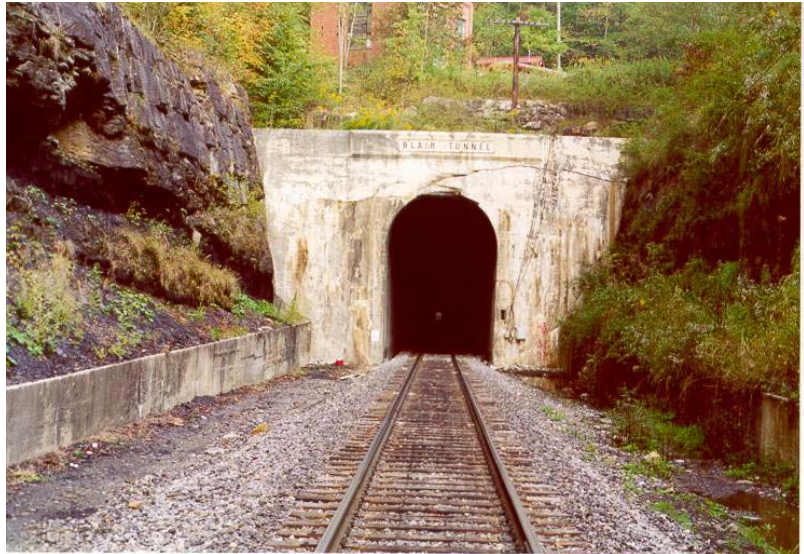


Norfolk Southern Blair Railroad Tunnel

CNA investigated the causes of tunnel distress and developed repair recommendations for the Norfolk Southern Blair Railroad Tunnel, located near Jewel Ridge, Virginia. This tunnel was designed in the late 1960's and construction was completed by 1971. By 1984, tunnel liner cracking and water inflow near the east portal necessitated repairs consisting of crack sealing, liner patching, rockbolting and improved drainage. By 1998, tunnel liner cracking and water inflow had reached unacceptable levels, with pieces of the tunnel liner falling from the crown onto the tracks, and ice formation during the winter.

The repair alternatives for the Blair Railroad Tunnel fit into three time frames. Short-term repairs would cover up the problems and make the tunnel passable for a few years. Medium-term repairs would slow down but not stop the deterioration. Long-term repairs would solve the problems and provide the service life of a new tunnel. The preferred repair alternative would tradeoff technical issues, available funds and tunnel functionality.



CNA found that the Blair Railroad Tunnel was undergoing liner failure as the result of high horizontal rock loads caused in part by in situ rock stresses and in part by nearby coal mining and pillar robbing. The large shear movements that occurred before the 1980's repair, the failure of the 1980's repairs, and subsequent additional failure further into the tunnel indicated that the rock loads and movements had not reached equilibrium.

The recommended repairs were to scale and patch the existing liner, epoxy grout major cracks, install rockbolts in the tunnel crown to support the liner in place, localize liner crushing by cutting a longitudinal notch in the liner at the crown, provide drainage by placing insulated drainage pans in grooves cut in the liner, and place instrumentation to determine long term behavior.

Owner — Norfolk Southern Railroad

Completion Date — Fiscal Year 1999

Construction Cost — \$900,000

CNA
Consulting
Engineers

2800 University Ave. SE, #102
Minneapolis, MN 55414
Ph: (612) 379-8805
Fax: (612) 379-8160
E-mail: bkn@cnaengineers.com