Performance under static and fatigue loads are evaluated for two different wearing surfaces for possible use on the steel orthotropic deck of San Mateo Hayward Bridge in the bay area of California. The two wearing surface materials studied include a 2” thick (nominal) premixed polyester concrete (PC) and a 2” thick (nominal) epoxy asphalt concrete (EAC). Flexural specimens that comprise a steel-plate - wearing surface composite simulating the surfacing system and geometry specific to the orthotropic steel deck of the San Mateo Hayward Bridge are used for the static and fatigue tests. Flexural tests were conducted at different dynamic loading frequencies (0.0167, 1.0, 2.5, 5.0, 7.5, 10.0 and 15.0 Hz) and at several different temperatures (20 degrees F - 120 degrees F) to study the temperature dependency and loading rate effects. Following these tests, the fatigue tests were conducted on replicate EAC and PC composite specimens at each of room (70 degrees F), cold (32 degrees F) and hot (120 degrees F) temperatures. Both wearing surface systems performed well at the cold temperatures, surviving 10 million fatigue cycles. Both wearing surfaces experienced cracking at the room and hot temperatures prior to 10 million cycles and these cracks did not result in wearing surface delamination or local debonding. The comparative study in this exhaustive laboratory investigation has shown that the 2” thick PC material could perform equally well as the original EAC wearing surface existing on San Mateo Hayward Bridge.