Three Peer Experts Talk Ponding

***Ponding*. Every structural engineer knows ponding presents challenges to a roof system's integrity. The word itself calls to mind a number of variables — some of which you can design for and others that require more than simple engineering. Here are three peer perspectives on this complex subject.**

To equip you with insights about ponding, we met with three peer experts who have addressed ponding challenges throughout their careers.

- Arvind V. Goverdhan, Ph.D., PE, serves as an executive vice president in the Atlanta offices of Stanley D. Lindsey and Associates, Ltd.
- Mark Denavit, Ph.D., PE, is an assistant professor at the University of Tennessee and worked previously at Stanley D. Lindsey and Associates.
- James M. Fisher, Ph.D., PE, is a vice president emeritus of CSD Structural Engineers, having become a principal of the firm in 1974.

Simple Definition, Variable Problem

If ponding is, in its most basic definition, a process where water, gravitating to low points in the deflected surface of a roof system, causes progressively increasing deflection and load, then you might think ponding ought to be easy to anticipate and avoid. And while our experts' most essential advice supports that simple definition, there's more to avoiding ponding challenges than following a rule or a set of codes.

Dr. Denavit explains that while building to code is key, it can only get you so far. He says structural engineers "need to realize ponding is a real load. Under the current ASCE 7, the rain load that you would calculate is an underestimate of what would be present when the roof deflects and more water is able to collect in the space." The impact of that real load will vary depending on ongoing rain and snow conditions, the amount of allowable deflection, how the owners use the roof, and other factors.

The Importance of Communication

Dr. Fisher notes that in practice there is no real substitute for good communication within the design team. He says, "Sometimes the structural engineer doesn't determine the roof slope or size the drains. A plumbing designer does that. So, make sure you as the structural engineer coordinate with the plumbing designer or architect as to what assumptions they have made." It's important to get a dialogue going about all the details — storm information, drain sizes, scuppers — that will affect how the roof system performs. Dr. Fisher says, "You need to ask yourself, 'Have they provided adequate slope?' You need to get the water off the roof."

He recalls the evergreen example of an architect who doesn't like to see big holes for the scuppers in precast walls. "They design them too small. We need to make sure every decision on the design team is well coordinated."

Preempt Problems With an Analytical Model
Dr. Goverdhan sees the advantages of the structural engineer preparing for these conversations by identifying areas of concern ahead of time. He says, “You can create a quick analytical model and revise the loads as the structure deflects.” He adds, “A quick and dirty approach is that if you have a roof model and an inch of water weighs, nominally, 5 pounds per square foot, if the roof is deflecting under a 5-pound load, and it deflects 1 inch, you know you have a ponding problem.”

And he agrees that coordination with the design team is essential. “You have to actually determine where water will accumulate. The scuppers need to be at the correct elevation to get the water off the roof.”

Dr. Goverdhan advises that the entire roof system configuration be taken into account in order to locate opportunities to improve the design. “The amount of load that is on a single beam is also dependent on the deflection of the supporting girders. You can chase that support system back to any moveable point,” thus solving the problem the model reveals before finalizing a roof system design.

You Can’t Plan for Everything
Dr. Fisher notes that even when the structural engineer and architect do everything right, “other things happen.” He recalls a dangerous example that presented a risk to life where birds had nested in the drain system of a building. “Unfortunately, this was a canopy over a gas station. The whole canopy came down and severely injured a customer who was pumping gas.” Another example is when a contractor puts drains on a membrane roof. The design calls for an 8-inch drain, but the contractor may have only cut a 4-inch hole in the membrane, “so flow is severely restricted, and that causes more water to build up.”

To Dr. Fisher, there’s no substitute for the owners simply getting the debris off their roof. “To me, those things are almost as important as what we structural engineers do.”

“Ponding is an instability problem. And it can happen almost instantaneously.”
—Dr. Arvind V. Goverdhan

The Role of Innovation
The most commonly used method to analyze ponding risk was developed 50 years ago. Although innovation in ponding has been slow compared to almost every other aspect of structural engineering, Dr. Denavit sees real advantages to how simple and straightforward it is to create a model and conduct an analysis. He says, “The trend is really the one SJI started — using software. It’s not really that complicated of an analysis. It can’t be that complicated if we’re doing it inside of an Excel spreadsheet. Doing an analysis is certainly the trend, and may become the rule in the next edition of the ASCE 7.”

The Essential Problem Remains
Ponding can be anticipated, planned for, even ameliorated once identified. But the essential problem remains one structural engineers will always have to tackle.

To anticipate ponding risk, you can do more than adhere to codes. Every structural engineer should carry out careful modeling, supported by clear, ongoing communication, to address ponding risk before it becomes a practical problem.

Download a Tool for Ponding Analysis

SJI has led the way to help structural engineers create roof system models to address ponding. You'll find the Ponding Analysis option within SJI's Roof Bay Analysis Tool so you can properly evaluate additional loading conditions. A link to this free product is here: