In the present paper, particle filter technique has been used to identify vehicle mass, suspension stiffness and damping including tyre parameters from simulated bridge accelerations at different locations. A closed form expression has been derived to generate independent response samples, required as a solution of forward problem in particle filtering technique. The generated response samples are made to be contaminated by adding artificial noise in order to reflect field condition. The mean acceleration time history has been used in particle filtering technique. The vehicle imposed dynamic load has been reconstructed with the identified parameters and compared with the simulated results. The present identification technique has been examined in presence of different level of artificial noise with bridge response simulated at different location. The effect of vehicle velocity, bridge surface roughness and choice of prior probability density parameters on the efficiency of the method has been discussed.