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Journal

Plazas:

Form, Function & The Bottom Line

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Plaza spaces, when well designed and maintained, enhance the value of properties and attract tenants. Measures taken to improve plaza spaces or to reverse and retard their inevitable deterioration, range from minimal repairs to full system replacements. Simple projects may involve repair of minor cracks or deterioration in pavers or plaza wearing surfaces. More extensive rehabilitation programs may involve the enhancement of an existing plaza through the incorporation of seating, landscape and water elements, or the full replacement and reconfiguration of the space.

In any case, successful plaza designs simultaneously accommodate space use requirements, improve aesthetics, minimize ongoing maintenance/operation costs and increase longevity. When poorly designed plaza spaces fail, the beauty and benefit of elective elements diminish significantly. What good, for example, is a beautiful plaza that pools with water after every rain? No good.

What To Do When Good Plazas Go Bad

Water is the enemy

Standing water, typically the result of inadequate drainage, accelerates deteriora-

tion in masonry, stone, concrete and other materials routinely used to construct plaza spaces. Evidence of deterioration in plazas is commonly apparent as:

- water stains, cracks/spalls, or displacement in paved or poured wearing surfaces;
- failed or open mortar and/or sealant joints in paved surfaces or at the juncture of horizontal and vertical surfaces; and,
- water infiltration through a plaza surface (particularly at penetrations or at planter, fountain or landscape elements) into occupied space beneath the plaza.

Lasting repairs to plaza problems are the result of sound rehabilitation plans, well implemented. A sound rehabilitation plan, however, cannot be developed until the nature and extent of a plaza's problems are known. A thorough investigation, involving the examination of conditions both visible and concealed, will yield information on the state of vulnerable elements of the plaza – waterproofing membranes (at a plaza deck or setting bed and in planters, fountains, etc.), drainage



▲ Plazas may incorporate seating, landscaping and lighting design, as in this multiple-level space in Manhattan. While these enhancements come at a price, property owners find them to be worthwhile investments.

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Craig A. Hargrove, AIA, Senior Architect, and Russell M. Sanders, AIA, Director of Technical Services at Hoffmann Architects, develop a variety of plaza rehabilitation solutions for the firm.

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systems, and wearing surfaces – that will dictate rehabilitation requirements.

Plaza “Feng Shui”

The best plaza designs are those that accommodate both function *and* form. What better time to revitalize a plaza, to perhaps reconfigure a space to better suit current usage, than when implementing a rehabilitation plan? While making aesthetic improvements to a plaza space may not reenergize the soul, they will have a direct, positive effect on the appeal of the space to prospective owners and tenants. And, by designing plaza enhancements such as fountains and landscaping concurrently with repairs/rehabilitation, the necessary installation and maintenance of sophisticated pumping and irrigation systems, for example, can be successfully integrated with a plaza’s waterproofing and drainage requirements. Furthermore, simultaneously performing construction for both repairs and aesthetic improvements (as opposed to implementing enhancements at a later date) saves not only time, but money as well, as construction phase expenditures are incurred only once.

Plaza enhancements may also be of a practical nature. Installation of mechanical snow melting systems, for example, pump heat into paving stones via glycol or electricity, allowing maintenance crews to keep up with snow removal and reduce the potential for hazardous conditions during storm events. While these systems add to capital expenditures and are costly should repairs become necessary, the expense is often acceptable in comparison to the potential for lawsuits and increased insurance premiums.

Plaza improvements are seemingly limitless, so a fundamental overview

of the use of a plaza is vital to establishing a successful design for a renovated space that accommodates both form and function. Who uses the space and when? Are there American Disabilities Act (ADA) considerations that need to be considered in the renovation/redesign of the space? Are there frequent off-hours activities, such as concerts? What are the lighting and security requirements? Does the original plaza still conform to the building code? Will the renovated plaza constitute a “change of use” in the eyes of the governing municipality? The answers to these questions will begin to define the space in terms of use, maintenance and construction requirements and will inform the direction of a plaza’s renovation design.

Understanding Plaza Construction

Whether a plaza is designed and configured on a single-level, on multiple-levels, on-grade, or over excavated/occupied space, the method for construction of a plaza should be determined according to the ways in which the space will be used.

Paver-on-pedestal:

The finish surface of plazas that are designed to accommodate seating, dining, staging (for entertainment) and the like should be level. These types of plazas are best constructed using a *paver-on-pedestal* or open-joint system, in which the waterproofing membrane is designed with a positive slope to the drainage system, while the finish surface is installed to achieve a level surface. This system provides for excellent drainage, as water flows freely through the open joints, and is a good solution for regions where precipitation is frequent.

However, as with all systems, there are drawbacks. The open joints between



▲ Plaza spaces range from the elaborate to the minimalist. Top: Channel Gardens at Rockefeller Center. Middle: a multiple-level plaza on a college campus. Bottom: a concrete plaza in Washington DC.

pavers that promote drainage of surface water have, on occasion, resulted in litigation because they can become tripping hazards. And, while a pedestal system is loose laid and facilitates access to the area under the plaza should it become necessary to identify problems or perform maintenance, it provides support to paving stones at the corners only, permitting stones to crack under excessive loads. Finally, installation costs associated with a paver-on-pedestal system may be higher than those for other plaza types, due to the hands-on skill required to place each individual paver.

Solid-/hard-set:

Understandably, plazas that offer

pedestrian settings must be designed to withstand frequent and heavy foot traffic. Often incorporating seating and landscaping, these spaces are usually constructed using the *solid-/hard-set paver* or closed-joint system. In this type of system, modular brick, stone or concrete pavers are set on mortar or asphalt, and the finish surface is typically allowed to conform to the drainage slope, as it provides for an adequate walking surface.

As for drawbacks, a hard-set system can be difficult to remove and replace should access to the area beneath the stones become necessary; it does not tolerate expansion, contraction or deflection of the deck surface; and, maintenance requirements are extensive, especially to protect the mortar joints.

Loose-laid/sand-set:

When a plaza is set on grade, a loose-laid or *sand-set* system may be constructed of tile, brick, stone or concrete pavers that are placed in a sand-setting bed. As the pavers are installed over a slab-on-grade substrate, no waterproofing is needed with this type of system as water is permitted to drain down through the slab to the soil below. Adequate surface drainage, however, is critical to the success of this system.

While a sand-set system is relatively easy to maintain, this type of construction may allow vegetation to grow between the stones, causing maintenance problems. In addition, a sand-set system is more susceptible to differential movement of the paving stones due to settlement and improper drainage, causing tripping hazards and increased maintenance and repair expenditures.

Invest in quality materials

As is the case with all components of the building envelope, investing in quality

materials and systems at the time of plaza construction will save repair and replacement dollars, as well as headaches, in the future. As there are a vast variety of man-made and natural materials available on the market today that are acceptable for use in plaza construction--all of which meet a minimum set of requirements such as non-slip capability and durability--the choice of finishing materials often comes down to preference and cost. Figure 1 provides some basic information regarding relative costs associated with a number of popular plaza building materials.

Defeating the Enemy

It cannot be said enough: water is the enemy of plazas. Therefore, nothing increases the longevity of a plaza space and protects an owner's investment more than the measures that eliminate the threat of deterioration from standing water: the proper design and installation of appropriate drainage and waterproofing systems. These systems efficiently remove water from the plaza and thereby prevent deterioration of plaza materials, prevent leaks into excavated/occupied spaces, and reduce the potential for accidents from standing water and freeze/thaw upheaval.

Waterproofing membranes

Just as there are a variety of finishing materials available for plaza construction, there are a variety of waterproofing membranes that can be utilized to protect a plaza from water. Once a waterproofing membrane is installed and plaza construction is complete, the membrane is buried away from view. It is therefore critical to ensure that an appropriate membrane has been installed to comply with the design documents and the manufacturer's specifications.

A waterproofing membrane should be continuous throughout a plaza, including installation in planters and on vertical surfaces. Furthermore, waterproofing should fully adhere to the substrate in order to help localize any leaks that may occur, easing the repair process. (A loose-laid membrane, to the contrary, allows water to flow throughout the plaza, making it difficult to determine the precise source of a leak, often requiring the removal of the entire plaza overburden to do so.) Lastly, membranes, and any flashing installed above the surface of the plaza, should be sufficiently protected from the sun, as all waterproofing membranes are vulnerable to ultraviolet light.

Rubberized asphalt sheets:

The most popular of the waterproofing membranes are rubberized asphalt sheets, which are beneficial in that they can be applied cold and are relatively odor-free. Factory-made of uniform thickness, these sheets are relatively easy to install, even in intricate situations or on vertical surfaces. The sheets, self-healing when punctured, are flexible, can be applied to uneven surfaces without tearing, and can bridge small cracks up to ¼" wide.

Because rubberized asphalt sheets are available only in three-foot wide rolls, multiple seams are required and must be field-fabricated. Because the seams need to be perfect in order to yield successful waterproofing, two-layer installation, in which a second layer of sheets is laid over the first layer to create staggered seams, is recommended. This dual-layer approach also protects the membrane from damage from heavy loads and/or construction operations.

Modified bitumen membranes (MBRs):

Typically used as roofing material, MBRs

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are gaining momentum in the field of plaza construction due to their dependability and superior warranties. MBRs, however, are more difficult to install than rubberized asphalt sheets and require propane torches or hot liquid asphalt during the application process. Many municipalities closely regulate such “hot” applications. While there are a few MBR products that can be applied with a cold adhesive, these membranes do not have a proven track record.

Adhered butyl sheets: Adhered butyl sheets are available in various thicknesses and in rolls up to 20 feet wide and 100 feet long, requiring minimal seams. These flexible, factory-made sheets are capable of bridging small cracks, are relatively easy to install on both horizontal and vertical surfaces, and can be formed around penetrations such as pipes and flashings.

Critical to the successful installation of adhered butyl sheets are caution during surface preparation and the ability to prevent sharp or rough objects (even pebbles) from puncturing the membrane. Also, these sheets are vulnerable to adhesive failure at the seams. Field conditions must be

controlled to minimize dust and other contaminants from interfering as the adhesive cures.

Hot-applied rubberized asphalt: Hot-applied rubberized asphalt systems resist punctures, provide monolithic waterproofing with no seams, and are relatively easy to install. However, installers must be highly skilled. Uneven thickness and variable temperatures while heating the asphalt may compromise its integrity. And, projections (such as pebbles or bumps) will not receive an equally thick coating. Though the ability to bridge cracks is limited to little more than 1/8”, reinforcement may be used where necessary.

Whatever waterproofing membrane is ultimately selected, installation of it should begin with some form of substrate preparation that facilitates adhesion to the structural deck. After membrane installation, a drainage mat is laid over the top to help move water to areas where it can be removed from the site. A 1/4” asphaltic protection board is utilized where additional protection of the system is desirable. Finally, where a plaza sits over occupied space, a high-density polystyrene insulation board is placed to help reduce energy costs (see Figure 2). The result is an efficient, durable system

that can receive a paving overburden and still maintain waterproofing integrity.

Where old meets new

Where should a new waterproofing system end? Typically, waterproofing ends at a sidewalk, street or perimeter surround and involves attaching the new waterproofing to an existing system. Unfortunately, the existing system is often suspect to begin with. Care must be taken at these critical “tie-ins” to ensure that the plaza’s new system is not compromised by existing conditions. Proper design should detail optimum tie-ins for these conditions.

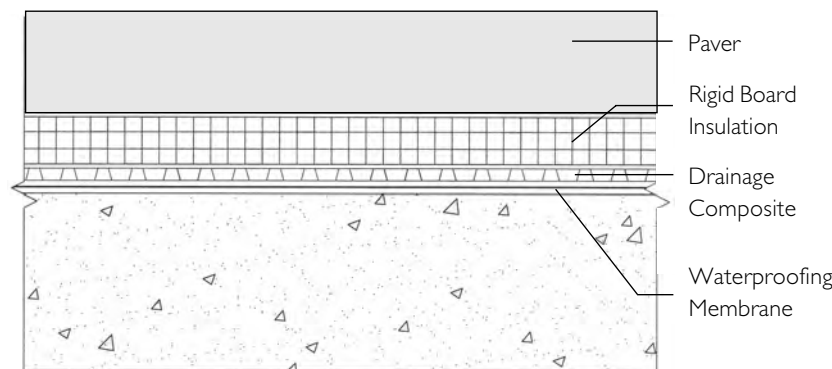
Flood testing

Flood tests are an essential part of any membrane installation and can help avoid costly repairs and remedial construction later. However, it is important to recognize the benefits and limitations of testing. Typically, flood tests are most effective when the monitoring team is looking for water infiltration within the building as opposed to calculating the loss of water from the test area. Plazas built on multiple levels will require longer flood tests, as water will take longer to travel the distance that it needs to infiltrate the building. The use of dyes in test water may be useful in identifying the source of the infiltration.

Warranties

Some manufacturers of waterproofing membranes offer 10 to 20 year warranties against material and labor defects. A warranty, however, is not a panacea. It is important to realize that a manufacturer’s warranty does not cover overburdens such as a paving system placed on top of a membrane. In the event of a leak or failure, most warranties state that the owner must remove the overburden to provide the manufacturer access to the system and replace the overburden when corrective

Fig. 2 Typical Section Through A Plaza Floor



work is complete. Some MBR manufacturers, however, warrant overburdens when a paving system is installed on pedestals.

Finally, waterproofing warranties do not reimburse for damage to property that results from a failure of the system or from failures that occur as a result of actions by a third party such as the property manager's maintenance staff or a subcontractor.

Drainage

While waterproofing protects the interior spaces of the property and moves water at the membrane level to areas where it can be eliminated, drainage eliminates that water; both on the surface and at the membrane. Drainage systems involve three vehicles: plaza pitch, area drains and trench drains.

The pitch of the surface of the plaza is crucial in moving water to drains. Typically, a pitch of 1/4" per foot along a walking surface is optimum to move water efficiently. However, an 1/8" per foot is better suited for areas that contain chairs and tables and therefore need to be more level.

But, it's not enough to remove water at the surface. A plaza is built as a series of layers and water will move at the bottom – the membrane level – as well as at the top. Failure to address water at the membrane level risks trapping water and causing freeze/thaw damage and premature deterioration of the plaza system as a whole. Therefore, bi-level drainage is necessary to allow for the most comprehensive removal of water.

Many styles of area drains are bi-level, allowing for drainage at both levels (see Figure 3). While trench drains allow for collection and removal of water over a much greater area than the smaller area

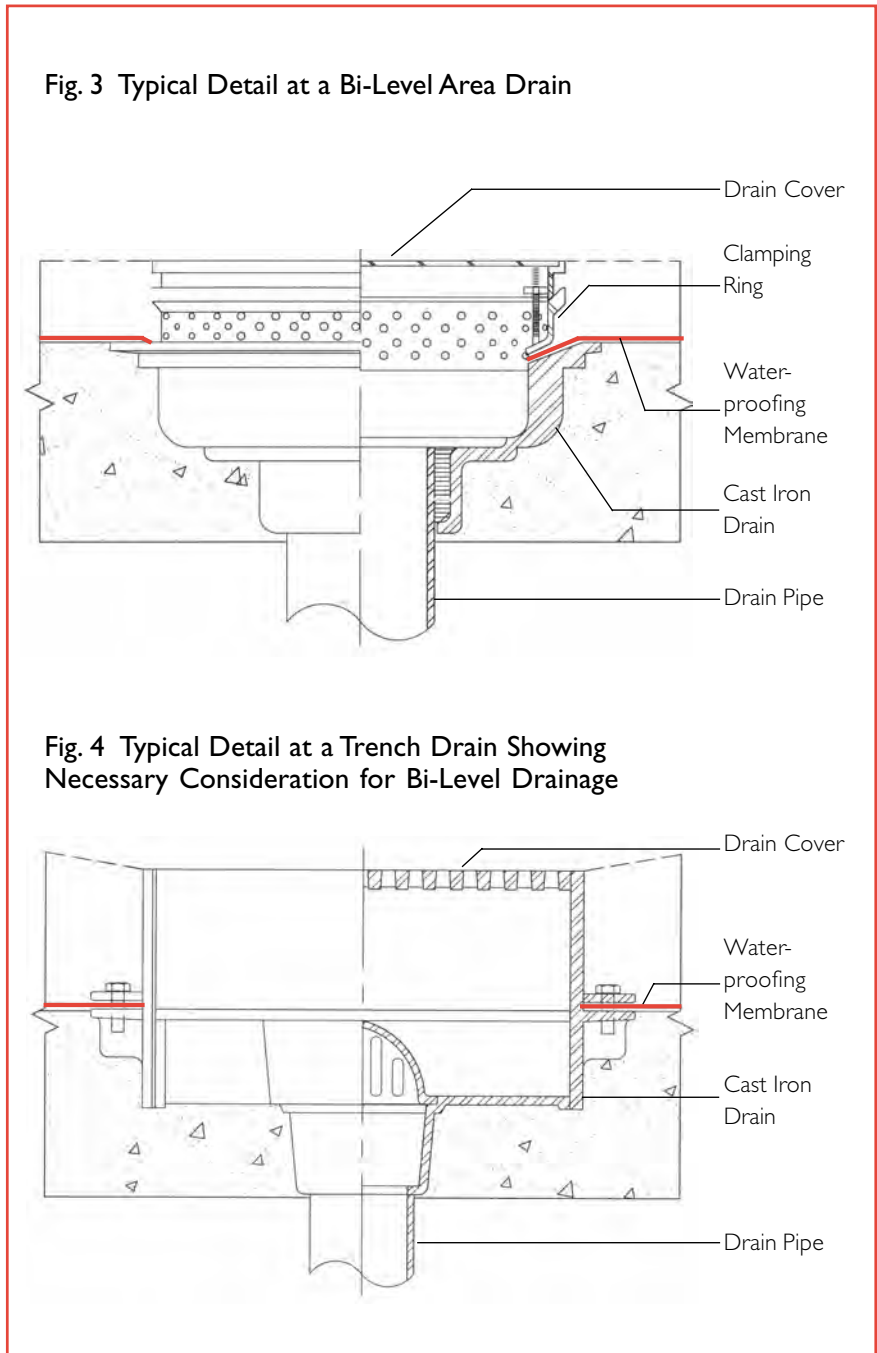


Fig. 3 Typical Detail at a Bi-Level Area Drain

Fig. 4 Typical Detail at a Trench Drain Showing Necessary Consideration for Bi-Level Drainage

drains, they are far less efficient and in many cases incapable of removing water at a subsurface level. It is therefore important to use these two devices in conjunction with each other to optimize the efficiency of a drainage system (see Figure 4).

Maintaining the Plaza

Once a plaza space has been revitalized, whether with minimal repairs or with complete replacement, consistent maintenance, as with any component of

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the building envelope, is the key to preserving its long life. In addition to regular cleaning, close attention should



▲ Cracking and spalling in interior spaces below a plaza is an indication of water infiltration.



▲ Cracks and heaved pavers, tripping hazards, are among the indicators of failure in plazas.



▲ Failure to maintain the plaza space has turned this once attractive urban setting into an eye sore.



▲ Plaza spaces require continuous waterproofing protection, including installation of membranes in planters and on vertical surfaces.

be paid to drainage and waterproofing systems. Drains, piping, irrigation systems and sump pumps should be consistently monitored to ensure that they operate properly. And, membranes, mortar joints, expansion joints and sealant should be regularly checked for leaks and deterioration.

Preventive measures, such as cleaning drains and draining down piping and pumping systems during the off season and maintaining construction features such as paving joints, go a long way toward preserving the lifespan of a plaza. The bottom line? By detecting problem areas early on, a property manager will be able to preserve the useful life of a plaza for as long as possible by planning pro-active repairs and maintenance that keep costs low.

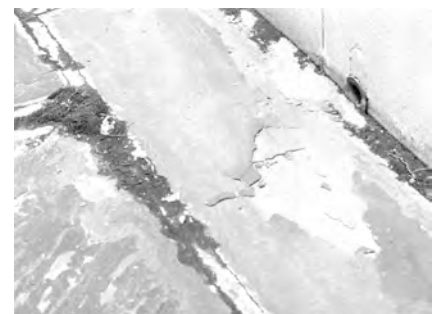
Have Your Cake and Eat It Too

Plazas have enhanced our architectural landscape for centuries. They provide space for civic and political activities, theater and musical performances, and markets and street vendors. Perhaps the most long-lived function of the plaza, however, is its most fundamental one: a respite from the daily grind, a place to take a break from the usual drill, if only for a moment or for a lunch hour.

It is not surprising, therefore, that plazas are continually constructed in areas originally designed to serve other

purposes. More and more urban communities are reaping the benefits of establishing pedestrian-only streets in traditionally congested portions of their cities. These streets-turned-plazas enhance the appeal of surrounding buildings, particularly when they are optimized with planters, seating areas, sculpture, fountains and reflecting pools.

Whether a popular weekday meeting place on a college campus, a seating area in a bustling commercial center, or a tranquil pedestrian setting at a suburban office park, a plaza is a worthwhile investment that should not be overlooked. Providing a functional, safe and cost-efficient plaza space *can* be achieved while accommodating aesthetic considerations. A sound rehabilitation plan, based on a comprehensive investigation and a thorough examination of usage requirements, is the key to success. ■



▲ Spalling stone pavement, cracked joints and vegetation on a 2nd floor terrace.



▲ Evidence of deterioration in plazas is commonly apparent as water stains, cracks and spalls. The poured plaza wearing surface above exhibits all of these.



▲ Pro-active repairs and maintenance measures could have prevented the many failures at this plaza.

representative projects



Plaza Rehabilitation

Hoffmann Architects has developed and implemented plaza rehabilitation solutions for a number of its clients, in both urban and suburban settings:

United States Capitol Complex

Washington, DC
Terrace, Fountain & Stair Rehabilitation
 United States Capitol
 Cannon Office Building
 United States Botanical Garden
 Rayburn House Office Building

Yale New Haven Hospital

New Haven, CT
Water Infiltration Investigation and Terrace Rehabilitation

Nine West Group Inc. Corporate Headquarters

White Plains, NY
Plaza Rehabilitation

1166 Avenue of the Americas

New York, NY
Plaza Rehabilitation

New York Public Library 455 Fifth Avenue

New York, NY
Sidewalk Rehabilitation

Chase Manhattan Bank Atria Complex

Garden City, NY
Water Infiltration Investigation

Rockefeller Center Complex

New York, NY
Plaza and Skating Rink Rehabilitation

Exxon Building 1251 Avenue of the Americas Rockefeller Center

New York, NY
Elevated Plaza and Planter Rehabilitation

Smith College

Northampton, MA
Plaza Rehabilitation
 Mendenhall Center
 for the Performing Arts

Princeton University

Princeton, NJ
Pool/Plaza Investigation

Champion International Headquarters

Stamford, CT
Plaza Rehabilitation

The George Washington University

Washington, DC
Plaza Rehabilitation

One Beacon Street

Boston, MA
Plaza Rehabilitation

Yale University

Beinecke Rare Books Library
Plaza Investigation
 New Haven, CT

Becton Dickinson Corporate Headquarters

Franklin Lakes, NJ
Plaza Rehabilitation

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■ **1251 Avenue of the Americas** New York, New York. Hoffmann Architects was retained by the owner to design a comprehensive program of repairs to restore the elevated plazas and planters.





▲ An urban plaza with multiple levels, seasonal plantings and seating areas.

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Greenwich Plaza
Greenwich, CT
Plaza Rehabilitation

Plaza Building
50 Prospect Street
Hartford, CT
Plaza Investigation

J. P. Morgan Co., Incorporated
New York, NY
Sidewalk/Vault Rehabilitation, Building Envelope Survey, and Facade Restoration
43 Exchange Place

Lever House
New York, NY
Roof/Terrace Restoration

Columbia University
New York, NY
Plaza Drainage and Water Infiltration
Avery Hall
Uris Hall
Schermerhorn Hall

University of Connecticut
Storrs, CT
Plaza and Planter Waterproofing
Weston A. Bousfield Hall

560 Riverside Drive
New York, NY
Plaza Renovation Design

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