

This article is based on several of the ten CASE Foundations. For the complete list, see the on-line version of this article, or the Risk Management article in the December 2007 issue.

IT FELL

By Richard Bender, P.E. and Rob Houser, P.E.

In spite of all we had done, all we had prepared for, all the meetings, the drawings, and discussions, it fell anyway. Everyone involved felt we had all bases covered and the project could be constructed without problems.

As with many historic building renovations, the feasibility of a project is directly related to the amount of tax relief one can procure by maintaining a significant portion of the existing architectural and structural qualities of the original building. Such was the case for a historic residence in downtown Knoxville, Tennessee. The owner selected an architect and construction manager, and the architect selected Bender & Associates as structural engineers for the project.

Many facets of city life, such as poor drainage, constant traffic, utility and road construction, remodeling, and even possible sinkholes had taken their toll on the west end of the structure over the years. Large cracks in much of this wing were in need of repair, as well as correction of the underlying causes of the cracks. Most of the walls did not have foundations, but were bearing on a mortar bed directly on the soil. The subsurface and bearing for the walls had deteriorated, and the geotechnical consultant found indications of possible sinkholes.

Prior to construction, meetings were held with the construction manager, his subcontractors, the geotechnical engineer, and the design team to discuss methods of stabilizing the walls that had no foundations. After painstaking discussions and the consideration of many alternatives, a grade beam system supported by micropiles was chosen as the most economically feasible method to achieve project goals. Constructability and phasing of the grade beam installation in coordination with the micropiles, and geotechnical requirements regarding excavations, were discussed at length during the meetings, as well as the detailing that would be required for the contract documents. The drawings were produced with information resulting from these meetings and with indications for shoring that would be the responsibility of the contractor. Once the drawings were complete, Bender & Associates met with the architect, construction managers, the project manager, and the superintendent to discuss this critical part of the work prior to demolition. All sides appeared to be in agreement with the way we expected things to proceed.

How could it happen?

Before the digging commenced, the construction manager replaced his job site superintendent. During the transition, some critical information was not conveyed to the new manager. The excavator and grade beam subcontractor did not follow guidelines for phasing of the work, as had been discussed at length in earlier preconstruction meetings. Whether he missed a meeting, did not follow the guidelines, or was told to proceed as he did, the excavator completely excavated along two sides of the building, undermining both of these walls. No shoring of the framing or walls was in place during the excavation. Naturally, when you excavate below something and provide no shoring, collapse of the walls and framing is inevitable.

At this point, a non-historic structure might have been demolished and started again from scratch. Since there were historic significance and tax breaks involved, most of the structure was required to be saved rather than demolished. After many delays and much finger pointing, more meetings and insurance claims, the building was shored and the construction completed using the details shown on the original construction documents. The project was successful, although there were legal considerations between the construction manager and the excavation contractor regarding the builder's risk insurance.

Do the 10 foundations apply?

A review of the project using the RMP 10 Foundations leads to the following:

- #2 - Prevention and proactivity: The entire design team was aware of the problems associated with this job due to the historic nature, and we attempted to be preventative and proactive by meeting with all parties involved.
- #4 - Communications: The design team, along with the geotechnical consultant, the owner, and the contractor, tried to communicate so that everyone knew what was expected and required of each other.
- #5 - Education: Each member of the team provided information to all of the other members to show what responsibilities belonged to each party.
- #6 - Scope: We tried to develop a clear scope to show exactly what was expected of each party.
- #9 - Construction documents: We felt that the construction documents by the design team were such that the contractor

and his subs would clearly understand the project if they followed the plans, details, and specifications.

- #10 - Construction phase: There were periodic site visits and shop drawing submittals to verify design intent.

What did we learn?

Construction Phase

Although shoring and excavation protection was not in the scope of the design team's work, if there had been site visits and/or submittals to review construction progress at these crucial times, the collapse could have been prevented. Without piercing the veil of means, methods, and techniques, it is up to the design team to verify that the construction process meets the design intent.

Communication

If the new superintendent had been cognizant of the special requirements that were discussed ad nauseum during preconstruction meetings, this entire failure could have been avoided. The chain of communication between the design team, construction manager, subcontractor, site superintendent, and those performing the work must be kept strong. If one link is broken, the chain must be reconnected and every link must be rechecked to maintain its integrity. Verbal records are not enough; a written meeting summary with important information should be kept for each meeting and available to all parties. When a new team member becomes involved, they should be given the contract documents, addenda, and all meeting notes that affect the construction in order to be made aware of things discussed but potentially not documented elsewhere.

Conclusion

Although this turned out to be a successful project in spite of the partial collapse, there was a stigma attached to all parties associated with the construction. Accidents will happen, but accidents due to lack of communication are fortunately avoidable. Redundancy in communication will help to get your point understood; if that doesn't work, tell them twice!■

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