After the Civil War, a large number of black Baptists migrated to Baltimore. This church was organized in 1872 by black Baptists of the Sharp-Leadenhall area, with the help of the Maryland Baptist Union Association. It is the second oldest church building in Baltimore continuously occupied by the same black congregation. The neighboring areas of Sharp-Leadenhall and Otterbein are rich in black history, but many of the buildings which housed the people and institutions intimately associated with the advancement of blacks since the Civil War have been demolished. Leadenhall Baptist Church is one of the rare survivors.

The church was designed and built by Joseph B. Thomas and Son, Baptists and local manufacturers of building materials and furniture. The Thomas family commissions included the City Council chambers of Baltimore City Hall (George A. Frederick, 1867-75), and the interiors of Grace Methodist Episcopal Church (now Metropolitan United Methodist, Frank E. Davis, 1874) and First English Lutheran Church (now New Shiloh Baptist, Frank E. Davis, 1874).

The original appearance of the church is recorded in the 1885 engraving shown below.