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16. Abstract <p>Current seismic design philosophy uses capacity based design principles. The capacity based design procedure involves selecting locations of inelastic mechanisms at the design stage and designing designated capacity protected components. These capacity protected components are designed to remain essentially elastic during a seismic event. In capacity based design of bridges, the inelastic mechanisms are located in the columns. The bent cap, girders and interface between the bent cap and girders are designated capacity protected components and therefore are designed based on the full column overstrength moment.</p> <p>An experimental program at the University of California in San Diego (UCSD) was conducted to characterize the behavior of an innovative bridge design detail that integrates a steel superstructure with a concrete substructure using a concrete bent cap. When this integral bridge is subjected to a longitudinal seismic event, the seismic moment needs to be transferred between the girders and column through a torsional action in the bent cap. Since the bent cap is a designated capacity protected component, it needs to transfer the torsional moment elastically. The objective of this research was to establish a behavior profile of the bent cap connection in order for the connection to be designed to remain essentially elastic in future applications of the integral bridge form.</p> <p>The effect of two design parameters on the bent cap torsional behavior and capacity was investigated in a series of four component tests and one system test. The two parameters investigated were 1) bent cap reinforcement (post-tensioned versus conventionally reinforced) and 2) girder web configuration inside the bent cap (with or without bearing stiffeners). All tests were conducted at 40% scale and subjected to a quasi-static, fully reversed cyclic loading protocol. The bent cap design moment was equal to the maximum column moment overstrength at the top of the column extrapolated to the bent cap centerline and subsequently multiplied by a capacity protection factor of 1.2</p> <p>The bent caps of all component specimens reached maximum capacities greater than the column moment overstrength demand. The specimens with post-tensioned bent caps exhibited less crack dilation during the initial loading stages than the specimens with conventionally reinforced bent caps. The specimens with girder web bearing stiffeners reached maximum capacities approximately 25% higher than the specimens without girder web stiffeners. The results of the component tests led to a recommendation of a post-tensioned bent cap and steel girders with a single pair of full height bearing stiffeners for these integral bridge systems.</p> <p>The system test served to describe bent behavior in relation to column behavior as the column was subjected to increasing displacement levels. The bent cap performed essentially elastically, developing only minor cracking during the initial loading stages. Once the column failure mechanism developed, all further damage was concentrated at the column hinge and the bent cap remained essentially elastic.</p>					
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