

BRIDGE FATIGUE^{13,14}

by
Bruce S. Siria
Research Engineer
Division of Research
Kentucky Department of Highways

The collapse of the Silver Bridge at Point Pleasant, West Virginia in December 1967 rekindled concern about fatigue of metal as a possible cause of failure of bridge structures. It was hypothesized that an analysis of the fatigue history of a bridge member could be derived from traffic characteristics in a manner similar to that used to design and evaluate pavement structures.

Shortly after the Silver Bridge disaster, a summary of available data (traffic counts, classification studies, and loadometer data) in Kentucky was prepared. Recommendations for a proposed methodology and the acquisition of necessary data requisite thereto were made at that time. Subsequently, weight data were collected at specific bridges by the Department of Motor Transportation. Bridges which cross the Ohio River from Kentucky were chosen as most critical from a "need for analysis" standpoint. At these same locations, classification counts and time interval data were obtained by the Division of Planning. The Division of Research collected spot-speed data.

From these data, analyses were made separately of classification data and loadometer data. Percentages of vehicle types were computed and added to previous classification counts. Spot-speed data and time interval data were critically analyzed as vital inputs for load studies of the bridges, for it was from these data that vehicle-gap probabilities were derived. Necessary loadometer data distributions, such as gross load distribution, axleload distribution, axle spacing distribution, and wheel base distribution, were analyzed as additional requisites to a bridge fatigue analysis.

For final analysis, histories of traffic characteristics and loading probabilities will be utilized in conjunction with conventional charts of stress vs number of repetitions (S-N diagrams) and load-stress relationships for various bridge members to complete a fatigue life evaluation of a bridge structure. It is anticipated that a practical analysis of the fatigue life of Ohio River bridges will be conducted.

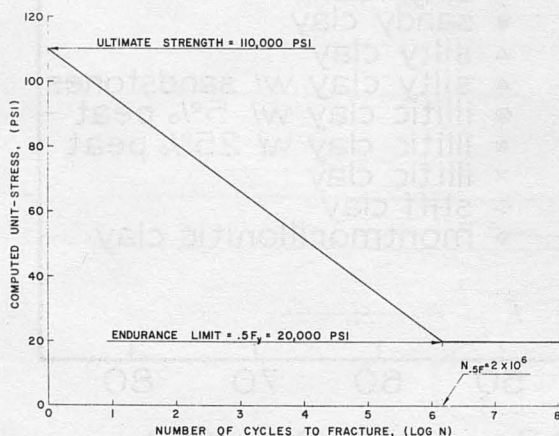


Figure 18. Typical and Idealized S-N Curve for Structural Metal

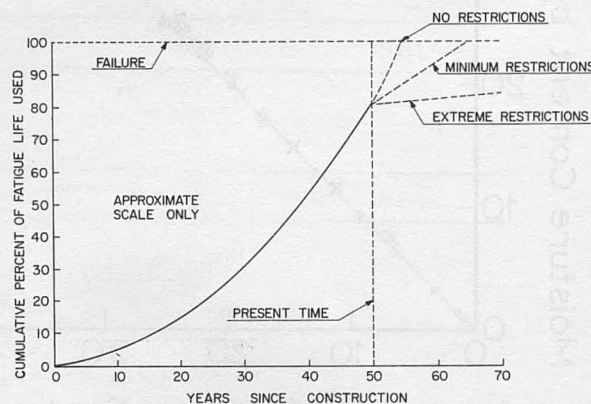


Figure 19. Possible Changes in Useful Life of a Structure as a Result of Varying Load Restrictions