# Vibration and Deflection of Steel Bridges

Paper presented by RICHARD N. WRIGHT and WILLIAM H. WALKER (January 1972 issue)

Discussion by **THOMAS M. MURRAY**

IT IS suggested in the paper that the criterion for human response to bridge vibration be the Goldman curve for sustained motion and a modification for transient motion. The purpose of this discussion is to point out the statistical inconsistencies used in the development of the Goldman curves and recommendation of a substitute curve.

The curves were produced by Goldman from data of Best, Constant, Jacklin and Liddell, Reiher and Meister, von Bekesy, and Zand. Hanes[1] has found that Goldman used a clearly unwarranted relative weighting of the various sets of data. He cites that at the threshold of perception, at frequencies of 1.5 and 2.0 Hz, the Reiher and Meister data (based on 15 subjects standing and reclining) were given five times the weight of the Jacklin and Liddell data (based on about 100 seated subjects) in determining the "average." Hanes further notes that at frequencies above 2.0 Hz, Jacklin and Liddell had no data, so this work was not involved in the average. However, for the threshold of discomfort, Jacklin and Liddell's subjects provided all of the data for the average at 1.0 Hz. Hanes concludes "the Goldman curves are essentially meaningless."

The set of curves presented by Reiher and Meister (see Ref. 2) and shown in Fig. 1 is the most frequently used criterion of human response to vertical structural movement. For transient vibration, the amplitude scale is multiplied by a factor of 10. Although Reiher and

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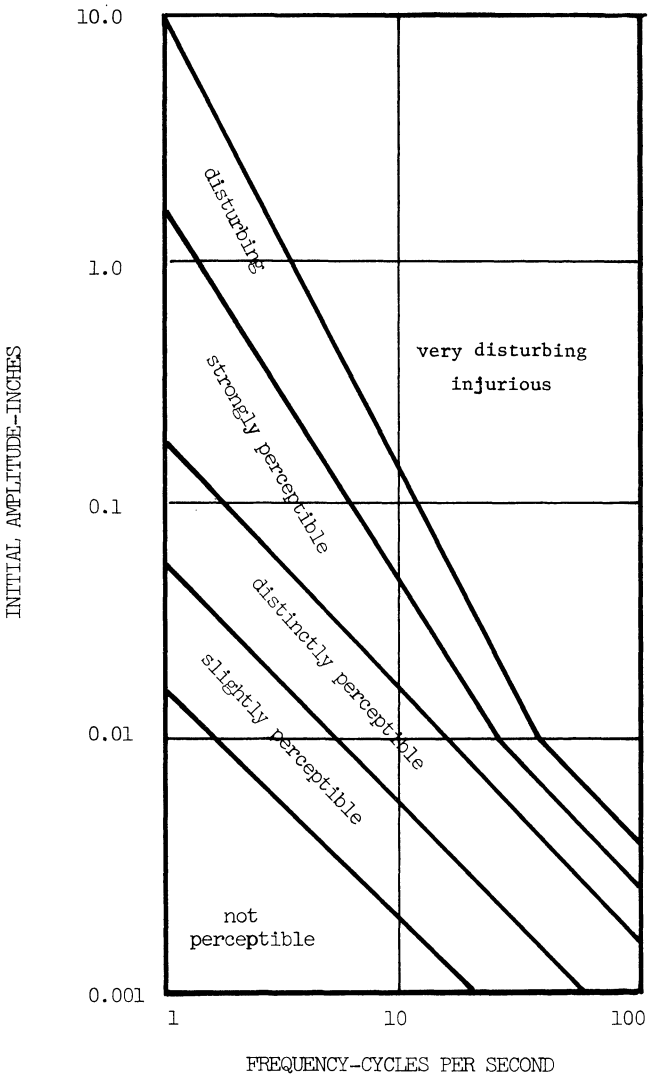


*Fig. 1. Domains of various strengths of sensations for standing persons subject to vertical vibration, adjusted for transient vibrations (after Reiher and Meister)*

Meister curves were developed using a limited number of subjects, the modified curves have been investigated on a number of different types of building floor systems by different researchers: Lenzen,[2] steel joint-concrete slab systems; Lenzen and Murray,[3] steel beam-concrete slab systems; Polensek[4] wood joist systems; Commonwealth Experimental Building Station,[5] various systems.

Based on the above investigations and on extensive literature review on human response to structure-borne vibrations,[6] this discusser recommends the use of the Reiher-Meister curves until a badly needed research program is undertaken to more accurately define human response to vibration.

## REFERENCES


1. *Hanes, R. M.* Human Sensitivity to Whole-Body Vibration in Urban Transportation Systems: A Literature Review, *Johns Hopkins University, APL/JHU-TPR 004, May, 1970.*
2. *Lenzen, K. H.* Vibration of Steel Joist-Concrete Slab Floor Systems, *Center for Research in Engineering Science, University of Kansas, 1966.*
3. *Lenzen, K. H. and Murray, T. M.* Vibration of Steel Beam-Concrete Slab Floor Systems, *Center for Research in Engineering Science, University of Kansas, 1968.*
4. *Polensek, A.* Human Response to Vibration of Wood Floor Systems, *Forest Products Research Laboratory Meeting, July, 1969.*
5. Human Sensitivity to Vibration in Buildings, *RF No. 12, Commonwealth Experimental Building Station, Sydney, Australia, May, 1966.*
6. *Pool, T. W. and Murray, T. M.* Human Response to Structure-Borne Vibrations: A Literature Review, *University of Oklahoma Research Institute, April, 1972.*