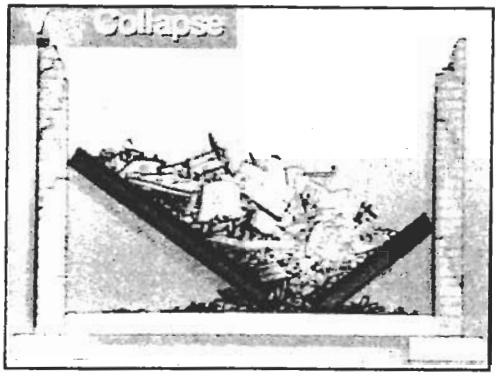
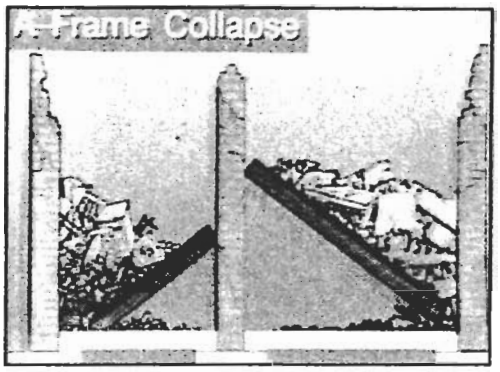
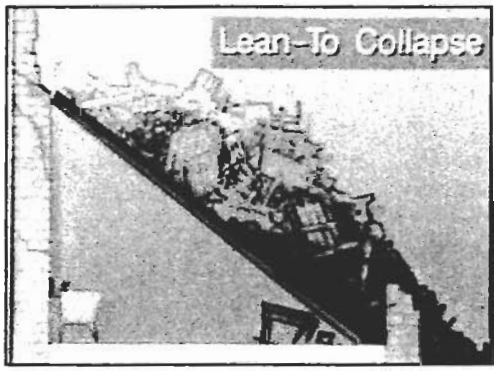
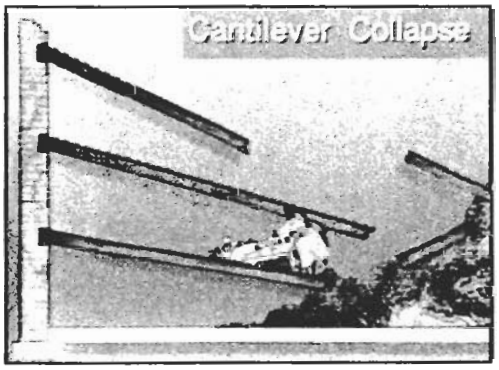
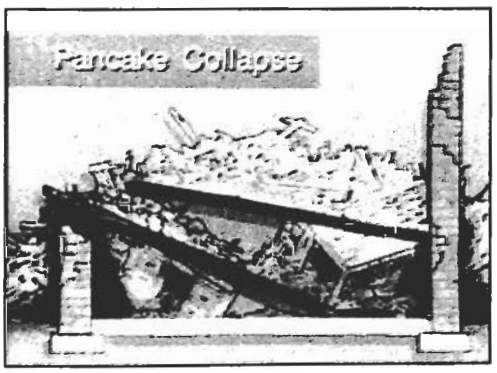
all photos/artwork by or courtesy of Battalion Chief Raymond M Downey











Types of Collapse

by Battalion Chief Raymond M. Downey, SOC

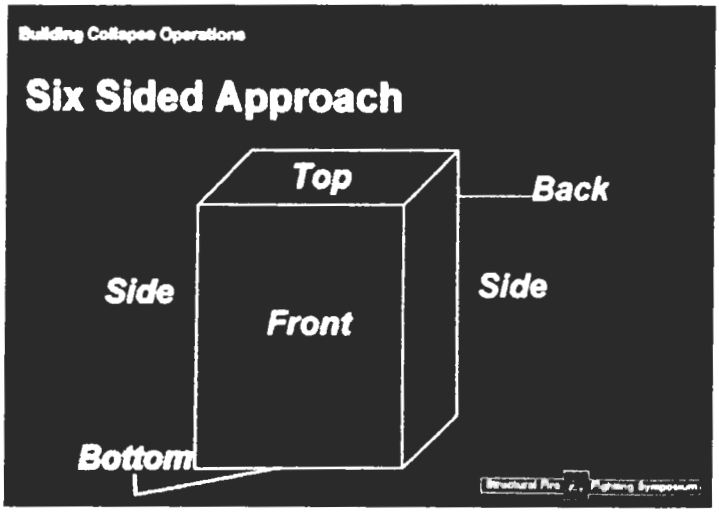
In the "Rescue Operations" portion of "State Street, Brooklyn, Collapse," by Battalion Chief Raymond M. Downey, *WNYF* 4th/2000, it was noted that there are generally five recognized types of collapse:

1. V-shape
2. A-frame or tent
3. Lean-to
4. Unsupported lean-to, also known as cantilever
5. Pancake.

Why is it important that firefighters know what type of collapse has occurred? What are the advantages and negatives of operating at such a collapse?

Typically, when buildings collapse, there are voids that are created, depending upon what and how the debris settles. There are six possible sides that can provide access--the top and bottom, front and rear and both sides. It usually is uncommon that there are more than a few sides of the six-sided approach that can be used at any collapse operation.

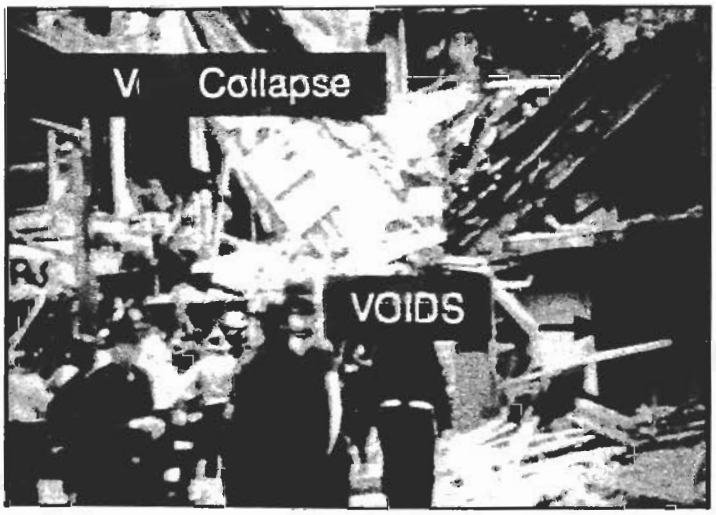
During the State Street collapse, the main means of reaching the victims were



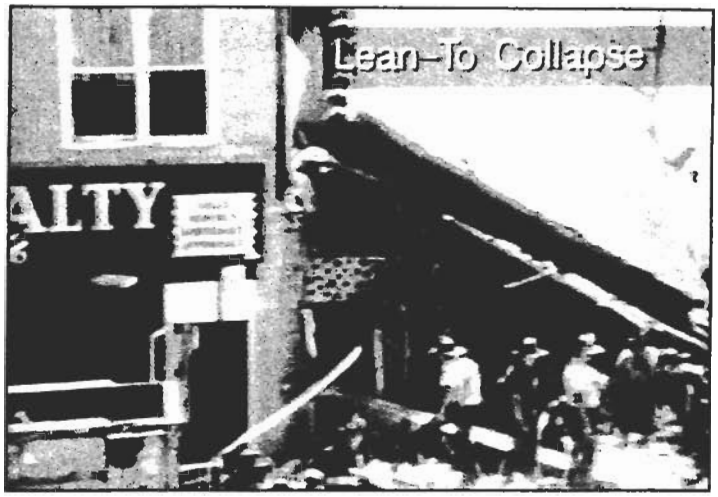
from the top and rear. Access was made from the bottom, but removing any debris would have caused a secondary collapse and trapped rescuers.

At another point, access was made from a void on the exposure #2 side, but provided only about five feet of space with the rest blocked by tons of debris. At times, some void openings are blocked partially by debris, furniture, etc., which must be removed so entry can be made. Experienced rescuers must use *extreme* caution in circumstances where debris removal in voids is necessary. Void shoring must be used to stabilize any area from which debris or other material has been removed. Remember, any action has a reaction.

A ***V-shaped collapse*** usually occurs when center support is compromised and the floor or roof collapses and settles into the shape of a V. The cause could be from structural weakness, removal of a supporting member or explosion, to name a few. Victims can be found in the debris formed by the legs of the V and the void spaces created can provide access to other possible victims. Structural stability of the remaining structure--whether it is the V collapse or remaining walls--must be examined closely for potential further collapse.



At this V-shaped collapse in the Washington Market, Manhattan, note the void spaces indicated by the arrows.



(Above) A propane explosion produced this lean-to collapse in Borough Park, Brooklyn.

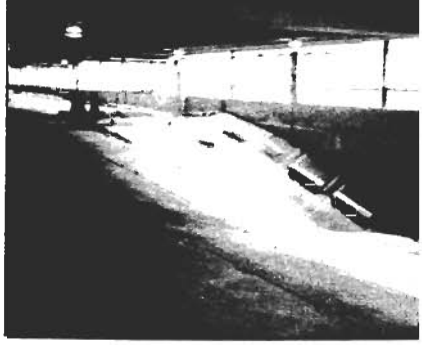
The ***A-frame or tent collapse***, often referred to as the inverted V, provides access openings with center wall support. It must be remembered there is potential for all three walls to be compromised. If the collapsed building is attached to another structure, the attached building must be examined for possible damage, too. Victims possibly can be found in the debris or void openings created by the collapse.

The ***lean-to collapse*** occurs when only one side of the floor, roof or structure collapses and forms a lean-to. The remaining walls must be checked for stability and the base of the lean-to must be examined to assess how it's resting at that point and if it is supported sufficiently.

Depending upon the amount of furniture, debris, material, etc., resting on the leg (floor, etc.) of the lean-to, caution must be exercised when operating in the void. At times, it may have to be shored to provide additional support and stability. Again, always check any other attached walls, structures, floors, etc.

The fourth type of collapse is the ***unsupported lean-to,*** also known as the ***cantilever collapse***. It is one of the most dangerous types of collapse at which members operate. After the collapse, the remaining structure/s is unsupported and hanging freely in the air. Victims still can be trapped on these floors, which makes rescue very difficult.

In photo above, the top floors reveal an unsupported lean-to collapse and the bottom exhibits a pancake collapse at August 1997 incident at 3851 Flatlands Avenue, Brooklyn.



Above and left, the Queens parking garage collapse. In photo at left, note where corbel used to sit. It was not reinforced. Remaining corbels are holding garage floor in photo above.

Additionally, debris can be left on the remaining structure and slide off or fall down on members below. This is a situation where extreme caution must be taken when operating at or near these kinds of collapse. There have been cases where victims slid down the cantilever section and landed on the debris pile and survived. The real danger occurs when during initial operations, rescuers performing searches possibly could be exposed to falling debris or a secondary collapse occurs and the remaining structure falls.

The ***pancake collapse*** generally has the fewest void spaces and is considered to offer the least chance of survival for victims. A complete pancake collapse results in a large pile of debris. Floors land one on top of each other and void spaces usually are non-existent. There are other times when floors collapse on each other, yet furniture or other materials provide enough space to create a small void. Operations at these incidents are extremely difficult due to the amount and compactness of the debris. Hand-by-hand operations are time-consuming, but must be employed in hope of finding survivors.

Operating in any void in a pancake collapse is extremely dangerous due to the size and secondary collapse potential. A floor could be resting on a piece of furniture and any movement in the area could dislodge the floor.

The type of construction impacts all kinds of collapse. Consider the weight of materials when collapses occur. Wood construction in a private dwelling collapse will be a lot easier to move than debris from a collapse occurring in a reinforced concrete structure. Operations will be much more difficult and time-consuming in concrete structure collapses. In a Queens parking garage, the structural failure of a supporting corbel, which was holding a parking level floor, caused near complete failure of that floor level.

Collapse operations require close supervision, extreme caution, knowledge, experience and a lot of patience. There are numerous reasons for collapses, one of which we deal with on any given day--*fire*. Respect the collapse and beware of the secondary collapse. "He" generally doesn't give firefighters a second chance.

About the Author...

Battalion Chief Raymond M. Downey is a 38-year veteran with the FDNY and heads up the Special Operations Command--Rescue Operations. He is a Contributing Editor for Fire Engineering, *the author of* The Rescue Company, *a regular contributor to* WNYF *and a frequently requested speaker and instructor throughout the country. He holds an AAS degree in Fire Science.*