Permit Upgrading

MEMO TO DESIGNERS:

The Office of Structures Design is frequently requested to upgrade a bridge to permit capacity or to update an earlier estimate made by others. The permit capacity is generally P13, but occasionally on certain routes a lesser capacity may be adequate. Check with Structures Maintenance Permit Engineer as to the capacity required.

The Office of Structure Maintenance determines the deficient structures on the State System and has adopted certain policies and procedures of which Structures Design should be aware.

I. Concrete structures are rated on the basis of the superstructure longitudinal member with the lowest moment capacity. It is also possible that other longitudinal members will require strengthening.

II. Steel girder structures are rated for longitudinal member moment capacity only, using 'P' Loads at service level and .75 f_y for the allowable flexural stress. All the deficient members are usually summarized in the "Bridge Maintenance Book."

III. For truss bridges, the compression members are rated exclusively by the Secant Formula at service level using a factor of safety of 1.48.

The rating analyses of all steel structures are retained in Maintenance and are available on request. The analyses of concrete structures are not retained.

In preparing the contract plans for upgrading concrete and steel girders, base the strengthening on LFD. Use 'P' Loads only for steel girders.

The Secant formula, when compared to the Interaction formula in the AASHTO Design Specifications, may yield significantly different results and is generally more conservative. The following guidelines should be used when preparing contract plans to upgrade a truss bridge.

A. Concentrically loaded compression members; i.e., rolled beams symmetrical about both major axis, may be analyzed with the design formulae from AASHTO 1.7.69(A)

B. Compression members with eccentricity, actual or assumed:

1. WF shapes; channels with cover plates, lacing or batten plates; and other built-up closed sections can be designed by either the interaction design formulae, AASHTO 1.7.69(B), or the Secant formula providing that consistent values for effective length, end condition factors and member eccentricity are used.

2. Built-up columns with nominal bracing on one or both faces, i.e., open angles with lacing; and other open column sections, should be analyzed using the Secant formula only.

The Secant formula can be found in the AASHTO Manual of Maintenance Inspection of Bridges. Structure Maintenance uses a different form of the Secant formula as follows:

$$P/A = \frac{F_y/F.S.}{1 + \left[\left(\frac{ec}{r^2} + .25\right) \sec \frac{KL}{2r} \sqrt{\frac{P/A(F.S.)}{E}}\right]}$$

A 'HP' Program is available for the Secant formula from the Structural Steel Committee.

The check of the concrete substructure should be limited to a cursory review unless gross deficiencies are evident or are indicated in the Bridge Book. Steel substructures should be given a structural check and a review to discover any low fatigue-resistant details.

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