**TRANSMITTAL MEMORANDUM 96-03**

MEMO TO: Design Consultants
Division of Bridge Design Staff

FROM: Richard K. Sutherland, P.E.
Director
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DATE: May 8, 1996

SUBJECT: Tapered Elastomeric Layers in
Reinforced Elastomeric Bearings

Contrary to paragraph 14.1 of the AASHTO Specifications: "Tapered Elastomeric Layers in Reinforced Bearings are not permitted", a tapered top cover layer will be allowed. When tapered layers are used, the designer will be responsible for checking the bearing based on the least favorable rubber thickness from one side of the bearing to the other coupled with the least favorable shear modulus for the durometer hardness specified in the plans.

Therefore the following criteria must be satisfied:

1) Allowable Compressive Stress - use the thicker rubber layer with the lowest shear modulus.
2) Allowable Horizontal Movement - use the thinner rubber layer.
3) Allowable Rotation - use the thinner rubber layer with the highest shear modulus (as with non-tapered bearings the pretensioned girder rotation associated with camber may be considered as acting to cancel the rotations associated with the application of subsequent loads).
4) Anchorage Requirements - use the thinnest rubber layer and the highest shear modulus.
5) Shear Forces Transferred to the Substructure - use the thinnest rubber layer and the highest shear modulus.

The designer shall limit the plan dimension of the bearing to the plan dimensions provided for the non-tapered elastomeric bearings shown in the standard drawings. Further, the designer shall limit the magnitude of the taper to the following specific tapers for the established beam grade ranges:

| **Beam Grade Range** | **Required Taper** |
|---|---|
| 0.0 - 0.5% | 0% |
| 0.5 - 1.5% | 1% |
| 1.5 - 2.5% | 2% |
| 2.5 - 3.5% | 3% |
| 3.5 - 4.5% | 4% |
| 4.5 - 6.0% | 5.25% |

The tapered top layer of the bearing shall be dimensioned to the millimeter. We recognize that the fabricators will round the taper to the nearest 1/8 inch. In this way we will avoid building into our design a round-off error and the burden will rest with the bearing manufacturer to use the tolerance allowed in the specifications to accommodate their fabrication practices.

In any instance a tapered bearing in the range of 4.5 - 6.0% is used, the designer shall incorporate in the design some positive means of restraint of the beam to prevent slippage of the beam down grade.

Further, in the case of sag or crest vertical curve bridges where the bearing taper might theoretically vary from one span to the next (potentially jumping from one beam grade range to another), the designer should make every effort to use one of the tapers shown above throughout the bridge. For example, adjust beam seats and or haunches to bring individual beam lines into reasonable proximity of one of the listed tapers. In those instances where the designer is unable to assure a reasonably uniform bearing at each beam line at each substructure, the bridge seats and/or haunches should be adjusted to at least insure all beam ends from one span at a particular substructure are supported by pads of the same taper.

While the preceding criteria may seem cumbersome, and in some instances unworkable, our intent is to avoid unnecessarily expensive bearing details and maintenance prone details often used by other states to account for bridge grades. We consider elastomeric bearings to be very forgiving, in that they have been used for years in many “less than desirable” bearing conditions without any evidence of deficient performance. Our intent is to restrict and standardize the application of tapered pads to the extent possible. With this approach, we assure our bridges will generally include the type bearing we most prefer and provide designers with appropriate restrictions in recognition that this is a deviation from the AASHTO Specifications, while limiting the cost of the bearings by limiting the number of different bearing geometries that would no doubt result if each designer were to tailor each bearing in each bridge to the specific geometry of that bearing location.

The designer is cautioned that in the use of tapered bearings, care should be taken to insure the bottom of the beam will remain clear of the edge of the substructure concrete.