Transactions of the Korean Nuclear Society Autumn Meeting
Gyeongju, Korea, October 25-26, 2012

Vibration Effect on 100-MeV Accelerator Tunnel from the Environment Elements

Dae-Il Kim*, Hyeok-Jung Kwon, Bum-Sik Park, Yong-Sub Cho
PEFP, KAERI, Gyeongju, 780-904, Korea
**dikim@kaeri.re.kr*

1. Introduction

Proton Engineering Frontier Project (PEFP) is developing a 100-MeV proton linac. The building structure for an accelerator was constructed on rock field [1].

Since the accelerator site will be used for high precision performance, it will be asked to have strict conditions where low vibration levels will be allowed. It is obvious that the surrounding elements existing in the area will have an influence on the accelerator components behavior.

Next to accelerator site, there is the Gyeong-bu expressway that will make different waves depending on the traffic density towards the accelerator tunnel. And it is difficult to confirm the quantity of vibration level. Likewise, Korea Train eXpress (KTX) is operated at 1.5km distance from the site that also may disrupt the performance of the linac. It can be confirmed the quantity of vibration level due to check the schedule of KTX. Fig. 1 shows the KTX station and Gyeong-bu expressway including the accelerator site. Table 1 is summarized the degree of the perception about vibration by Bachmann and Ammann [2].

In this paper, the measurement results of the vibration sources are described and discussed.

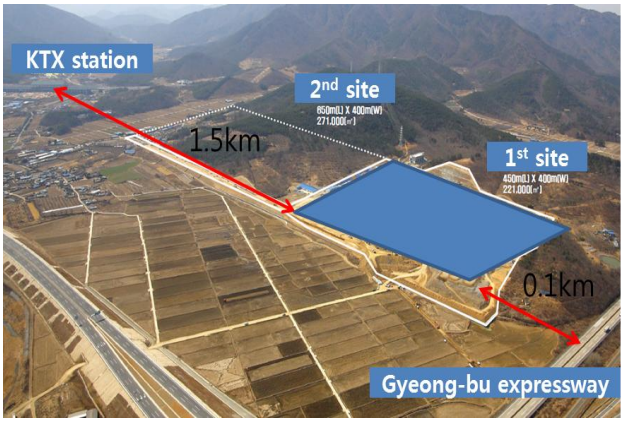

Fig. 1. Gyeong-ju site for 100MeV proton linac

Table1. Degree of the perception about vibration

Degree	Acceleration [mm/s^2]
Perception does not	60 dB
Slight crush	72dB
Surely aware of	81dB
Annoyed cause	92dB
Displeasure and anguish persists	100dB
Harming	>100dB

2. Vibration Analysis

The vibration level meter (VM-1220E, IMV) was installed on the bottom at the center of the accelerator tunnel as shown in Fig. 2. The vibration quantity of vertical motion was monitored in vibration average level. The vibration data processed with limit because approximately 550 pieces of data can be memorized using memory function of vibration level meter.

Fig. 2. Installation of vibration level meter

2.1 Vibration effect depending on KTX operation

Fig. 3 shows the vibration measurement for 45 hours. The vibration level is about 60dB during the work hours and about 27dB during the other hours such as lunch time and quitting time. For work hours, the maximum vibration level is about 84dB due to construction equipment noise.

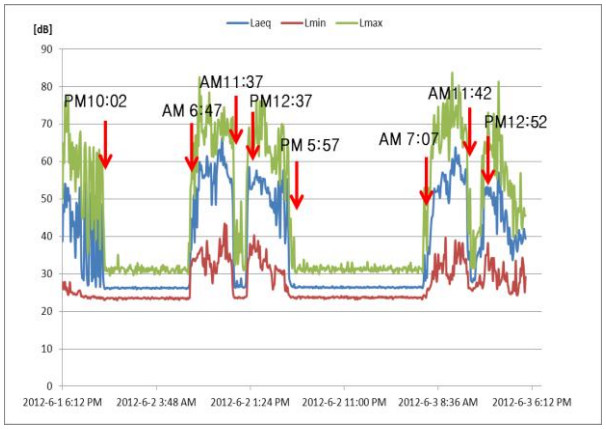

Fig. 3. Vibration measurement for 45hours (Laeq: acceleration average level, Lmin: minmum level, Lmax: maximum level)

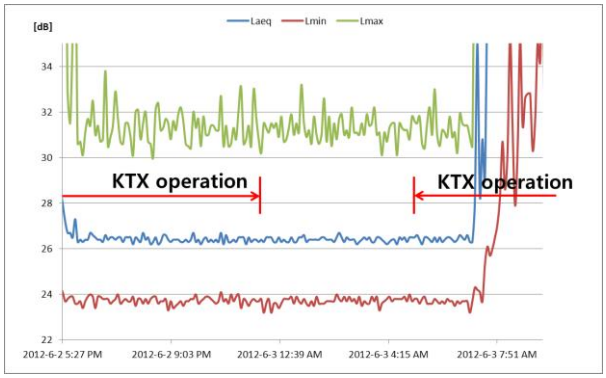

Fig. 4. KTX operation schedules on the vibration level data
(Laeq: acceleration average level, Lmin: minmum level, Lmax: maximum level)

To confirm the vibration effect by KTX operation, the operation schedule of KTX was marked on the vibration level data as shown in the Fig. 4 which is region of between PM 5:00 and AM 7:00 in Fig. 3. The measured vibration levels were about 27dB regardless of KTX operation. These test results mean that the vibration by KTX operation is not effected on the accelerator tunnel.

2.2 Vibration effect depending on an excavator operation

Fig. 5 shows the vibration level when an excavator operated near the accelerator building. This result is about 60dB similar to the vibration level results for work hour in Fig. 3 regardless of the repetitive movement by an excavator.

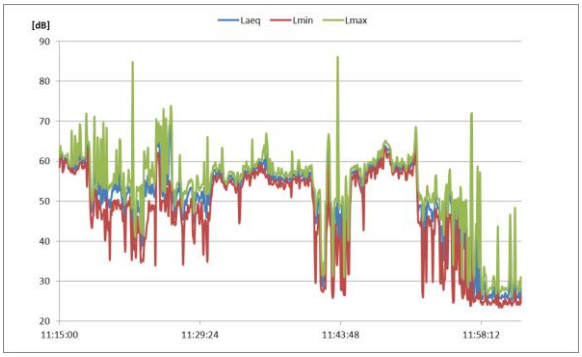

Fig. 5. Vibration effect by an excavator
(Laeq: acceleration average level, Lmin: minmum level, Lmax: maximum level)

3. Conclusions

In the vibration measurements by KTX and an excavator, the vibration effect could not find to have influence on accelerator components. After final construction, the vibration level should be investigated continuously in order to reduce the vibration sources to the accelerator components.

Acknowledgement

This work was supported by the Ministry of Education, Science and Technology of Korea.

REFERENCES

[1] Y. S. Cho, et al., "Installation of 100-MeV Proton Linac for PEFP", Proceedings of IPAC12, USA, p. 3832 (2012).
[2] Hugo Bachmann, Walter Ammann, Vibrations in Structures (International Association for Bridge and Structural Engineering, 1987), Chap. 2.