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Journal

Regular Inspections Are Key to Building Envelope Integrity

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Early detection of building distress can prevent problems from snowballing.

Conducting an organized building inspection at least once a year should be part of every building manager's operations and maintenance program. Until a problem is observed, it can't be fixed. Documenting deterioration or water infiltration conditions will allow you to plan prompt repairs or, for minor issues that don't demand immediate intervention, to monitor the area over time. Should conditions worsen, you will be able to look back at past inspection logs and evaluate how deterioration has progressed, so as to determine an appropriate course of action.

Why Inspect Your Building?

Examining building components takes time. With many obligations vying for attention, why book a day out of your overscheduled calendar to take camera and clipboard in search of cracks?

For good reason. It may seem overly precautious to look for problems where there seem to be none, but, actually, it's sensible. Investing a day or two a year on a building envelope evaluation is a small outlay with a big return. If you spot a puncture in the roof membrane before leaks are reported at the building interior, you might be able to fix the problem quickly and easily. If you wait until tenants are putting buckets under the dripping ceiling, you'll likely wind up replacing the entire roof assembly and repairing interior finishes, not to mention losing an unhappy tenant.

Inspect roofs, facades, windows, and doors regularly to:

- Identify materials near the end of their service life,
- Anticipate and plan for replacements,
- Catch small problems before they become big ones,
- Extend component lifespan,
- Avoid unforeseen emergency repairs, and
- Minimize major capital expenditures.

Collecting building envelope data on a regular basis establishes a storehouse of information on manufacturers, warranties, age of components, and the success of ongoing maintenance practices. It also creates a comprehensive record on which to build throughout the year.

For example, the checklist included in this issue has a box for "leaks reported or observed," which demands little more than a yes or no answer. However, this check mark should be supplemented by documentation between inspections, whereby leaks are reported on an ongoing basis. Diligent record-keeping can accelerate the remediation process, as it is easier to resolve a leak for which the location and frequency have been

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documented than one for which the history is unknown.

Buildings under Stress

Buildings may seem rigid and unmoving, but this is far from the truth. In reality, building materials are constantly on the move, responding to changes in humidity, wind, and temperature, and behaving according to their intrinsic properties. Good building design allows for this movement, particularly where materials with widely different coefficients of expansion and contraction intersect. Control joints, expansion joints, flashings, and flexible materials aim to manage changes in shape, size, and position by providing room to move.

However, because they are under constant stress, these areas are particularly susceptible to wear. In some cases, signs of damage due to differential movement, such as long vertical cracks at building corners, may point to inadequate provision for expansion and contraction, or they may indicate underlying corroded steel. Either way, even the most diligently performed routine maintenance, from repairing surface cracks to repointing mortar joints, won't fix the problem. The materials will continue to move, and until the building area is redesigned to provide for this movement, they will also continue to fail.

A Word about Warranties

For components that are covered by warranty, supplement your periodic inspection with a follow-up evaluation by the architect—before the warranty expires. It is not uncommon to find that, eleven months after a roof installation, problems have come up that the manufacturer is then obligated to fix. While routine inspections by building personnel can catch such defects, some issues are sufficiently subtle as to demand the trained eye of a design professional. Don't put off the inspection, however; once that warranty deadline has passed, it will be up to the building owner to pay for repairs.

How to Begin

Schedule a building envelope inspection in early spring, to check for winter damage. For roofs and any areas of concern, it would be prudent to conduct a second inspection in late summer or early fall. Additional inspections may be required after severe weather.

Before the inspection, review safety rules about avoiding falls from ladders and other elevated vantage points. Use common sense. Generally, binoculars or telescopic photographic lenses provide enough magnification to identify a deficiency. If closer examination is required, retain a professional and use proper equipment.

Roof assemblies, rooftop equipment, drainage systems, flashings, joints, wall cladding systems, fenestration, and accessories can be complex. Don't be intimidated. Even if you are new to inspecting the exterior envelope, you can still help to protect your building by focusing on observable defects. If you're not sure about a condition, write it down; it's better to double-check something benign than to ignore a budding catastrophe. ■

Causes of Distress and Failure

Man-made			
Installation Error	**Inappropriate Materials**	**Component Damage**	**Inadequate Design**
Open termination points Improper anchorage Inattention to detail Insufficient surface preparation	Incompatible materials Incorrect sealants or fasteners Mishandling of materials Manufacturing defects	Vandalism Foot or vehicle traffic Storm debris Contaminants	Insufficient waterproofing Structural deficiencies Incomplete documents Restricted movement
Natural			
Exposure	**Building Movement**	**Organisms**	**Material Properties**
Water Freeze-thaw cycles UV radiation and heat Wind Lightning	Thermal expansion / contraction Building settlement Seismic activity Soil displacement	Birds and insects Animals Vegetative growth Mold	Lifespan Chemical reactivity Durability Structural characteristics

Building Exterior Inspection Guide

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When and Why to Inspect

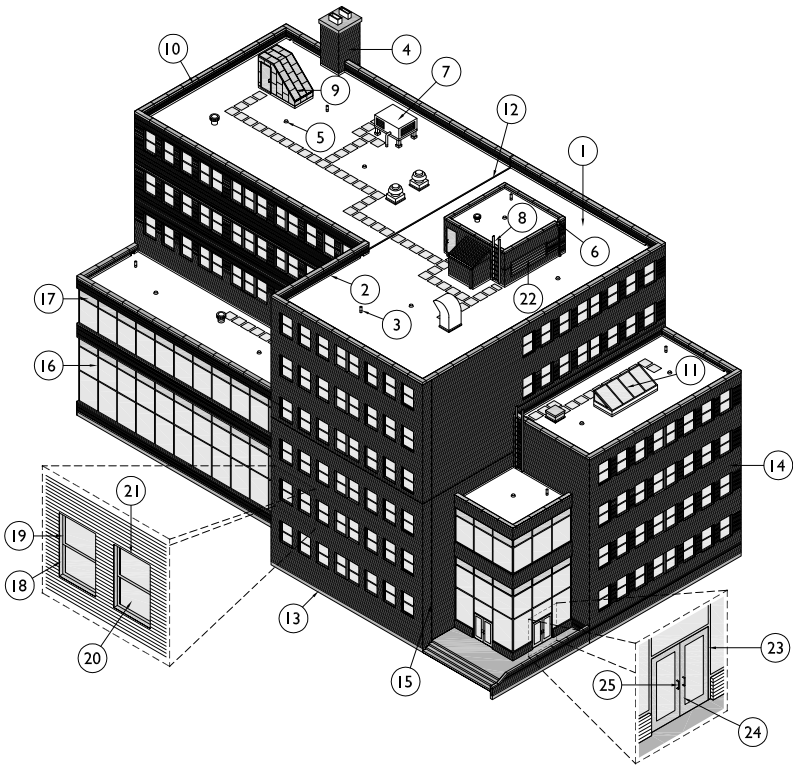
At least twice annually, it's important to conduct a thorough inspection of the building enclosure to identify signs of deterioration or failure. By correcting minor problems before they become major ones, the prudent building owner or facility manager can extend the lifespan of building components and avoid major capital expenditures. Regular inspection can also identify materials approaching the end of their service life, so that replacement can be scheduled and budgeted in advance. Otherwise, building systems will fail without warning, requiring rushed and, often, unsatisfactory emergency repair.

The Big Deal about Small Repairs

The building enclosure is made up of many components that work in concert to keep the building watertight and secure. If any one of these systems becomes compromised, inter-related building elements are at risk for failure—and costly repair. For instance, what may appear an insignificant open joint at a parapet cap can allow a surprising amount of water to enter the wall. As this water migrates down through the building facade, it rusts steel framing, soaks insulation, and displaces wall surfacing. The water also works its way under the roof membrane, leading to energy loss and leaks. While repair of cap joints is relatively simple, rehabilitating water-damaged roof and wall systems is anything but.

How to Use this Guide

Because the risks of deferred repair work carry a hefty price tag, it's worth investing a few hours on a regular basis to look for signs of trouble. This guide is intended not as an exhaustive list of all possible points of wear, but rather as an overview of typical building systems and common problems. Use the checklists to keep written records of observations, so as to prioritize repairs and anticipate major replacements. Should any concerns arise, diligent record-keeping can assist a design professional in pinpointing the source of the problem and recommending an appropriate rehabilitation strategy.



Roofs
1. Membrane
2. Flashing
3. Vent
4. Chimney
5. Drain
6. Scupper
7. Rooftop equipment
8. Ladder
9. Penthouse / bulkhead
10. Parapet wall
11. Skylight
12. Expansion joint

Facades
13. Foundation wall
14. Masonry
15. Sealant
16. Curtain wall mullions
17. Spandrels

Windows
18. Frame
19. Sash
20. Glazing
21. Wall openings
22. Louvers

Doors
23. Frame
24. Door
25. Latch

Building Exterior Inspection Checklist

Building: _____ Inspector: _____ Date: _____

Check all that apply *and describe any observed deficiencies. Attach additional documentation and photographs as needed.*

ROOFS						
☐ Repairs/modifications since last inspection	Description					
☐ Leaks observed or reported						
☐ Major damage						

GENERAL CONDITIONS							
Flashings		**Penetrations**		**Drainage**		**Accessories**	
☐ Splits / cracks		☐ Waterproofing damage		☐ Ponded water		☐ Broken snow guards	
☐ Open seams		☐ Leaks		☐ Clogged drains		☐ Bent lightning rods	
☐ Deformation		☐ Faulty vents / hatches		☐ Loose gutters		☐ Loose railings	
☐ Punctures		☐ Missing flashing		☐ Ice dams		☐ Equipment damage	
Description							

LOW-SLOPE ASSEMBLIES						
Built-up *e.g. MBR, BUR*	Location	Size	Type	Manufacturer	Year	Warranty
☐ Blisters	Description					
☐ Ridges						
☐ Cracks						
☐ Aligatoring						
Single-ply *e.g. EPDM, TPO, PVC*	Location	Size	Type	Manufacturer	Year	Warranty
☐ Splits	Description					
☐ Wrinkles						
☐ Open seams						
☐ Punctures						
Fluid-applied *e.g. asphaltic, acrylic, epoxy*	Location	Size	Type	Manufacturer	Year	Warranty
☐ Bubbles	Description					
☐ Thin coverage						
☐ Pinholes						
☐ Poor adhesion						

STEEP-SLOPE ASSEMBLIES						
Metal *e.g. batten, standing seam*	Location	Size	Type	Manufacturer	Year	Warranty
☐ Open seams	Description					
☐ Rust						
☐ Dents / physical damage						
☐ Missing fasteners						
Shingle *e.g. slate, terra cotta, asphaltic*	Location	Size	Type	Manufacturer	Year	Warranty
☐ Cracks / breaks	Description					
☐ Misalignment						
☐ Missing shingles						
☐ Worn peaks / valleys						

Building Exterior Inspection Checklist

Building: _____ Inspector: _____ Date: _____

Check all that apply *and describe any observed deficiencies. Attach additional documentation and photographs as needed.*

FACADES	
☐ Repairs/modifications since last inspection	Description
☐ Leaks observed or reported	
☐ Major damage	

GENERAL CONDITIONS			
Structural	**Coatings**	**Surface**	**Intersections**
☐ Leaning / bowing	☐ Peeling / blistering	☐ Dirt / stains	☐ Coping displacement
☐ Foundation damage	☐ Substrate damage	☐ Mineral deposits	☐ Expansion joint damage
☐ Cracks at corners	☐ Failed patch	☐ Bird excrement	☐ Worn flashings
☐ Insecure elements	☐ Trapped moisture	☐ Vandalism	☐ Sealant joint failure
Description			

MATERIAL-SPECIFIC CONDITIONS				
Masonry *e.g. brick, stone*	Location	Type	Manufacturer	Year
☐ Efflorescence	Description			
☐ Cracks / spalls				
☐ Mortar deterioration				
☐ Movement / displacement				
☐ Vegetative growth				
Concrete *e.g. cast-in-place, pre-cast*	Location	Type	Manufacturer	Year
☐ Corroded rebar / spalls	Description			
☐ Cracks				
☐ Rust stains				
☐ Displacement				
Glass curtain wall *e.g. vision and spandrel panels*	Location	Type	Manufacturer	Year
☐ Buckling / bulging	Description			
☐ Loose gaskets				
☐ Corrosion				
☐ Loose stops / beads				
☐ Condensation				
Thin stone veneer *e.g. marble, granite*	Location	Type	Manufacturer	Year
☐ Displacement	Description			
☐ Cracks				
☐ Loose anchors				
Other *e.g. EIFS, stucco, metal*	Location	Type	Manufacturer	Year
☐ Surface defects	Description			
☐ Loose fasteners				

Building Exterior Inspection Checklist

Building: _____ Inspector: _____ Date: _____

Check all that apply *and describe any observed deficiencies. Attach additional documentation and photographs as needed.*

WINDOWS

	Repairs/modifications since last inspection	Description
	Leaks observed or reported	
	Major damage	

WINDOW TYPES

Operability	General Location	Quantity	Material	Manufacturer	Year	Warranty
Fixed						
Single- or double-hung						
Sliding						
Awning or hopper						
Casement						

COMMON PROBLEM AREAS

Frame		Sash		Glazing	
	Failed sealant		Weatherstrip damage		Condensation
	Rust or rot		Broken hardware		Cracks / breaks
	Missing fasteners		Incomplete closure		Defective seals

Description

DOORS

	Repairs/modifications since last inspection	Description
	Leaks observed or reported	
	Major damage	

DOOR TYPES

Function	General Location	Quantity	Material	Manufacturer	Year	Warranty
Main entrance						
Secondary entrances						
Service doors						
Roof / bulkhead doors						

COMMON PROBLEM AREAS

Frame		Door		Hardware	
	Failed sealant		Racked / warped		Latch / lock faulty
	Corrosion		Impact damage		Weatherstrip damage
	Threshold damage		Incomplete closure		Broken or worn hinges

Description

Leak Reporting

It is extremely important to document instances of water infiltration and to investigate the source of observed leaks. Every incident of water entry should be documented. This is especially true for roofs and other building elements that are under warranty; should the source of a leak be covered by a warranty, a call should be made to the appropriate manufacturer's claim department.

Record every leak every time, even if it is at the same location and only a day later.

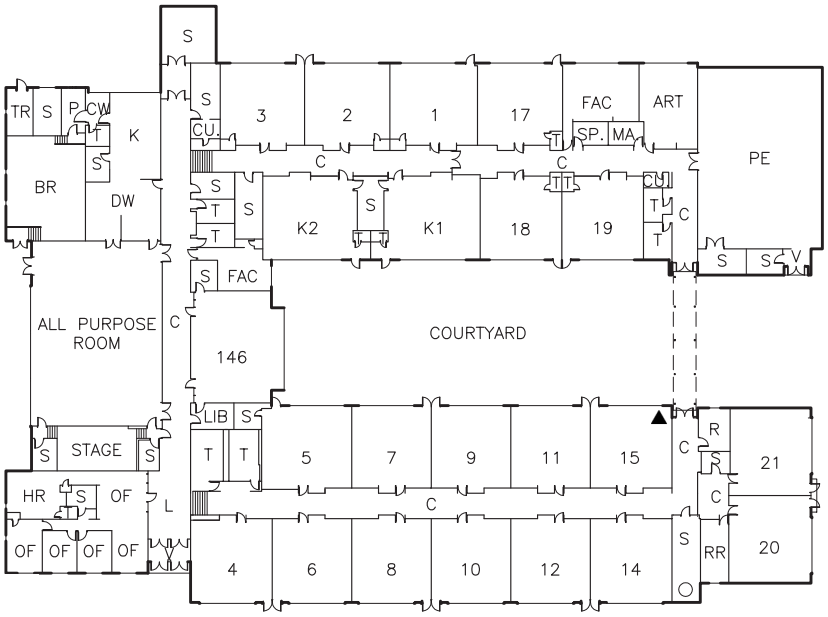
To report a leak, mark the location of water entry on a floor plan that can then be used for further investigation or reporting. Include a chart to record the date, a description of the leak, a summary of the weather at the time of the leak, the date the leak was reported and to whom. A triangle, asterisk, or other symbol in the chart can be used to reference a corresponding mark on the plan at the location of the leak.

Shown at right are sample floor and roof plans. In this example, the leak at location 15 is directly below roof H, a built-up roof still covered by the manufacturer's warranty.

However, be aware of pipe leaks, condensation, and exterior wall problems that can also lead to water at the building interior. Before scheduling a service call, investigate the leak to verify its likely source. Having a manufacturer's representative show up when their product is not at fault often results in a charge for their time.

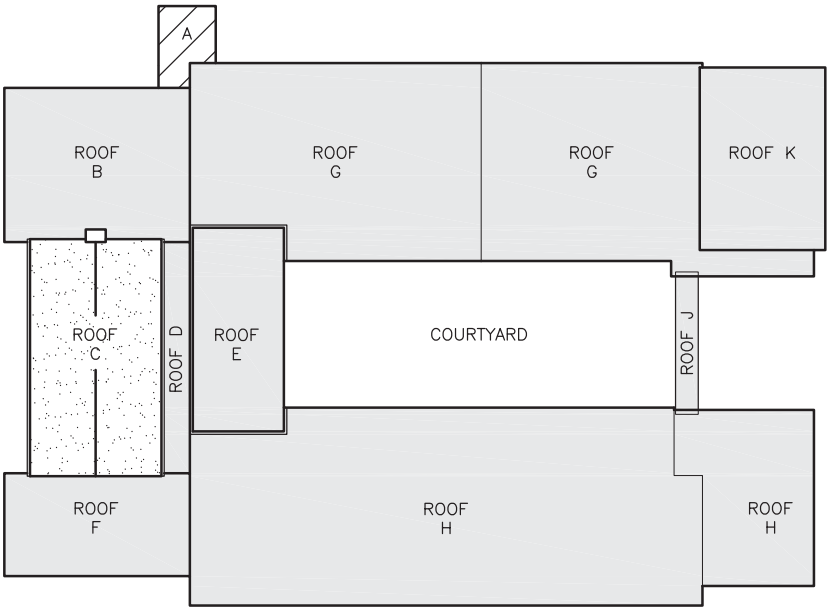
Involve occupants, custodians, and caretaking staff by asking that they report leaks promptly to maintenance personnel. By committing the resources of building users and staff, owners and managers will be more successful in finding and resolving leaks before they can do any serious damage. ■

Drawings not to scale.



LEAK DOCUMENTATION

DATE	LOCATION SYMBOL	DESCRIPTION OF LEAK	WEATHER CONDITIONS	REPORTED DATE	TO	STATUS
7/13/09	▲	*Stained ceiling tile*	*Three days of rain*	*7/14/09*	*Maintenance*	*Claim filed*



ROOF PLAN

KEY	AREA DESIGNATION	TYPE	AREA - SQ FT	DATE COMPLETED	WARRANTY EXPIRATION	MANUFACTURER / ROOFING CONTRACTOR
	A	*MDF*	*500*	*9/2000*	*N/A*	*Unknown / Roofs R Us*
	B, D-K	*BUR*	*38,900*	*10/1991*	*10/21/2011*	*Best Roofing / 123 Roofs*
	C	*SHINGLE*	*4,000*	*3/2003*	*N/A*	*Unknown / XYZ Roofs*

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Resolving Building Envelope Problems

Routine inspections can identify persistent problem areas, allowing for proactive intervention. For example, an Exterior Insulation and Finish System (EIFS) facade that repeatedly sustains vandalism damage might call for more rigorous preventive and long-term rehabilitative measures.

Investigating Recurrent Problems

Typically, a design professional will use the inspection log to initiate a comprehensive evaluation of building conditions. The goals of a failure or distress investigation are:

- Accurately attribute the nature and extent of the problem,
- Develop technically and aesthetically appropriate remedial solutions,
- Define the scope of work, and
- Establish probable construction costs.

The right repair strategy begins with the correct diagnosis. Because a given symptom can have a variety of causes, it helps to have a record of how the problem has evolved, as well as how adjacent building areas have responded. Unless the cause of building failure is addressed, repairs will provide only a temporary fix, as the damage will likely recur.

Designing and Overseeing the Solution

Once the owner and architect have settled on the project goals and rehabilitation strategy, involving the design professional in the development, planning, bidding, and construction administration process protects against incorrect installation and enables prompt response to unforeseen setbacks. To implement the design solution, an architect or engineer will:

- Develop contract documents (drawings and specifications),
- Identify and solicit bids from capable contractors, and
- See that work is performed as designed.

Sometimes, unexpected conditions arise. Rather than trust these on-the-spot changes to a contractor's judgment, owners can rely on an on-site architect to act as their representative, protecting their interests and responding quickly and appropriately to last-minute changes. ■

JOURNAL is a publication of Hoffmann Architects, Inc., specialists in the rehabilitation of building exteriors. The firm's work includes investigative and rehabilitative architecture and engineering services for the analysis and resolution of problems within roofs, facades, glazing, and structural systems of existing buildings, plazas, terraces and parking garages.

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