Communication Breakdown

It's Always the Same…

By D. Matthew Stuart, P.E., S.E., F.ASCE, SECB

During the 1980s, I was involved with the structural design of a number of low-rise (less than 10 stories) structures across the mid-south. All of the buildings were cast-in-place, post-tensioned, flat plate concrete structures.

Due to the success of the company for which I was working at the time, the firm decided (via a joint venture with a local contractor) to construct an office building that would be partially occupied by my company and partially rented out to other tenants. The structure was to be five stories tall, including a partially below-grade basement garage, and clad with masonry brick veneer.

For similar types of structures that I had previously designed, it was common to employ a perimeter down-turned concrete spandrel beam around the exterior of the building to support the brick façade in order to control vertical deflections. For the company's new office building, we adopted a similar approach.

While working for this same employer, I was required to travel approximately 25% of the time as a part of the company's involvement with the certification program of a national manufacturers association. The time away from the office lasted from at least one week to no more than two weeks at a time. During these absences, it was common for a principal or another engineer with the firm to handle any problems or issues that came up with projects for which I was responsible.

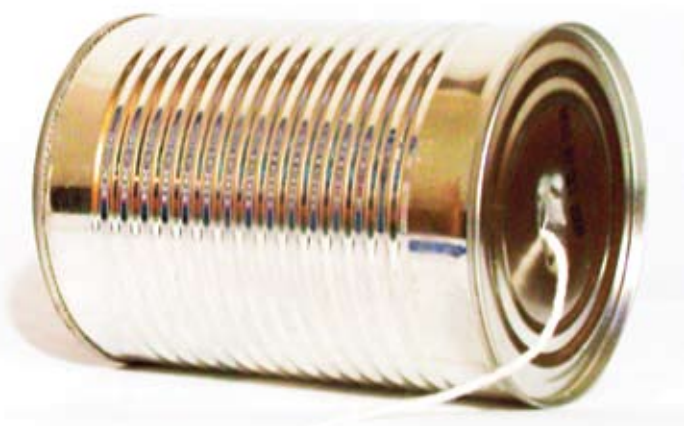
After the completion of the design and development of the contract documents for the new company office building, it became necessary for me to be away from the office on one of my scheduled trips. During this same time period, the joint venture contractor for the project indicated that pricing of the final construction documents had revealed that costs had to be reduced in order to stay within the original budget.

One of the cost-cutting measures approved by the principal in charge of the project included the elimination of the perimeter spandrel beams and the reduction of the amount of brick veneer that clad the building. These changes were not clearly communicated to me upon my return. In addition, because of my subsequent additional travel away from the office, the shop drawing review process was handled by another engineer. Consequently, I continued to be unaware of the elimination of the spandrel beams up until construction began.

The contractor formed, cast and tensioned the first framed level of the slab without any apparent problems. However, during the process of re-shoring the structure after removal of the forms, a failure occurred at a corner column. The failure was a classic punching shear collapse at the interior face of the corner column, which was surrounded by concrete slab on only two sides. Fortunately, the corner panel of the slab did not completely collapse because four post-tensioned strands, two in each direction, had been placed through the vertical reinforcing cage of the column. After the surrounding concrete slab failed in shear, these cables acted as catenaries to support the edge of the structure between the corner column and the next adjacent edge column on each side of the building corner.

A subsequent internal review of the design of the structure indicated that the proper serviceability and strength checks of the perimeter condition had been made relative to the elimination of the spandrel and reduction of brick. However, no one had taken the time to analyze the impact of the revision on the punching shear capacity of the slab at the exterior columns.

We subsequently developed a new detail that involved the construction of drop panels around the critical exterior corner columns. The contractor installed the drop panel after the fact at the first framed level, and also incorporated it into the initial slab and column pour for all of the upper levels. There were no further problems with the structure as a result of the original design and the building is still in use today. However, once the building was occupied, a mechanical contractor inadvertently cut one of the unbonded strands during the placement of a post-installed slab soffit embed hanger. A subsequent analysis of the affected slab panel for the loss of the one tendon indicated that there was enough reserve capacity to support the imposed dead and live loads.



The punching shear failure, which occurred in the first decade of my career, was the first and only such problem that I have personally been involved with during my 30 years of experience. I continued to work at the same firm for a few more years after the incident; however, even though the sequence of events that led to the failure occurred without my knowledge or direct involvement, I still felt that my image at the company had been tarnished.

In any case, independent of my travel schedule and the decisions made by others in the company, had there been better lines of communication open between myself as the project designer and others involved with the construction administration of the project, this failure probably could have been avoided.▪

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