

## 4.3.13 Structural Collapse

### 4.3.13.1 Location and Extent

Based upon building age, construction type, maintenance, and modification, structural collapses could happen anywhere within the limits of the Lehigh Valley. In addition, incidents of structural collapse may be reported as a cascading event following the identification of another incident. For example, the identification of a water main break under a residence may cause the failure of any of the load bearing elements within a structure.

### 4.3.13.2 Range of Magnitude

A structural collapse is defined by the Occupational Health and Safety Administration (OSHA) as the point when load bearing structural elements fail. Structural collapse severity can range from the single failure of a load-bearing element within or on a structure, weakening it, to the failure of all load-bearing elements within a structure bringing about the complete collapse of the structure.

Following any type of collapse, partial or complete, the development of additional cascading effects must be anticipated. Building construction utilizes load bearing and non-load bearing voids to house transmission lines for gases, liquids, and other products based upon the use of the structure. The failure of any of these elements can create the release of an unwanted material into the environment either from product in use within the building (e.g., natural gas, water, electricity) or used in the building's construction (e.g., sheetrock dust, asbestos or any other building product). Additionally, the reaction of the public, residents, or individuals trapped may create an environment of hysteria creating the possibility of civil unrest.

### 4.3.13.3 Past Occurrence

Historical records for the Lehigh Valley, submitted annually to the state, note two incidents of structure collapse, not generated as a cascading impact from a separate incident, over the past decade. In 2006, while constructing a new apartment building in Upper Macungie Township, Lehigh County construction crews reported a catastrophic failure of the structure. No injuries resulted from this incident. In 2007, a ceiling within a commercial building in Bangor Township, Northampton County failed, temporarily trapping four individuals.

In addition to stand-alone incidents, some notable structural failures based upon other incidents have caused significant damage within the Lehigh Valley. Lehigh County has been home to notable structural collapses suspected of being generated from incidents such as water main breaks or sinkholes. The most notable of these incidents happened in 1994 in the City of Allentown. A commercial structure valued at over 9 million dollars was impacted by a large sinkhole, which caused the failure of systems within the structure. Following unsuccessful mitigation attempts, the structure was imploded in order to minimize any additional damage to surrounding structures.

Similar to Lehigh County, Northampton County has also been impacted by structural collapses based upon cascading events. In 2008 a large sinkhole at an apartment complex in Hanover Township, Northampton County forced the evacuation of over 40 residents. The incident caused the failure of load bearing walls within the structures, ultimately leading to the demolition of the two buildings. In addition, the City of Easton evacuated an apartment complex in 2004 following the development of a large sinkhole. The structure sustained partial failure of load bearing elements forcing the relocation of 25 residents.

Additional information on land subsidence (sinkhole) frequency can be found in Section 4.3.9.

#### 4.3.13.4 Future Occurrence

Structural collapse within the Lehigh Valley is generally considered as a cascading event following another incident. The regional geography, soil make-up, and age of infrastructure leave it prone to incidents such as land subsidence, which, based upon location can lead to a partial through total structural collapse. Based upon the Risk Factor Methodology Probability Criteria, the likelihood of a structural collapse within the region, due to a non-cascading event, still remains very unlikely.

*Table 4.3.13-1. Likelihood of Future Occurrence of Structural Collapse*

County	Avg. #/Year	% Probability	Category
<b>Structural Collapse (non-cascading impact)</b>			
Lehigh	<1	10	Very Unlikely
Northampton	<1	10	Very Unlikely
<b>Structural Collapse (cascading event)</b>			
Lehigh	<1	10	Very Unlikely
Northampton	<1	20	Very Unlikely

Source: Pennsylvania Emergency Incident Reporting System (PEIRS); Knowledge Center, County 9-1-1 Databases

#### 4.3.13.5 Vulnerability Assessment

All infrastructure, commercial and industrial businesses, and residential structures within the Lehigh Valley are vulnerable to loss due to structural collapse whether due to a cascading event or a catastrophic structural failure. This vulnerability is compounded due to the ground composition, which is prone to subsidence throughout the region.