

## Federal Transit Administration: Transit Vibration Impact Criteria

The FTA has developed impact criteria for acceptable levels of ground-borne noise and vibration as summarized in Table 3. Those criteria are based, in part, on the following:

- The threshold of vibration perception for most humans is around 65 VdB (i.e. Velocity Level in Decibel Units). Levels in the 70 to 75 VdB range are often noticeable but acceptable, and levels greater than 80 VdB are often considered unacceptable.
- For light rail systems with ten to 20 trains per hour throughout the day, limits for acceptable levels of residential ground-borne vibration are usually between 70 and 75 VdB.
- For human annoyance, there is some relationship between the number of events and the degree of annoyance caused by the vibration. Therefore, for category 2 and 3 land uses, the criteria in the *FTA Guidance Manual* include an eight VdB higher impact threshold if there are fewer than 70 trains per day.
- Ground-borne vibration from any type of train operations will rarely be high enough to cause any sort of building damage, even minor cosmetic damage. The only real concern is that the vibration will be intrusive to building occupants or interfere with vibration sensitive equipment.

Some buildings, such as concert halls, TV and recording studios and theaters, can be very sensitive to vibration and noise but do not fit into any of the three categories. Because of the sensitivity of these buildings, they usually warrant special attention during the vibration impact assessment of a transit project.

**Table X**  
**FTA Ground-Borne Vibration Impact Criteria**

Land Use Category	Ground-Borne Vibration Impact Levels (VdB re 1 u-inch/sec)		Ground-Borne Noise Impact Levels (dB re 20 micro-Pa)	
	Frequent <sup>1</sup>	Infrequent <sup>2</sup>	Frequent <sup>1</sup>	Infrequent <sup>2</sup>
	Events	Events	Events	Events
<b>Category 1:</b> Buildings where low ambient vibration is essential for interior operations.	65 VdB <sup>3</sup>	65 VdB <sup>3</sup>	4	4
<b>Category 2:</b> Residences and buildings where people normally sleep.	72 VdB	80 VdB	35 VdB	43 dBA
<b>Category 3:</b> Institutional land uses with primarily daytime use.	75 VdB	83 VdB	40 dBA	48 dBA

Notes: "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category. "Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems. This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC system and stiffened floors. Vibration-sensitive equipment is not sensitive to ground-borne noise.

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**Table X****FTA Ground-Borne Vibration Impact Criteria for Special Buildings**

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Type of Building or Room	Ground-Borne Vibration Impact Levels (VdB re 1 u-inch/sec)		Ground-Borne Noise Impact Levels (dB re 20 micro-Pa)	
	Frequent <sup>1</sup> Events	Infrequent <sup>2</sup> Events	Frequent <sup>1</sup> Events	Infrequent <sup>2</sup> Events
Concert Halls	65 VdB	65 VdB	25 dBA	25 dBA
TV Studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording Studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

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Notes: "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.  
"Infrequent Events" is defined as fewer than 70 vibration events per day. This category includes most commuter rail systems.  
If the building will rarely be occupied when the trains are operating, there is no need to consider impact. As an example, consider locating a commuter rail line next to a concert hall. If no commuter trains will operate after 7 P.M., it should be rare that the trains interfere with the use of the hall.

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