# Appendix B: Compressive Deflections of Reinforced Elastomeric Bearing Pads

## B-1 Introduction

Reinforced elastomeric bearing pads consist of alternate layers of elastomer and steel sheets or fiberglass fabric reinforcement.

The compression deflections for steel and fiberglass reinforced elastomeric bearing pads can be reliably predicted within the normal range of construction tolerances. Tests performed at the Transportation Laboratory (Translab) have found that compressive strain is dependent upon two factors - compressive stress and shape factor. In addition, tests showed that compressive stress/strain behavior of fiberglass or steel-reinforced pads is not significantly dependent upon overall pad thickness. In most situations, the compressive deflection of the pad will be so small as to not affect the profile of the bridge. However, in the case of a hinge, the magnitude of the deflection should be investigated, as it may be significant.

Memo to Designers (MTD 7-1), *Bridge Bearings,* shows two figures with families of curves which can be used to predict compressive deflection based on stress, shape factor, and strain. There are separate figures for fiberglass reinforced or steel-reinforced pads, which apply regardless of overall pad thickness. If long term compressive creep is to be included in the prediction, the strain values obtained from MTD 7-1 Figure 4A, *Recommended Compressive Stress vs. Strain Curve for Fiberglass Reinforced Bearing Pads*, and Figure 4B, *Recommended Compressive Stress vs. Strain Curves for Steel-Reinforced Bearing Pads*, should be increased by 25 percent.

Tests have shown that fiberglass and steel-reinforced pads recover from dynamic creep caused by live loads. Therefore, only dead load stress will be considered in determining compressive deflection. Current bridge design practice limits the nominal compressive stress on a pad to 800 psi due to dead load and live load, not including impact load. For steel-reinforced pads with a shape factor ≥ 7.5, the average pressure shall not exceed 1000 psi. For calculating compressive deflection in the field, a dead load stress of 600 psi should be used. If a more accurate value of dead load stress is desired, contact the Bridge Design section responsible for your project plans.

Sample pads are tested at the Translab to determine the stress/strain behavior of each lot of pads. Note that the current *Standard Specifications*, Section 51-3.02A(4)(b), *Concrete Structures – Bearings – Elastomeric Bearing Pads – General – Quality Assurance – Department Acceptance*, requires samples to be obtained and tested for both plain elastomeric bearing pads as well as for steel-reinforced elastomeric bearing pads.

# B-2 Sample Calculation

Consider a 12" x 18" x 4" fiberglass reinforced bearing pad:

Assume compressive stress of 600 psi

$$\text{Shape Factor} = \frac{\text{width x length}}{\text{width} + \text{length}} \quad \frac{12(18)}{12+18} = 7.20$$

From MTD 7-1 Figure 4A, *Recommended Compressive Stress vs. Strain Curve for Fiberglass Reinforced Bearing Pads*:

Strain = 4.0% = 0.040

Compressive deflection including long term creep of 25% is equal to:
(Total Pad Thick.) x (Strain) x (125%) =
4.00 x (0.040) x (1.25) = 0.20"

Say: **3/16"**

The bearing pad thickness shown on the plans will be that for elastomer only. Note that steel-reinforced bearing pads are thicker than the corresponding fabric reinforced pads. If the thickness of a fabric reinforced pad is **T** (inches), the thickness of the corresponding steel-reinforced bearing is 1.15 **T**. See MTD 7-1 for a table of thicknesses for steel-reinforced pads. For pads more than 1/2-inch-thick, it is the responsibility of the Contractor to notify the Engineer, in writing, of the type of pad to be used before constructing the bearing seats. Bearing seat elevations must be set to correspond to the bearings to be used.