



PROJECT PROFILE

Frankford Elevated Rapid Rail Line

Bearing Failure Evaluation and Repair Design | Philadelphia, PA



CLIENT

Southeastern Pennsylvania
Transportation Authority (SEPTA)

BACKGROUND

The Frankford elevated rail line was originally constructed in 1915 and extends from the center of Philadelphia to the northeast for approximately 5¼ miles. Reconstruction of the rail line was completed in 1997. The reconstruction consisted of new precast concrete decks supported on new steel stringers connected to the existing steel bents. The haunches of the precast concrete deck span perpendicular to the steel stringers and are spaced approximately every 5 feet.

The Frankford elevated rapid rail line was reconstructed due to deterioration coupled with constant inspection and maintenance. The new design was intended to have a life span of 100 years. Shortly after reconstruction was complete, haunch bearings began cracking and spalling. Others recommended repairs but did not identify the cause of distress. WJE was retained by SEPTA to perform a peer review of previous analysis and reports, review existing haunch bearing conditions, determine the cause of concrete haunch distress, and provide repair details.



SOLUTION

WJE visually inspected and documented the condition of 18,000 haunches using a web-based user interface developed in-house and database software. WJE engineers installed instrumentation to perform field testing under controlled conditions and during normal train operation to measure the cyclic loads, stresses, and displacements experienced by the haunches and supporting steel stringers. Surplus decks were tested in WJE's structural laboratory to evaluate the different loading mechanisms causing the haunch distress.

A repair was designed and then tested in the structural laboratory based on the field test measurements to determine the ability to resist cyclic loading. The repair design was able to resist over forty-five years of simulated loading without any deterioration or loss of bearing support. The repair has been implemented on the rail line.

