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ABSTRACT: Five professionals examine five areas where maintenance is typically deferred: roofs, facades, boilers, garages, and plumbing.

ARTICLE TEXT: “The time to repair the roof is when the sun is shining,” said John F. Kennedy during his State of the Union address in 1962. While the president may have been referring to the national budget, every manager and board should take heed of his statement…literally. From the top of your building down to the basement, from facades to plumbing, the potential for disastrous situations exists everywhere. The small problems you’ve been putting off because of time or money are ticking time bombs waiting to explode into maintenance nightmares.

To help you avoid that, Habitat asked some of New York’s top maintenance experts to share their wisdom. Here’s what they had to say on how to spot and prevent potential disasters.

Roofs

Because roofs are regularly subjected to rain, wind, snow, ice, and blistering sun, they require as much if not more care and feeding than most building systems. Yet, the roof is one area where boards all too often put off necessary maintenance and repairs or opt for short-term fixes in a misguided attempt to save money.

Keep in mind that a roofing system is more than just its membranes. Roof maintenance must address not only the protective layers covering the underlying roof deck, but also the roof-level components, such as parapets, copings, base flashing, counterflashing, bulkheads, chimneys, railings, drains, and scuppers, all of which are exposed to the elements and therefore vulnerable to water infiltration. Repairing a worn roofing membrane will not stop leaks if water is entering through cracks in a parapet wall or seeping underneath the roofing layers because of defective or missing counterflashing.

A common but ultimately detrimental method of roof “maintenance” is to apply tar everywhere at the roof-level, including on parapets, coping stones, bulkheads, and other masonry. Tar (asphalt) acts as an effective sealant on roofing membranes but not on masonry, which needs to breathe. It prevents stonework and brickwork from releasing the incidental moisture that they naturally absorb. Also, tar eventually melts and cracks, creating pockets that act as a conduit for more water to enter. Trapped water freezes and expands, creating more cracks, loosening

bricks and stones, and weakening the structural integrity of the masonry, making a bad situation worse. Another overused and ultimately futile maintenance practice is repeatedly “capping” a roof by applying a new membrane on top of the existing layers. Cap sheets can add a supplemental level of waterproofing if the underlying roof structure is generally sound. But in too many cases, cap sheets are applied on top of badly deteriorated membranes, trapping saturated water. In addition, the new membrane will not adhere properly if the underlying layers are peeling, bubbling, fraying, or otherwise defective. Repeated layers of cap sheets can also distort the pitch of the roof, disrupting drainage and causing ponding.

While capping a roof is much less expensive than tearing up the existing roof down to its deck and completely replacing the membranes (roughly $5 a square foot vs. $17 to $20 a square foot), capping provides only temporary relief because it doesn’t fix the underlying defects. Furthermore, manufacturers may give a limited pro-rated warranty for a cap sheet, but you will be unlikely to receive the type of long-term No Dollar Limit (NDL) warranty typically provided on a full roof replacement.

Even if you’ve repaired defective roof-level masonry and replaced the roof itself, you can’t forget about the roof for 20 years until the NDL is up. A regular roof maintenance program is still required and should include checking for the following items:

• Cracked and loose masonry and open mortar joints
• Torn membrane and loose seams
• Debris and sharp objects that could puncture the membrane
• Ponding and clogged drains
• Base flashing separated from parapet walls
• Missing or defective counterflashing
• Recreational use of a roof not designed for such activities

Although cash-strapped boards may be tempted to defer necessary repair and maintenance items (or mistakenly overlook them), addressing potential problems early on will avoid more extensive – and expensive – work down the line.

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Facades

The forces of deterioration that attack building façades can be compared to wounds on the human body. A scratch (think: hairline crack) only needs to be cleaned off and protected with a Band-Aid; a deep cut (think: cracking or spalling) might require stitches and ointment; while a major wound or shattered bone (think: falling chunks of brickwork or cornice) may call for surgery. Any neglected wound will fester; the longer it is neglected, the worse the problem becomes and the more expensive the cure.

This analogy of the neglected wound applies directly to signs of deterioration in a building façade. The wound in the façade is “infected” by water, the nemesis of all building materials. Typically, the façade of a large residential building in New York City consists of brick or stone surfaces interrupted by window openings and the occasional area of decorative stone or terra-

cotta work. Regardless of the combination of materials visible on the exterior, the hidden supporting framework is either steel or concrete enclosing steel-reinforcing bars. The materials of the façade fit together to form components that deflect water toward the building's exterior surface, away from the supporting framework. However, no building material is impermeable. As a result, over time, water that sits on and/or penetrates these materials works its way into the façade, attacking everything it touches.

The steel in a building's structure is especially vulnerable to attack by water. Prolonged contact with water causes steel to rust. Rusting can cause steel to expand up to three times its original size. In the process, the expanding steel puts increasing pressure on the surrounding building materials. This pressure, called "rust jacking," compels those materials – whether stone, brick, or concrete – to move or bulge or crack. Shifting or cracking of building materials forces open new points of access for additional water to penetrate the building envelope, speeding the deterioration process. The pace of this process speeds up when the water freezes inside these new openings.

Freezing causes water to expand, enlarging the size of any openings it has infiltrated, and eventually making way for even more water penetration. This increased penetration leads to ever more shifting and cracking with each additional freeze/thaw cycle.

The resulting signs of deterioration, which you might see on your own building, fall into a variety of categories, each reflecting a specific type of damage:

• Vertical cracking, provoked by rusting and expansion of steel columns. This is especially prevalent at building corners lacking in expansion joints, where all the systems meet and one gives way as the others expand.
• Horizontal cracking at window lintels and supporting angles that hold up the brick or stonework above openings. Here again, the rusting and expanding steel puts pressure on the surrounding masonry, causing it to bulge, shift, or crack.
• Spalling, after water infiltrates glazed masonry or terra-cotta. The masonry backing expands at a different rate than the glazed surface, which eventually separates from the masonry. This separation allows more water into the material, only becoming apparent when the glazed surface falls from the façade. As a result, this problem poses a danger to the passing public while it greatly increases the permeability of the exposed materials.
Other less visible, but still eventually dangerous, locations for deterioration include:

• Fire escapes, which seem to be the last place owners want to spend their money. However, as exposed metal elements attached to the façade, fire escapes are uniquely vulnerable to the effects of weathering. The steps and platforms rust and deteriorate, as do the anchor bolts attaching them to the façade. With time and water, a half-inch anchor bolt can easily be reduced to the size of a needle.
• Cornices and water tables, decorative elements of stone, terra cotta, or metal, like fire escapes, which are the most exposed and vulnerable components of the façade. Not only are they exposed to wind and rain, but also their projections provide opportunities for water to collect and sit against the adjacent building elements, weakening their structural connection to the façade

Unlike the wound analogy, where we used wounds of different magnitudes to provoke ever-increasing cures, building maintenance problems only increase if deferred. The greater cure is

the direct result of neglect on the part of the owner. Each of these problems starts out small and, while small, can be easily contained by small (and inexpensive) measures.

Once building problems are allowed to fester, however, they take on a life (and a costliness) of their own. As much as a good engineer may try to be sensitive to an owner's budget constraints, every owner should keep in mind that, in the long run, preventive maintenance pays for itself. A tube of caulk is cheap and should be used when appropriate, but a tube of caulk will not help once a problem has reached the point where surgery is needed.

Howard L. Zimmerman, an architect, is a principal in Howard L. Zimmerman, Architects.

Boilers

In these turbulent times, many of our customers have been asking us for ideas on how to save on energy costs. So I asked Bill Connelly, president of Consolidated Boiler Service, to visit my office and discuss boiler maintenance. He made a very interesting presentation. Bill asked me to hold out my right hand. To my surprise, he put some black soot from a sample container into my palm. Then, he lit a stick match and held it over the soot. I could not feel the heat from the match! I was curious as to how this demonstration could relate to boiler efficiency.

Bill said that soot acts as an insulator and is a major reason for inefficient boiler operations. He went on to tell me that one-eighth of an inch of soot in boiler tubes decreases fuel consumption by 8.5 percent. Scaling, caused by soot and condensation on the inside of the boiler, reduces efficiency even further.

With today's energy prices, boiler efficiency should be considered a top priority. Delaying an annual overhaul and cleaning only keeps your boiler running less efficiently, thereby running longer and burning fuel needlessly.

Many owners and managers get a jump-start and have their overhauls and cleanings done in the spring or early summer rather than waiting until just before the heating season starts in October. This early preventive maintenance eliminates a buildup of soot that contains acids that lead to boiler tube corrosion. Scaling on the inside of the boiler tubes can create leaks and expensive repairs for you and disruptions for your tenants but, most of all, they lower the efficiency of the heating plant. A 50-tube boiler with only five plugged tubes will reduce the heat output to 90 percent, thereby making the boiler run longer and unnecessarily burn additional fuel.

There are some simple steps that must be taken on a regular basis to increase boiler efficiency and save considerable energy dollars:

• Complete a full boiler cleaning.
• Have an annual efficiency test and overhaul on every burner.
• Set in place an annual preventive maintenance program contract for boiler-cleaning. Different fuels and burner sizes require different programs. Ask your boiler maintenance company which of the programs it offers is best for your property.
• Replace boiler tubes as soon as possible after they start leaking. Plugging tubes reduces boiler efficiency. Any delay will negatively affect your energy budget.

• Make certain that the boiler chambers are in good condition. This can be investigated during your annual overhaul and repaired at that time.
• Check draft regulators and replace, if necessary. Too much of a draft can pull heat through the boiler too quickly and reduce efficiency.
• Keep burner cones clean of scaling and soot. Burner cones are designed to keep the flame in its optimal shape for an efficient burn. Cleaning them enhances efficiency and saves energy.
• Schedule regular professional chemical treatment of boiler water. This increases the overall life of the boiler.

There are other tangible benefits to good boiler and burner maintenance besides saving fuel. Good preventive maintenance extends the longevity of your equipment, reduces overall equipment maintenance costs, minimizes air pollution, and prevents disruptions in service to tenants. It makes economic sense not to delay these simple and relatively inexpensive preventive maintenance programs.

Lou Romano is the senior vice president/ sales at Castle Oil Corporation.

Garages

Parking garages are the ugly stepsisters of the building world. As long as they continue to do their chores without complaining, no one cares. The problem is that these cash cows don't get the attention they deserve from their owners, who often leave repairs to the discretion of their garage company.

The problem with that arrangement is that emergency repairs are the only ones that get done and preventive maintenance is rarely performed. Eventually, given this minimalist approach, a considerable expenditure is required to get the garage to an acceptable condition.

The type of parking garage also determines the repair frequency. If you are the unlucky owner of a "waffle deck" or "concrete joist" parking structure, congratulations! You own the Desoto of the parking garage world. If you have this type, don't despair, it can be maintained. To get the most life out of it, the best approach is to perform the necessary repairs and, then, install a quality traffic-bearing membrane on the surface that prevents chloride penetration. This won't be the end, however, and you will need to budget for periodic overhead repairs.

The occurrence of decay within a garage varies depending upon location. For example, the entry (or street-level) deck will suffer more than the other decks and the drive lanes; ramps and turning areas will suffer more than the parking areas. Garages positioned beneath buildings are typically in better condition than garages that are standalone structures. Garages that exist beneath playgrounds, landscaping, or open parking areas are especially vulnerable because their roofs are almost always saturated. These below-grade garages are usually immense and contain many joints to accommodate predicted movements as well as area drains to collect surface water. The joints and drains are a constant source of maintenance and are usually not repaired until well after the damage has occurred.

The costs for garage repairs depend on the type. Waffle decks, or decks with ribs, have overhead rib repairs ($70/lineal foot), and web repairs ($45/square foot). Unfortunately, these garages have lots of rib and web quantities. Flat-surface repair depends upon depth, but costs about $25/square foot and surface crack repair about $5/lineal foot. High-quality joints that allow

movement between parking decks or between garages and rigid structures cost about $120/ lineal foot. The best investment is the application of a traffic-bearing system on the surface of the concrete. There are many types available, all with more pros than cons. The costs vary, ranging from $5 to $9/square foot.

If you have a parking structure in your life, I suggest that you always have a competent structural engineer involved; be active in the maintenance of your parking structure; and beware of bargain contractors. Finally, remember to keep your problems small and out in front and you will avoid a massive repair project and the aggravation that goes along with it.

Eric W. Cowley, an engineer, is president of Cowley Engineering.

Plumbing

With construction costs increasing because of the rising prices of materials and labor, more and more boards are concerned about preventive measures to avoid dangers to plumbing systems. By performing regular preventive maintenance, the overall yearly costs for plumbing repairs can be reduced.

Among the areas to watch:

Drainage. Underground and horizontal sewer drainage piping should be cleaned by water jet or roto-rooting once a year to avoid stoppages. Drainage piping that leaks and has been provided with a temporary saddle should be removed and replaced with new piping. All fixtures should be vented and the waste pipes should pitch in the direction of flow. Plumbing fixture traps under sinks and lavatories should have the plug removed every year so that the traps can be cleaned of obstructions.

Storm drainage. Roof, terrace, balcony, and plaza drains including gutters should be cleaned periodically and cleared of leaves and other debris (at least twice a year) to avoid stoppages and backups. Floor-drain grates should be removed and the trap cleaned as well. The entire underground and horizontal house drains should be flushed clean and roto-rooted at least once a year. Basket strainers should be installed in drains that collect debris to avoid stoppages in the piping system.

Water systems. In areas with hard water, calcium carbonate will adhere to the walls of the copper tubing, eventually causing a reduction of the pressure available at faucets and showerheads. In order to prevent this, a magnet should be installed on the water piping as it enters the building. The magnet reverses the polarity of the water and causes the calcium carbonate to be repelled from the walls of the piping.

Water piping in old buildings may be galvanized and, over the years, galvanic action can occur forming a white residue within the inside of the pipe that reduces the water column and pressure. Often, when new renovations occurred, the contractor would use copper piping to replace the old galvanized pipe. However, if a dielectric coupling is not installed between the two dissimilar metal pipes, deterioration will occur at the connections. All galvanized piping should be removed and replaced with copper piping in old buildings to increase the water volume and pressure.

Local water heaters usually have a five-year warranty. The relief valve should be checked once a year by lifting the lever and making sure that water is discharged. If rust is starting to appear at the base of the gas or electric water heater, it is time for a replacement.

Water tanks and pumps. Gravity wood and steel roof tanks and suction tanks are required by the health and building code to be cleaned once a year. However, this is seldom done and often the water can become a “coffee color” if the tank has not been cleaned. A bypass should always be installed around gravity roof tanks and suction tanks for emergencies with connections from the building’s house pumps to maintain the water supply temporarily.

Booster water pumps, when used as a source of water supply without tanks in a cellar or basement area, should also be equipped with a bypass line so street pressure can serve the building’s fixtures up to the lower floors. Pumps should be checked to make sure that they are not turning on and off more than five times an hour. They should be checked and lubricated every year.

Valves. Valves in water systems should be inspected periodically. If they do not close tightly, it is time for their replacement. The stop valves at plumbing fixtures should be opened fully and then closed slightly in order to prevent the valves from locking in the open position. Pressure-reducing valves should have strainers that can be checked once a year. Shower-mixing valves should have stop valves and should also be opened fully then closed slightly to prevent locking open.

By following the maintenance procedures suggested here, lower plumbing costs can usually be achieved every year.

Vincent J. Pantuso has more than 50 years experience in plumbing and fire protection design. He is president of Decorative Display Fountains. Richard H. Toder is the executive director of a New York-based mechanical consulting firm.