# Structural Diversity

## Shankar Nair is known for both his building and bridge designs

**By Jennifer Wesley**

When Shankar Nair, P.E., Ph.D., looks out his office window on the 36th floor of the 205 Michigan Ave. building in Chicago, he has an enviable view of the Chicago skyline—and of a small portion of his own portfolio. But only a samll portion; the rest of it is hidden from his view and is found both in nearby locations such as Knoxville, TN, and Baltimore, and around the globe in countries like Kuwait and Egypt.

*Shankar Nair began his long and impressive career in Chicago with Alfred Benesch, moved to Baltimore to work for RTKL Associates and is now back in Chicago at Teng & Associates*

And his work is not limited to buildings; rather, he also is recognized for his accomplishments in bridge design. Though such structural ambidexterity is quite uncommon among Nair's colleagues, Nair says his dual specialization was just happenstance. "I had opportunities to do both," Nair says. "And I enjoyed doing both." At 51, Nair has earned accolades from numerous professional associations, including the American Institute of Steel Construction and the American Consulting Engineers Council, and also has been the recipient of five "Most Innovative Structure" awards from the Structural Engineers Association of Illinois.

At the same time, Nair continues to lecture and conduct research, particularly in the area of lateral bracing where Nair's scholastic contributions are being applied by practitioners around the globe. As chairperson of the Committee on Design of Steel Building Structures of the American Society of Civil Engineers, Nair acts on his conviction that the practical and the theoretical aspects of structural engineering are inextricable and interdependent.

Sitting behind his neat, modern desk, the only objects that suggest Nair's work are the pile of blueprints and posters and his laptop. A trim Nair, wearing a perfectly pressed pinstriped shirt and gray slacks, exudes a serenity and wisdom that might be intimidating if he wasn't so straightforward and genuine—the perfect demeanor for an up-and-coming guru—of lateral bracing that is. Ask him why he became a structural engineer and he leans back in his chair and answers with ease. "I've always assumed I would become a structural engineer," he notes with incisive confidence. "Since I was a child, I knew." Nair's father was also a structural engineer, while relatives on the other side of his family were mostly diplomats.

Nair didn't always know, however, that he would become a hybrid of academic and practitioner. When he came to the U.S. from India in 1965, he intended to get his master's degree in civil engineering from the University of Illinois. Nair thrived in graduate school, where he jokes that there were hardly any lectures, and decided to continue on for his Ph.D. with the intention of pursuing a teaching career upon its completion. When he finished the degree in 1969, he worked at Chicago-based Alfred Benesch & Associates to gain practical exposure to structural engineering.

### Introduction To Engineering

But Nair's passion for academia was quickly usurped by the thrill of practice. He enjoyed seeing his ideas incarnate in both towering structures—such as the one he sits in today—and also the less imperial, but even more important,

Chicago Mercantile Exchange. By 1978, Nair was named a principal and vice president at Benesch. Now, his January 1995 appointment as a senior vice president of Chicago-based Teng & Associates marks his return the city where he spent almost two decades of his 25 years in professional practice.

During his 15 years tenure at Benesch, Nair concentrated his work within the Chicago area. His most notable projects from this time include One South Wacker, a steel 40-story office building and 900 North Michigan, a 68-story hybrid structure. The 900 North Michigan building was built to accommodate the needs of both office and retail space by stacking a 40-story concrete tower on a 30-story steel structure. Today, it stands out as one of the most stylistic buildings in the Chicago skyline with four attendant turrets on top of the structure.

As an independent consultant, Nair was also a major contributor to the Morton International office building in Chicago. Partially through Nair's efforts, the 36-story steel structure was designed to be built over a railyard.

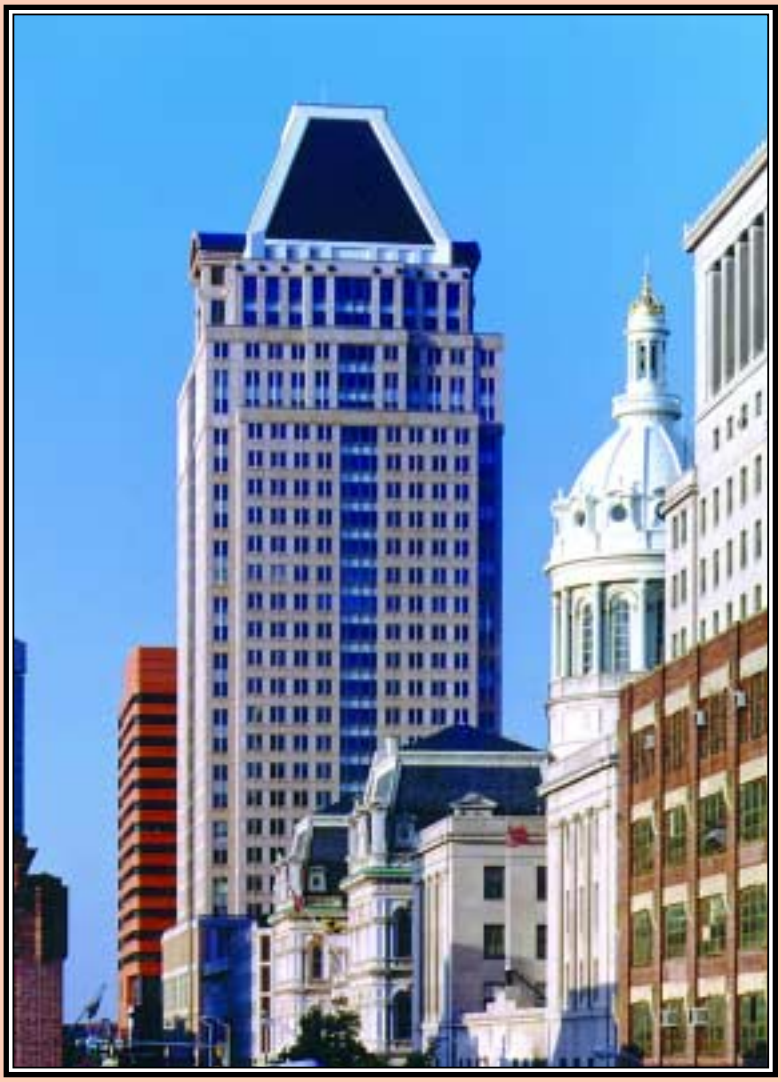
"Other developers believed that the site was unusable because of the structural constraints of the space," says Nair. "But through strong innovation we were able to build." Nair explains that the building was built on stilts and the steel trusses on the roof, substitutes for more conventional ground supports, suspend one entire corner of the building."

Switching between his talents for buildings and bridges, Nair also worked on the Interstate 255 bridge over the Mississippi River in St. Louis during his time at Benesch. At the time of its construction, the bridge stood as the longest tied arch bridge in the U.S. "Nothing about the overall form was unique, " says Nair. "But the choice of components went against conventional wisdom and went against the conventional problems." In this bridge, Nair decided to use an I-section for the large girder of the bridge rather than a more traditional box section, a decision that undoubtedly helped the bridge earn "Most Innovative Structure" recognition in AISC's Prize Bridge Awards competition.

"A big bridge is exciting because it's pure structure and allows the most leeway to exercise innovation," Nair explains. In terms of preferences, a tall building is a close second to bridges because they provide the additional opportunity to develop a concept to adapt structural needs to developers' needs. No matter what Nair is doing it seems he is always thinking of ways to innovate and create opportunities for each player on the development team.

"When structural engineering can create a site and an opportunity for development, that is what I find most exciting," says Nair. " A building's design begins with what the owner wants and what he expects to get out of it." In Nair's opinion, the engineer must merge the visions of the owners, the developers and the architects and create a balance between those ideas and the structural concerns.

Indeed, the same urge to create prompted Nair's 1988 move to



*Despite its huge size, the 702,000-sq.-ft., 30-story Commerce Place office tower in Baltimore's expanding financial and municipal district, the building was designed to senstively fit into its urban environment. Photo courtesy of RTKL Associates*

Baltimore-based RTKL. In the late '80s, Baltimore was experiencing a relative construction boom, particularly in the construction of tall buildings. As usual, Nair followed the action. As vice president and principal, Nair managed the administrative, technical and financial aspects of the engineering department. He was involved in several large building projects as well as smaller, more intricate projects involving hospital buildings. "The hospitals are unusual because they are a different breed of structural animal and tend to be quite involved," Nair says. Nair also had the opportunity to expand his international portfolio while consulting on a project for the American Embassy in Kuwait and a multi-use facility in Hanoi.

*The 8th Street bridge over the Sheboygan River in Sheboygan, WI, has a single-leaf bascule of 90-ft. and supports four traffic lanes and two sidewalks. In addition to a unique structural framing system featuring a massive cylindrical cross girder, the bridge has an unbalanced bascule leaf with no counterweight and no associated pit and the use of a cast-in-place concrete slab deck instead of steel plate or grating. Photo courtesy of Jim Maroney, The Oilgear Co.*

One of Nair's major domestic projects at RTKL was the Commerce Place building, a 30-story tower that employed an economical, post-tension framing system. Again, it was Nair who introduced the structural and economical innovations to the structure, impressing developers with both his design and fiscal sense by developing ideas that were affordable and innovative. Bob Knight, a principal at RTKL, values Nair consideration of all of these factors and comments that his clients recognize Nair's pragmatic, but erudite design practices. "Dr. Nair has an ability to cut through to the essence of problems," says Knight. "He can pinpoint problems and devise relatively simple solutions."

In fact, Nair is considered by many to be the ultimate problem solver, especially in the arena of lateral bracing. "He has an extremely deep knowledge of structural behavior," says Louis Geschwinder who worked with Nair at RTKL during a sabbatical. Geschwinder is currently a professor of Civil Engineering at Penn State University. "He applies that breadth of knowledge to every project he works on."

And as one of the most prominent researchers in the area of lateral bracing, Nair is something like the H&R block for lateral support systems—according to his colleagues, when he talks everyone listens. Nair agrees that he has a talent of explaining these sometimes misunderstood concepts. "I can show people how to analyze structural problems on the back of an envelope," confesses Nair. "But if I have done anything to forward the study of lateral bracing, it's simply to make it less mysterious."

Nair articulates and demystifies those forces through his academic pursuits and research which he deliberately gears toward practicing engineers. "Dr. Nair raises the consciousness of engineers that there are new things to be considered, " says Geschwinder. "He then presents it in a way that can be applied." Unlike many Ph.D.s, Nair's papers are practical and design-oriented so they can be understood and incorporated in everyday buildings by practicing engineers.

"Nair is unique in the field," says Ivan DeVorak, president of Teng and Associates. "It's rare to find a good talented academic who is also a gifted technical engineer." On top of that, Nair is a good-natured and friendly human being, DeVorak notes.

Nair's deft combination of practical and academic wisdom is equally evident through his work on the Committee on Design of Steel Building Structures. The Committee, known for its emphasis on designing solutions for practicing engineers, is one of the few committees within ASCE that is composed of practicing engineers, although there are three academics in the group. In its biannual meetings, the group develops solid and universal solutions for structural problems that are brought to their attention by ASCE.

Nair enjoys his leadership role because the committee is facilitating communication between academics and practitioners. "It is unusual because it's dominated by practicing engineers who are designing buildings everyday. The academics are very happy to hear from us, "Nair asserts. "They don't always hear from us (practicing engineers) and this committee bridges the gap so that we can meet academics at the same level." With an unusually high attendance rate of 90% for its meetings, it is clear that the committee members welcome the opportunity to approach and design structural rules and solutions that are often deferred to the academics. And Nair's knowledge of both worlds makes his insight crucial to the decision process. "The committee discusses the problems and if Shankar doesn't agree, we go back to the drawing board," confides Bob Disque, a long standing member of committee. "Everyone looks to Shankar —he's the last word."

### Current Practice

At Teng, Nair is both the first word and the last word. He is an integral contributor to projects at the firm from their inception to their completion. And that's how Nair likes it. "The best project is the one that I am involved in from the beginning," says Nair. His arrival at Teng comes after almost a decade of recruitment by the Chicago firm. Only recently, as building growth tapered in Baltimore, did Nair and his family feel that the development opportunities awaiting him in Chicago would be challenging and diverse. And that decision was not an easy one. Nair's wife, Catherine, a practicing attorney, is still living in Baltimore while their 16-year-old daughter finishes high school.

In the meantime, Nair has his work cut out for him at Teng with a full range of structural challenges. "Whenever there is some exceptional structural challenging structural problem, he is definitely one of the best guys available to deal or advise clients on what the solutions is," says Ivan DeVorak.

One of his more exciting projects is a bascule bridge in Sheboygan, WI. The bridge has an unbalanced bascule leaf and no counterweight or associated pit, both of which represent significant costs on a conventional bascule bridge. While the demands on the bridge-raising machinery are greater, the reduction in the initial structural cost more than compensates. In adition, the bridge has a unique structural framing system featuring a massive cylindrical cross girder about 5-ft. in diameter.

The cylindrical girder runs across the full width of the bridge under the roadway deck near the hinged end of the structure and serves as the rigid spine on which all other primary structural components of the bridge are mounted. The main longitudinal girders, one on each side, are fastened rigidly to the cross girder. Also mounted rigidly on the cross girder are four pairs of "crank plates," which support the cylindrical cross girder and, when acted upon by the hydraulic pistons, impart torque to the girder to lift the bridge. In effect, the cross girder uncouples the bridge support system from the longitudinal girders and deck framing, greatly simplifying the design of the bridge superstructure.

The inherent rigidity of the cylindrical cross girder holds all bearings in proper alignment, regardless of the flexibility of the longitudinal girders, which do not, therefore, need to be particularly stiff. Since the high torsional and lateral stiffness of a box section, as used in other recent bascule bridges, is not required, longitudinal girders of I section can be used, which simplifies the design of the deck framing members and connections, avoids the secondary floor beam end moments that have caused problems in other bridges, and economizes fabrication, painting and maintenance.

### Future Projects

Nair is also involved in the Lake Shore Drive relocation in Chicago funded by the McCormick Place Expansion Project and initiated by the Chicago Department of Transportation. The project, expected to be completed by 1997, involves the Teng team as well as Lawrence Helprin, a San Francisco-based urban planner and several subconsultants, in the translocation of the northbound lanes to the west of its current location.

Nair's new post also puts him at the helm of Teng's project to fully automate its information systems. Nair oversees the technical, administrative and accounting processes of the firm's network. Even with this diverse spectrum of responsibilities at Teng as well as the

ASCE, Nair finds time to write op-ed pieces for the Chicago Tribune and enjoy the classical concerts of the Chicago Symphony Orchestra.

As for Nair's structural ambitions, he expects to look out at the Chicago skyline well into the future. Looking forward though, he laments that the Chicago skyline is already set in steel, so to speak. "I hope Chicago starts building buildings again," he admits. "And when they do I would like to be involved."

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