

Department of Civil Engineering
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Director General,
Youth Affairs, Sports, Archaeology and Tourism Department
Government of Punjab

Subject REVIEW OF REPORTS REGARDING IMPACT OF CONSTRUCTION OF
LAHORE ORANGE LINE METRO TRAIN PROJECT (FROM ALI TOWN TO
DERA GUJRAN) ON HERITAGE SITES

This is response to your letter No. DGA-II(101)/Arch/2016/3141 dated April 14, 2016. A team of experts from Civil Engineering Department has reviewed the reports submitted by NESPAK and Dr. Javed Younas Uppal regarding the subject cited above.

Thorough examination of the consultants reports regarding Orange Line Train induced vibrations on historical buildings reveals that they have used 2D Finite Element Dynamic analysis to evaluate the complex dynamic response of this state of the art project. According to them, the vibrations reaching to the buildings will be well within the tolerable limits given by German standards.

According to the report of Dr. Javed Younas Uppal, the amplitudes of vibration for various buildings without soft barriers vary from 0.5 to 1.0 mm, velocity from 0.4 to 3.0 m/sec and acceleration from 7.0 to 10.0 m/sec². Similarly, the amplitudes of vibration for various buildings with soft barriers vary from 0.2 to 1.0 mm, velocity from 0.1 to 3.0 m/sec and acceleration from 3.0 to 10.0 m/sec². He has suggested extra preventive measures to damp out the vibrations and M/s NESPAK has agreed to his suggestions.

M/s CEC, the Chinese Counterpart Consultants of M/s NESPAK have endorsed the report of M/s NESPAK by giving review notes. The letter No. LOL-CEC-REVIEW-069 dated 25-04-2016 say "Should analyze the impact of noise on the line of sensitive points of the operation of the project". It is written in the review notes that "Standard is reasonable. According to the German Standard DIN 4150 Part 3 - 1999 'Structural Vibration in Buildings', the maximum vibration velocity at the foundation level of the heritage structure shall be less than 3 mm/sec, maximum acceleration levels of 0.010 m/sec² and 0.005 m/sec² are generally considered acceptable for human comfort during day and night time according to the document titled 'Construction Vibration of Management Plan'". "According to the similar projects in China, the prediction value of the vibration velocity of the sensitive points in the cut and cover, and the predicted value is inversely proportional to the distance". They have proposed to add speed, vehicle length, train number and other parameters in the report

M/s NESPAK has further suggested more vibration mitigation measures in the cut and cover section including isolation of the Train Line structure from the other parts and provision of more

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dampers in the system. They have given undertaking that their analysis is valid, the buildings, will not experience any damage due to the operation of the train, the noise will be within acceptable limits and the occupants of the adjoining buildings will not feel any discomfort according to the world renowned standards

In light of the undertaking of the consultants, M/s NESPAK, the endorsement by the Chinese counterpart M/s CEC, the views of the independent reviewer Dr. Javed Younas Uppal and the preventive measures promised by M/s NESPAK, it is reasonable to accept the claim of the above parties. The results of the studies may be accepted in the construction stage and the work may be completed in the light of this report, the comments of the independent reviewer and the recommendations of M/s CEC.

After the construction, during the trial running of the loaded and unloaded train considering the most critical loading conditions, accelerometers, velocity transducers and noise detectors must be installed on all the historic and nearby important buildings to make sure that the on-site produced vibrations and noise actually remain within the acceptable limits

Prof. Zahid Ahmad Siddiqui
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