

As is shown in Figures 3 and 4 a reduction in the basic allowable stress is made for stress ranges which are always a + for some conditions.

This takes us back to the previous discussion where we discussed the 60% overload and 30% overstress. With a critical number of large loads or overloads, the allowable stress should be reduced. Thus we see that the fatigue life of a member may be reduced by a large number of stress cycles slightly in excess of the fatigue limit or by a few cycles greatly in excess of the fatigue limit (overstressing). While we cannot say specifically what a change in the allowable loads will do to the actual number and size of heavy loads it is logical to assume that the truckers will take advantage of this increase. Therefore, it would seem that the fatigue life of the structures could be greatly reduced.

Just to give you an idea as to what must be considered in regard to fatigue the following discussion probably will be of value.

FACTORS AFFECTING FATIGUE OR SERVICE LIFE

The prediction of fatigue resistance is complicated by the fact that citation of maximum stress alone does not define a unique service life. In general, the stress spectrum to which a member or connection will be subjected, the nature and condition of the part, and the environment in which it will function will all influence the service life.

The factors influencing the fatigue resistance of a structural part or laboratory specimen are:

- A. Load Spectrum
 - 1. Stress ratio R
 - 2. Maximum stress
 - 3. State of stress
 - 4. Repetition of stress
 - a. Regular or random
 - b. Frequency
 - c. Rest periods
 - 5. Understressing or overstressing
- B. Nature and Condition of Member
 - 1. Prior stress history
 - a. Residual stresses
 - b. Work-hardening
 - 2. Size and shape of member
 - a. Size effect (simulation of a member by a small specimen)
 - b. Stress gradient
 - c. Presence of notches
 - 3. Metallurgical structure
 - a. Microstructure, grain size, and chemical composition
 - b. Mechanical properties
 - 4. Welding
 - a. Metallurgical
 - b. Mechanical
- C. Environment
 - 1. Temperature
 - 2. Atmosphere

The stress range and the number of cycles of loading are the two (2) most critical factors for fatigue. For example, it has been shown that for welded girder bridges with partial length cover plates a stress range of 11,300 psi leads to failure at approximately 2,000,000 cycles. If the stress range is increased to around 15,000 psi, which is a 33% increase in stress, failure can be expected to occur at approximately 1,000,000 cycles. Therefore, with a 33% overstress for this particular type of structure a reduction of 50% in the life of the structure can be anticipated. I might say that partial length welded cover plates are a common type of structural member for highway bridges.

Although it may be concluded that if controlled similar to the 1964 AASHO Policy the increased weight provisions occasioned by the 36,000 lb. tandem axle or the revised formula provided by S. 2658 will not have too bad an effect on those bridges designed for HS 20-44, it is my opinion that the increase cannot be tolerated for bridges designed for less than HS 20-44. Although the Bill provides that the new allowance apply to the Interstate System only, it is my judgment that it will be only a matter of time until pressures extend them to other systems. The matter of containing trucks to the Interstate System is, in our