ballast layer stiffness. Vibrations caused by axle load at different distances from cross-section of track were analyzed and the amount of vertical vibration displacement, velocity and acceleration has been examined. Results show that with increasing ballast layer stiffness caused by the filling of sand, vertical vibration acceleration levels increased. At the end of the paper, reduction methods of train-induced vibrations have been introduced.

**Keywords:** Train induced vibration, Desert area, Windy sands, Ballast layer stiffness

### **1 Introduction**

Expansion of suburban travels and induced traffic in the most country have caused that railway lines have designed and executed. However, the move of trains in distances between cities causes to create vibration in some area especially while environmental conditions is severe such as desert areas that spaces between the grains fills from fine particles by windy sands. vibrations produced are capable that worrying effects have been on the existing structures and facilities of people in this area because of windy sands as polluters of ballast layer cause to increase the track stiffness therefore will incur serious damages to sleepers, pads, rails and vehicles. Fig. 1 shows different components of track.

Indraratna and Salim (2005) who worked in the field of mechanics of ballasted rail tracks, Selig and Waters (1994) who studied about track geotechnology and substructure management and so researchers such as Tutumluer and Dombrow (2008) who studied about effect of coal dust on railroad ballast strength and stability. The other researchers such as Yang and Hung (2008) who worked in field of wave propagation for train-induced vibrations.

In the most studies conducted and methods used, modeling of subgrade and estimation of dynamic vibration with respect to effects of windy sand have not been considered. Therefore, in this study, we firstly investigated on the field studies of windy sand in Iran finally by using software of ABAQUS, vibrations of the track due to windy sand with changing of values of ballast layer stiffness are estimated.

### **2 Stiffness and settlement of Railway track**

Many factors including particle shape, aggregate size distribution, moisture and etc effect on stiffness of ballast for example sheet-shape aggregates increase wear rate, crashing, cumulative permanent strain and reduction of track hardness and therefore most researchers recommend cubic aggregates as ballast in railway. So, dry ballast has lower hardness than the wet ballast or in the high water pressure, effective stresses between particles reduced and thus the strength, hardness and eventually resilient modulus reduced. When trains pass on track and loads with different sizes and high frequencies are applied to the track, the ballast