

Collapse! Aftermath and Investigation

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For more than 30 years, Mr. Klein has studied and delivered solutions for buildings and bridges suffering from deterioration, distress or failure. He has investigated several major collapses, including the 1981 collapse of the sky walks in the Kansas City Hyatt Regency Hotel and the 1996 collapse of the KB Bridge in the Republic of Palau. He has also researched behavior of precast spandrel beams and volume change of precast buildings.

Summary

Based on more than 30 years of experience in investigating collapses of major bridges and other structures, this paper describes the immediate considerations in the aftermath of a collapse, as well as key steps in the investigation. The paper describes the role of involved parties and activities at the site immediately after a collapse. The primary considerations in the aftermath of a collapse include rescue and recovery, site security, restoring service or resuming construction, media relations, and preservation of key evidence. Key steps in investigations include documentation of conditions at the site, procurement and testing of construction materials, structural analyses, as well as structural tests of surviving elements and replicas.

Keywords: Collapse, investigation, documentation, evidence, analysis, testing

1. Introduction

During a tea dance on 17 July 1981, the suspended walkways through the lobby of the Kansas City Hyatt Regency hotel collapsed (Figure 1), killing 114 people and injuring 216 others [1]. At the time, it was the deadliest structural collapse in US history. First responders worked feverishly to rescue people who were trapped and injured, and to recover the bodies of the deceased. The US government, as well as engineers representing the owners and other parties, carried out intensive investigations into the cause of the collapse.

In September 1996, six months after the post-tensioned concrete bridge was retrofitted to correct midspan sag, the 241-meter main span of the Koror-Babeldaob suddenly collapsed into the Toegel Channel (Figure 2) [2]. Two motorists were killed and four more were injured. Local fishermen and dive shop operators managed to save many more who plunged into the 30 m deep channel. Several months after the collapse, the Republic of Palau engaged an engineering team led by Wiss, Janney, Elstner Associates, Inc. (WJE) to investigate the cause.

The twin towers of the World Trade Center collapsed on 11 September 2001 shortly after hijacked airliners flew into the towers (Figure 3) [3]. The terrorist attack killed 2,752 people, including all 157 passengers and crew aboard the two airplanes. Following the attack, hundreds of police, firefighters, contractors, and engineers — as well as volunteers from across the country — worked to rescue survivors, recover bodies, and clean up the site. With assistance from several engineering firms and professional associations, the US National Institute of Standards and Technology (NIST) coordinated a four-year investigation into the collapse. While it was clear from the start that the towers collapsed as a result of an act of terrorism, the purposed of the NIST investigation was to learn from the performance of the structures after the attack.

During the evening rush hour on 1 August 2007, the I-35W Bridge suddenly collapsed, killing 13 people and injuring 135 [4]. Emergency personnel and civilians worked through the night rescuing people who were trapped in their vehicles. Seventy-five local, state, and federal agencies were