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VIEWPOINT

Sealing Stadium Expansion Joints

By Lester Hensley

Most stadiums leak at expansion joints. Owners cringe and spend thousands, even millions, of dollars each year to repair leaks. The rare exceptions—stadiums completed with watertight joints—are characterized by a design and building process that involves a shift in the traditional way stakeholders relate to and execute their work. This process must begin early in the stages of design and planning and continue until construction is complete.

How can stadium owners ensure that their facility will be leak free? There are several steps that, if followed throughout the project, will ensure that the stadium remains dry and free of the need for expensive refurbishment.

Owner Responsibilities—Budget Appropriately

Less than half of 1% of a typical stadium construction budget is spent on expansion joints. The majority of post-tenancy problems with these structures, however, relate to water ingress. Owners must be receptive to recommendations for superior technologies presented to them by designers and be prepared to allocate additional resources to the design contract to allow proper detailing of joints and their relationships to other structural elements. By spending slightly more of the construction budget on waterproofing, stadium owners and managers can expect, and indeed demand, trouble-free, dry, and lasting joint seals.

Designer Responsibilities—Design for Joint Sealing Technologies from the Beginning

Even the best waterproofing system is going to fail if there are holes in the membrane. Structural expansion joints represent a planned hole in the waterproofing membrane. It is wise to begin then with consideration of how these major holes will be addressed and work out the membrane materials from there. Designing out expansion joint problems begins with consideration of the following:

- **Acknowledge the need for expansion joints**—Structural materials have limitations. Extreme weather conditions can cause damage over time. Cracks as a result of overstressed materials are nearly impossible to seal and can result in dangerous structural weaknesses. Properly designed expansion joints will prevent cracking, whereas carefully chosen sealant systems will withstand weather conditions and keep the facility dry.
- **Choose expansion joint location carefully**—Corners are a bad place for expansion joints. Do not cast or use the joints between precast corner units as the place for the structural expansion joints. Corners are impossible to set while creating a consistent expansion joint gap size. Furthermore, the angles created in the corner make awkward geometries for the attachment of sealant systems. Instead, cast the corners solid, or weld these precast connections and make them non-moving. Make the structural expansion joint in a straight line just off the corners.
- **Not through planters**—Do not try to waterproof structural expansion joints inside planters. If the joint runs through areas where planters are designed, detail the planters with back-to-back walls, leaving the expansion joint sealable.

Premature failure of unsuitable joint sealing technologies can lead to hazardous conditions and costly structural deterioration

- **Away from obvious water sources**—Keep scuppers away from joints and don't slope drainage across joints. Instead, for example, locate joints at the top of a ramp. Do not expect a deck to drain down a ramp and over, under, or through the joint.
- **Think about interiors**—Joints cut completely through the whole structure. Therefore, think about the interior layouts in relation to expansion joints. Considered early enough, it is even possible to hide some joints between back-to-back interior walls, thereby eliminating their aesthetic impact as well as the need to bridge them. Make sure the interior subcontractors know where joints are and the effect the joints may have on location of mechanical or plumbing fixtures. Finally, select and specify all-metal, high-point-load expansion joints capable of handling small-wheeled catering, cleaning, and other traffic that typically destroys "rubber and rail" joint systems.

Select structural supports wisely

Choose split columns rather than single columns with slide bearing pads. A single column structure results in hard-to-seal conditions around the column caps that create shear conditions for which most watertight joint systems are not designed. Split columns ensure that a system's sealing integrity can be maintained.

Size joints properly

There are four main facets related to sizing joints properly—expected movement, functional and installation temperature range, tolerance build-up, and movement capability. Architectural teams must also take the lead for sizing in joint design. Often, the structural team will make recommendations without considering a material and its movement capability and other effects on joint design. This can be avoided if the architectural team selects a technology and takes it to the structural team with the question, "What size joint do we need if we seal the joint with THIS specific technology?" The resulting joint size calculation can then take into account the movement capability of the product or technology type to be used.

Take time to find the right technology

Limit specifications to manufacturers that continually demonstrate a commitment to joint treatment, have sound technology, the ability to ensure and guarantee watertightness in plane and direction changes, and a commitment to quality.

Think and design in three dimension

Develop isometric, line-sketch schematics to show all the joints throughout the stadium. Include all changes in plane, direction, and intersection with other materials. This will put the design team on the same page, allowing all participants to identify and design out many problems before construction begins. Cross reference the material selection for each joint in the schematic with a cross-section detail. In addition, show axonometric details of each transition in plane and direction, especially when illustrating transitions between different material technologies, for example, between a concourse deck joint and a wall joint.

Communicate joint locations to all involved

Make sure to show expansion joints on all drawings, including structural, architectural, mechanical, and landscape. In the specifications, include a specific reference for responsibility of all trades to appropriate treatment of their work at expansion joints.

Interior joints in high-point load stadium environment

Factory-welded, custom tread and riser joint systems ensure durability and watertightness

Write project-specific specifications

Stadiums are not the place to use a "cookie cutter" approach to expansion joint design. The specifications for each job must match the specific performance demands of each venue. Research available technologies, implement them into the design and write specifications that reflect the choice. Make sure to stick with the plan throughout the project to ensure technology continuity and continuity of seal.

Have courage

Joint systems are a tiny percentage of the stadium construction jobs. Having engaged in the aforementioned expansion joint design-emphasis process, designers should have the courage to defend specifications of superior joint systems and hold to them even when pressured to substitute cheaper, less effective alternatives.

Contract Execution—General Contractor, Owner Responsibilities

Limit work to carefully selected contractors

Limiting work to a select group of contractors who have experience in this type of work can be a huge factor in ensuring watertight joint seals. Ensure that these contractors have been properly trained to install the chosen systems and can address substrate conditions that help ensure watertightness. Because they have the proper experience, these contractors are not likely to underbid the job, keeping change-order cost increases to a minimum; and they are likely to be versed in, and willing to remain committed to, a communication process involving the designer, owner representative, manufacturer, and general contractor.

Communicate clearly and often

Hold a preconstruction meeting with all parties involved in the treatment of work at and around expansion joints. This meeting should take place prior to pouring concrete that will define the expansion joints. Make sure all superintendents and forepersons with responsibility for casting activities attend the meeting to review issues such as:

- forming joint-gaps in relation to temperature changes;
- ensuring solid form construction to prevent collapsed and misaligned joint forming;
- proper consolidation and thorough vibration of slab edges and blockouts;
- zero tolerance on blockout formation;
- finesse concrete work for final blockout preparation;
- location, elevation, and configuration of joint curbs;

Thorough coordination between contractor and manufacturer welded joint system maintains continuity of seal around columns

- execution of concrete work to handle transitions to vertical plane; and
- protection of joints and traffic routing until decks are opened to normal use.

Emphasize expansion joints during all construction phases

Continue to place expansion joints on meeting agendas throughout the construction process. Many subcontractors, including electrical, heating, ventilation, and air-conditioning (HVAC), masonry, flooring, façade panel, waterproofing, and caulking, work in close proximity to expansion joint locations. They must be aware their work cannot impede structural movement that will occur at expansion joints or compromise the achievement of watertightness at expansion joints in any way. As construction progresses, the general contractor must emphasize expansion joints during each stage. Expansion joints must be considered a critical path item, rather than an added piece at the end of the project. Failure to emphasize expansion joints during construction is a significant contributor to delays, cost overruns, and the reworking that characterizes preparation of joints to receive the expansion joint systems.

This Viewpoint article has been selected by the editors as an offering to the interest of our readers. However, the opinions given are not neccessarily those of the International Concrete Repair Institute or of the editors of this magazine. Reader comment is invited.

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