

## Preventing School Roof Collapse

Private Schools Need to Review Load Capacity & Structural Integrity

*Every book has a cover; every building has a roof; and both have a story to tell. Like the cover of a book, the roof is there to protect its contents. Sometimes it fails.*



Roof fails from wet snow overload at Claypit Elementary School in Wayland, MA, 2003.

construction. Still others fail because maintenance was postponed or because there were no funds for inspection services. Whatever the reason, a roof collapse can be disastrous in terms of life and most certainly expensive in terms of injuries, property damage, and disruption.

The public media frequently remind us of the frailty of roofs. Thousands of roofs collapse each year, many from being overloaded with snow, rainwater, ice, or equipment, or from severe winds. Others collapse from faulty design, defective materials, or poor workmanship/

Although public schools often receive more media attention than private schools when there is a roof collapse, some private schools may be at higher risk than others. The degree of risk for all schools is related to the resources available to inspect, prevent, and mitigate losses. Schools that have available trained staff who can inspect roof structures, install supplementary structural members where necessary, and make routine

pg 3

## SCHOOL SECURITY CONCERNS vs. THE U.S. CONSTITUTION

Six parallels come to mind when comparing the battle against school violence and the war on terrorism: good intelligence, accurate and quick threat assessment, the evil and unpredictable nature of some people, the lack of short-term solutions, violations of constitutional rights, and early and appropriate measures of force.

Good intelligence involves separating real threats from rumors and misinformation. In the battle against school violence, intelligence is the cornerstone of deterrence. Yet the foretelling of school violence has been plagued by over-reaction and the inability of authorities to differentiate between threat and defamation. In some cases there has been a lack of timely action when action was necessary.



### INSIDE THIS ISSUE:

Preventing School Roof Collapse .....	1
School Security Concerns vs. the U.S. Constitution .....	1
Stay Informed .....	2
Contact Us .....	2

pg 4

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May 2005 bring you Peace  
and Prosperity*

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# ADVANTAGE

## Preventing School Roof Collapse, cont'd from page 1

repairs are less likely to incur weather-related and structural roof-related losses. Facility interruptions following a roof collapse are inevitable, and most schools have contingency plans. Any building modifications or repairs would require financial resources, which usually are available or can be made available to prevent disastrous conditions. Insurance, however, is usually the financial resource of choice to pay for actual damages as it prevents shock losses from impacting budgets and financial statements .

Most roof collapses are due to overloading the structure. Snow and ice are the prime culprits in the Northeast. In other sections of the country wind is a major factor in roof destruction. Occasionally there is a catastrophic structural problem. When the structure fails because of a design defect that could affect many other buildings across the region or nation, the loss usually receives national attention, and, in some cases may affect building codes. The 2004 roof collapse in Washingtonville, NY, is a prime example of a structural design defect that warrants widespread attention (contra). Because snow, ice and water accumulation is responsible for so many school roof failures, several cases, both private and public, are included in this article.

**Private schools may be at higher risk than public schools. Private schools need to carry adequate property, business interruption, and extra expense insurance.**

### Washingtonville, NY, School Roof Collapsed in 2004 when Critical Joist Failed

School buildings aren't immune to roof failures. In fact, there is a long history of such failures in both public and private buildings. In the summer of 2004 there was a partial roof collapse at an elementary school in Washingtonville, NY, that received a lot of attention, not because people were injured – none were – but because the incident arose from a failed steel joist of a type common to a high percentage of schools in this country.

The failed roof support, a U-shaped joist commonly used in school construction throughout the U.S. from 1900 to the early 1970s, had thoroughly rusted through from years of exposure to water from a leaking roof. Professional engineers report that this failure wouldn't have happened were it not for the leaking roof. In fact, other parts of the building with non-leaking roofs, but with similar construction materials, sustained no damage.

At the 44-year-old Taft Elementary School in Washingtonville, rainwater had collected in the joist, which wasted away until it finally gave way. A plaster drop ceiling beneath the roof hid the damaged joists for years and gave no indication

➔ pg 5

**The post-accident engineering findings regarding the roof collapse at Taft Elementary School provide us a critical opportunity. Every school district with school buildings constructed prior to 1980 should be inspected for potential roof failure. Engineers should determine if U-shaped steel joists were used in the construction of the building; and, if so, has their integrity been retained. Rusted joists should be analyzed by a professional structural engineer and replaced or repaired as necessary.**

## School Security Concerns, cont'd from page 1



In numerous Internet incidents, defamatory statements and inappropriate portrayals of classmates and school staff have been treated as though they were serious threats. Parents and civil libertarians are increasingly attacking the actions taken by school authorities as unlawful violations of student rights as guaranteed by the U.S. Constitution.

Schools all across America have for centuries exercised assumed authority to suspend, expel or otherwise discipline students, faculty, or school employees who are deemed a threat or disruptive force within the school environment. In recent decades the courts have been gradually eroding that authority. The most contentious issue emanates from the First Amendment to the U.S. Constitution, namely, the right of citizens to freedom of speech.

Most schools that have been sued for taking disciplinary action against students for making threats — against the school or persons associated with the school — or posting obscenities on the Internet have been unpersuasive in court. In lawsuit after lawsuit, schools have been compelled to make restitution or pay judgments. Many schools have reached out-of-court settlements when their cases faltered. With few exceptions, students have succeeded in arguing their rights to free speech when those rights are exercised off-campus.

The U.S. Supreme Court established the playing field in two seminal rulings made years ago, both involving high schools. In *Tinker v. Des Moines* (1969), which involved student protests to the war in Vietnam, the Court said that unless speech “materially disrupts classwork or involves substantial disorder or invasion of the rights of others,” the school couldn’t restrict expression, even on school grounds. In *Hazelwood School*

*District v. Kuhlmeier* (1988) the court ruled that the school district could censor student publications, on educational grounds, if that speech is part of an educational activity.

In the past decade hundreds of students have used their home computers to publish hit lists, make defamatory statements, or post false, composite pictures of students or officials doing obscene things. Most have simply made statements disparaging specific persons or made veiled threats that some persons might classify as pranks. The American Civil Liberties Union has been a staunch courtroom supporter of the rights of students who publish their feelings or anger on Websites, arguing, successfully in most cases, that the First Amendment protects the students.

Typical is an Oregon case in which a student and the ACLU filed a First Amendment lawsuit in federal court requesting more than \$100,000 from a school district for pain, suffering, and embarrassment caused the plaintiff when he was expelled for making obscenity-laden jabs at teachers, students, and others on the Internet. In Michigan, in response to a lawsuit seeking \$75,000, a federal judge ruled that a school district violated a student’s right to freedom of speech and due process when the district expelled the student for posting “intimidation and threats” on Satan’s Web page, a message that called for readers to stab someone at random, set them on fire, watch them suffer, and throw them off a cliff.



In Pennsylvania a school district paid \$60,000 to settle a lawsuit filed by a student who was ejected from the volleyball team for posting an Internet message defamatory to a school art teacher. The

# ADVANTAGE

## Preventing School Roof Collapse, cont'd from page 3

there was a moisture problem above the ceiling. Failure occurred on August 1, 2004.

The school had been inspected in 2001 and 2003. Both inspection reports noted unsatisfactory roof conditions. The original roof was a “tectum roof deck,” a composite panel structure supported by steel joists, reportedly built around 1958-1960. More recent work may have been done in 1985. About half of the original joists were sloped to create roof drainage; the other half had no pitch, and drainage was achieved through a tapered lightweight fill over the 2-inch tectum roof deck.

Most of the joists used at Taft Elementary were type “SJI46,” a U-shaped beam made from continuous formed plate, the top of which can trap water. The joists were spaced 36 inches-on-center. A problem arises in non-pitched areas if the steel joist deflects and water accumulates for long periods of time, eventually causing the joist to rust through.

The joists in the failed section of the Taft school building were not pitched. The collapse was the “result of a localized overload coupled with a decrease in roof joist capacity due to localized corrosion,” according to consulting engineers for the school district, McGoey, Hauser, and Edsall, P.C. of Milford, Pennsylvania. There is no problem with the SJI46 joist design as long as there are no roof leaks, which is why periodic roof and joist inspections and suitable, timely maintenance are critical.

The cost to repair the roof for the conditions reported in 2001 and 2003 was estimated at

\$950,000. The reports suggested, “replace roof with B.U.R.” Neither report mentioned wasted roof joists. Subsequent to the failure, engineers recommended a complete roof and ceiling replacement. The new roof would consist of a new metal deck over new structural beams and would be pitched to the drains.

Faulty construction can negate architectural safe load calculations for water or snow accumulation, especially if there is roof-sag.

A quick inspection by a structural engineer can readily determine if this type of joist is used in your school building, and, if so, the condition of each joist. With more than half of the nation’s existing schools having been built before 1970, according to

a Government Accounting Office census taken in 1996, other schools may well be in danger.

New York State’s Education Department put out a structural advisory to schools statewide, and other states have given notice that buildings should be inspected for U-joist problems. Interestingly, New York had put out a statewide structural defects warning in 1996 without reference to this problem, following the structural failure of a school cafeteria roof in North Syracuse; this specific joist problem was unknown at the time.

### School Roof Failures Are Common

Leaking roofs are common in schools. Repairing or replacing a roof is expensive and can often be put off for “next year” when funds might be more available. Next year sometimes doesn’t come soon enough.

The GAO noted that one third of the schools it



Courtesy Wayland, MA School Dept. Claypit Elementary School, 2003.

## School Security Concerns, cont'd from page 4

ACLU argued that the school shouldn't be allowed to punish a student for posting a non-threatening message on a Website simply because it offended someone. The plaintiff argued that he had a constitutional right to criticize the school.

The ACLU said that if teachers don't like what students say about them off-campus, they should inform the parents, not punish the student. That's the parents' prerogative to do or not do.

There has been one notable exception to the plethora of adverse court rulings. In 2002 the Pennsylvania Supreme Court upheld the 1998 expulsion of an eighth grader whose Website contained violent images directed against an algebra teacher. Besides ridiculing her physical characteristics, the Website included a solicitation for \$20 for a hit man to kill the teacher. The Website publisher also directed insults at the school principal. The student's parents sued the school for expelling their son, defending his right to free speech. The lower courts and the state Supreme Court disagreed saying the Website disrupted the school environment, thereby justifying the expulsion. The teacher said she suffered emotionally from the Website attack on her, and she took medical leave for the rest of the 1997-1998 school year. In a separate defamation lawsuit filed by the teacher, a jury ordered the parents to pay the teacher \$500,000 for invasion of privacy. The principal also sued the family, and that case settled out of court in favor of the principal.

Win or not, students who make threats or who post misinformation, false characterizations, or obscenities on Websites directed against classmates, faculty members, or

administrators are causing physical, psychological, and emotional harm across the nation. Always there is a high cost, major frustration, and demoralization.

A student's rights advocate, the Student Press Law Center, doesn't approve of schools punishing students; it and other organizations suggest that an appropriate remedy for an offended person is a lawsuit by the individual for defamation, slander, invasion of privacy, denial of rights, and the like. The SPLC said, students "are legally obligated to follow the same legal rules that everyone else is." Such lawsuits may yet prove to be the best deterrent, especially those filed for defamation, personal injury, and invasion of privacy.

Internet service providers may shut down offending Websites that may cause personal harm, but that action is also open to court challenge. Some schools have been successful with traditional suspensions and other disciplinary measures, but typically those are schools that haven't been challenged in court.

The National Education Association warns that many schools have been defeated in court over the First Amendment. Schools should mete out serious disciplinary measures only in compliance with *Tinker* and *Hazelwood*. The National School Boards Association, which has about 95,000 members, opines that since Columbine, schools cannot afford to overlook what years ago might have been treated as a prank. Where there is an outright threat, action is needed, the federation says. As for the taunts and obnoxious Web postings, the organization has suggested schools develop a thicker skin.

**Private schools face other security issues, not the least of which is kidnapping and extortion. In the next issue of Advantage, we will discuss this subject, including insurance and loss prevention.**

### Amendment I

*Congress shall make no law respecting an establishment of religion, or prohibiting the free exercise thereof; or abridging the freedom of speech, or of the press; or the right of the people peaceably to assemble, and to petition the government for a redress of grievances.*



# ADVANTAGE

## Preventing School Roof Collapse, cont'd from page 5

surveyed in 1996 needed extensive repair or replacement of one or more buildings; among the most pressing concerns were roofs that needed patching or replacing.

Schools have experienced roof collapses, from a variety of proximate causes. In 2000 the entire roof over the gym of East High School in Cleveland collapsed injuring three students and two adults. The supporting walls remained standing. The culprit in this case was a crack in a supporting beam.

On Saturday, February 23, 2003, snow and rain caused a partial roof cave-in of a school in Sunderland, Massachusetts. The collapse broke pipes, and a flood ensued, damaging the entire building. Fortunately, it was a weekend, and there were no injuries.

A day later the gymnasium roof of the Claypit Hill Elementary School in Wayland, Massachusetts, collapsed from a 2-foot rain, ice and snow overload. Because it was a weekend, no children were present, and no one was injured. Although the rest of the school was unaffected, all classes were temporarily suspended. Engineers “found that the surrounding structures were not of the same structural components as that of the gymnasium.” Roof replacement and repairs were localized to the gymnasium. The engineers also found that “two lower chords of bar-joist, located at the entrance hallway to the subject gymnasium, were altered and needed repair.”

In December 2003 custodians punctured a rubber membrane while shoveling snow off the Claypit Hill school’s roof. The accident allowed water to leak into the building, creating yet another loss. The workers were following directions to keep snow loading to a minimum. This incident illustrates the need to take extra precautions when removing snow

from roofs. Among the hazards associated with such work are roof and equipment damage, workers falling from the roof, falls from ladders, frostbite, exhaustion, and back and eye injuries. The school roof was replaced in 2004 at a cost of about \$633,000.

In Utah, heavy rains in September 2004 are believed to have caused a section of roof to fail at the Ogden Preparatory Academy. The roof had been under construction at the time.

Snow and ice have collapsed school roofs all across the northern tier of the country. A roof collapsed under a foot of snow at the University of Northern Iowa in 1994. In Springfield, Virginia, a foot of snow and gusting winds caused the failure of a roof covering a church high school in 1996.

In 2003 heavy snow in Herndon, Virginia, contributed to the nighttime collapse of the roof of a new parish hall even though the structure was designed to carry two to three times the snow load. The hall was part of a nearly completed \$8 million project that was to house a kindergarten and elementary school. To add insult to injury, the collapse caused the failure of the sprinkler and hot water heating systems, leaving four feet of water in the basement.

Ninety roofs failed in Beckley County, West Virginia, in 1998 after nearly four feet of wet snow fell in a two-week period; six people were killed, and many persons were injured. In 1996, tons of snow caused the roof of a building in Bay Shore, New York, to sag. A half-hour before roofers arrived to repair the structure, the roof failed, killing one worker and injuring two others. A warehouse roof collapsed in

Contractors may be in a hurry to meet schedules and budget. They may not be qualified to judge if a defect is serious or negligible. Therefore, architects and competent, independent engineers are vital to the long-term safety of construction projects.



# ADVANTAGE

## Preventing School Roof Collapse, cont'd from page 7

Carlstadt, New Jersey in 1994 when a weather-weakened roof couldn't support replacement materials. Three workmen were injured when they fell 25 feet.

In 2004, at a school near Tampa, Florida, inadequate roof attachments, missing and improperly placed roof welds, and walls that lacked strengthening steel and grout were noted by a volunteer structural engineer after a construction worker reported that the roof on an old section of the school was sagging and had a "4-inch bounce" to it. A sagging roof accumulates rainwater, and the weight of the water causes it to sag further, eventually causing the roof to fail. At the time of the discovery, two new buildings were being constructed. The new

construction project engineer declared that there was no problem with the old roof, and plans were proceeding to install heavy air conditioning equipment on the old – "bouncing" – roof. During a subsequent onsite visit, the volunteer engineer found defects in the new roofs as well. Fortunately, the defects were confirmed by an independent lab and corrected before there was a roof collapse.

**Most entities in the U.S. do more than buy insurance. They periodically study their risks and take action to remedy deficiencies.**

*For additional advice, contact the Massamont Loss Prevention Department.*

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