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# Journal

## Regular Inspections Are Key to Building Envelope Integrity

Arthur L. Sanders, AIA

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.



▲ Early detection of building distress can prevent problems from snowballing.

### 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 precautionary 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

## When and Why to Inspect

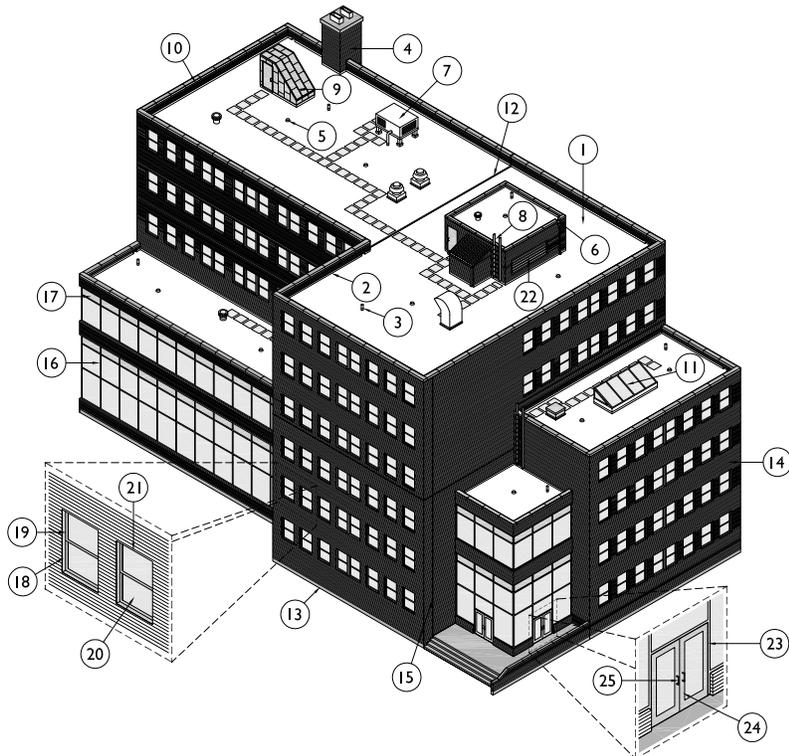
At least twice annually, it's important to conduct a thorough inspection of the building enclosure to identify signs of deterioration or failure. By correcting minor problems before they become major ones, the prudent building owner or facility manager can extend the lifespan of building components and 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



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## 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							
Aligating							
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							
<input type="checkbox"/>	Repairs/modifications since last inspection	Description					
<input type="checkbox"/>	Leaks observed or reported						
<input type="checkbox"/>	Major damage						
GENERAL CONDITIONS							
Structural	Coatings	Surface	Intersections				
<input type="checkbox"/>	Leaning / bowing	<input type="checkbox"/>	Peeling / blistering	<input type="checkbox"/>	Dirt / stains	<input type="checkbox"/>	Coping displacement
<input type="checkbox"/>	Foundation damage	<input type="checkbox"/>	Substrate damage	<input type="checkbox"/>	Mineral deposits	<input type="checkbox"/>	Expansion joint damage
<input type="checkbox"/>	Cracks at corners	<input type="checkbox"/>	Failed patch	<input type="checkbox"/>	Bird excrement	<input type="checkbox"/>	Worn flashings
<input type="checkbox"/>	Insecure elements	<input type="checkbox"/>	Trapped moisture	<input type="checkbox"/>	Vandalism	<input type="checkbox"/>	Sealant joint failure
Description							
MATERIAL-SPECIFIC CONDITIONS							
Masonry <i>e.g. brick, stone</i>	Location	Type	Manufacturer	Year			
<input type="checkbox"/>	Efflorescence	Description					
<input type="checkbox"/>	Cracks / spalls						
<input type="checkbox"/>	Mortar deterioration						
<input type="checkbox"/>	Movement / displacement						
<input type="checkbox"/>	Vegetative growth						
Concrete <i>e.g. cast-in-place, pre-cast</i>	Location	Type	Manufacturer	Year			
<input type="checkbox"/>	Corroded rebar / spalls	Description					
<input type="checkbox"/>	Cracks						
<input type="checkbox"/>	Rust stains						
<input type="checkbox"/>	Displacement						
Glass curtain wall <i>e.g. vision and spandrel panels</i>	Location	Type	Manufacturer	Year			
<input type="checkbox"/>	Buckling / bulging	Description					
<input type="checkbox"/>	Loose gaskets						
<input type="checkbox"/>	Corrosion						
<input type="checkbox"/>	Loose stops / beads						
<input type="checkbox"/>	Condensation						
Thin stone veneer <i>e.g. marble, granite</i>	Location	Type	Manufacturer	Year			
<input type="checkbox"/>	Displacement	Description					
<input type="checkbox"/>	Cracks						
<input type="checkbox"/>	Loose anchors						
Other <i>e.g. EIFS, stucco, metal</i>	Location	Type	Manufacturer	Year			
<input type="checkbox"/>	Surface defects	Description					
<input type="checkbox"/>	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.**

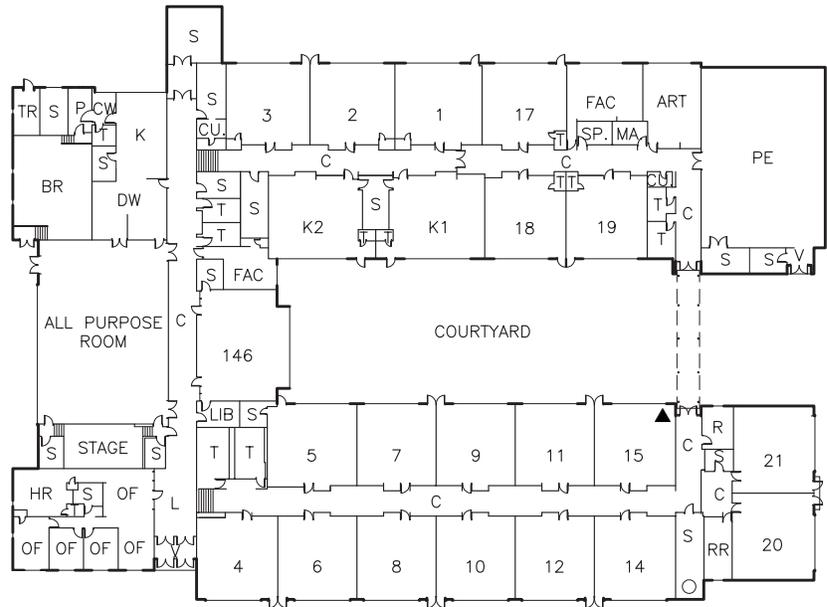
To report a leak, mark the location of water entry on a floor plan that can then be used for further investigation or reporting. Include a chart to record the date, a description of the leak, a summary of the weather at the time of the leak, the date the leak was reported and to whom. A triangle, asterisk,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