

## **ABSTRACT**

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The purpose of this study was to evaluate the applicability of several current approaches used to estimate losses in prestressed concrete members with compressive strengths greater than 15ksi. The scope of the study focused on time-dependent losses for normal weight concrete bonded applications. The approaches evaluated were the PCI Design Handbook (2010) method, the AASHTO Specifications (2012) refined method, the PCI Bridge Design Manual (2003) time-dependent analysis using both the AASHTO (2012) and the PCI-BDM (2003) creep and shrinkage models, and a time-step method developed by Swartz (2010). The methods were compared to existing data on prestress losses from twenty-two specimens with compressive strengths from 11ksi to 18ksi. However, a paucity of data existed for strengths higher than 15ksi, with only seven specimens available. Therefore, insufficient data was available to justify a change to the current limit. Based on the comparison of all approaches evaluated, the PCI-BDM (2003) time-dependent method using the PCI-BDM (2003) creep and shrinkage models was shown to give conservative estimates close to the measured losses from the available specimen data. If a simpler analysis is desired, the AASHTO (2012) refined method could be applied. Although, caution is recommended when using this method, since the

analysis conducted in this study showed that it could result in an underestimation of the losses within the range of existing data. Considering the scatter in the available data, it is recommended that more tests be carried out in order to properly evaluate extension of current approaches to design concrete strengths greater than the current limit of 15ksi. Guidance is given in this thesis on the key design parameters that should be considered in such experimental evaluation.

**Keywords:** prestress losses, high-strength concrete, creep, shrinkage, AASHTO, PCI.