Texas ASCE Guidelines for the Evaluation and Repair of Residential Foundations

An Online Continuing Education Course for Engineers

Course Number: S-3006

Credit: 3 Hours / 3 PDH / 3 CPD

Commentary on
Guidelines for the Evaluation and Repair of Residential Foundations

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Overview and Disclaimer. This is the course author's commentary on the Texas Section of the American Society of Civil Engineers (TxASCE) document, *Guidelines for the Evaluation and Repair of Residential Foundations*. While the course author was a contributing member of the committee that wrote the document, please note that the comments and opinions expressed herein are the author's alone, for the purposes of explaining some of the concepts presented and demonstrating how they might be used in practice, and should not be interpreted as those of the TxASCE.

Please refer to the corresponding section of the *Guidelines* as you read the commentary. Not all sections require comment.

Forward to Version 1. Committee chairman Robert F. Pierry, Jr., PE, provided the leadership that resulted in considerable time and talent being devoted to the production of the *Guidelines*. The committee members all were professional engineers and members of the ASCE. Their practices actively involved the topics of the *Guidelines*, and reflected engineering consensus from these general areas of Texas: Houston, Bryan-College Station, San Antonio, Austin, and Dallas-Fort Worth.

The document was subject to review by the entire TxASCE membership. Comments and suggestions were rigorously reviewed and considered by the Committee before presenting the final draft that was adopted by the TxASCE membership at its 2002 Fall Meeting. Anticipating advances in technology and construction practices and materials, the document has the subtitle *Version 1*.

The Forward notes that the *Guidelines* are primarily suited as an aid for engineers. The *Guidelines* were not intended to be a do-it-yourself manual for the homeowner with foundation problems. That being said, the *Guidelines* do provide the public and the Texas Board of Professional Engineers (TBPE) a means of assessing whether engineering counsel regarding the topics is consistent with the consensus of the TxASCE membership.

Section 1. PURPOSE AND SCOPE

The *Guidelines* are meant for engineers in Texas who practice in the field of residential foundation evaluation and repair. Texas is unique in that it has areas with both expansive soil and changes in climate that cause substantial changes in soil moisture content.

The document notes its limitations, and explains that merely following its recommendations does not necessarily mean a satisfactory result.

The document says that it should not comprise the standard of care. While that was its intent, many feel that it will become the de facto standard. The Texas Residential Construction Commission (TRCC), for example, as of November 1, 2004, proposes the document for use by engineers inspecting claims filed under the TRCC provisions.

As noted above, the Committee anticipated changes in the document. A procedure is given for submitting recommended changes, and the engineer is reminded to check with the TxASCE regarding updates.

Section 2. QUALIFICATIONS OF THE ENGINEER

2.1 Professional Qualifications. The document outlines the professional qualifications of the engineer. Simply stated, the engineer needs knowledge and experience in investigating and evaluating existing buildings. Without the original geotechnical report, the structural plans, and construction inspection and test reports, the evaluating engineer often has a daunting task.

The engineer should have a working knowledge of the following:

- local geology and its potential influence on foundations
- typical design procedures for the types of foundations investigated
- local construction practices
- building code requirements for the types of buildings investigated
- topographic surveying
- residential construction materials and testing
- implementing geotechnical recommendations and parameters in remediation plans
- design procedures for foundation remediation
- capabilities of local repair contractors

Not addressed in the *Guidelines* is the ability to communicate effectively. In investigations for real estate transactions, property damage claims, and matters subject to litigation, the final work product is a report that may have a substantial impact on either the client or another party. The value of such a report diminishes when it fails to be clear and concise.

2.2 Professional Ethics. Avoidance of a conflict of interest is paramount in an evaluation investigation. The periodic enumeration of TBPE sanctions is rife with situations where an engineer became an advocate instead of an unbiased third party.

A question the engineer may wish to ask is, “Would my report be any different if I were representing another client in this matter?” The answer, of course, should be that there would be no difference.

Section 3. LEVELS OF INVESTIGATION

3.1 General. The engineer should *recommend* the appropriate level of investigation for the client, but the ultimate scope of services should be established by agreement between both. Being the experienced professional in the matter, the engineer has knowledge of what level of investigation would accomplish the client's objective.

The engineer has to visit the site, and the engineer must be *in responsible charge* (See TBPE Rules) of the investigation. The engineer cannot conduct a foundation evaluation without visiting the site, and still call the work product an *investigation*.

The three levels of investigation are essentially the same as those recommended to the TBPE in 1998 by the Residential Foundation Study Committee, Expert Evaluations and Forensic Issues Subcommittee headed by Ray Messer. These recommendations subsequently were adopted by the TBPE with Policy Advisory 09-98-A, Regarding Design, Evaluation and Repair of Residential Foundations. That Policy since has been rescinded, and it has been removed from the TBPE website.

3.1.1 Level A. Like the other levels, the engineer should state clearly the scope and level of the investigation. The Level A investigation is a first-impression, or preliminary, investigation, and often its purpose is to determine the direction of further investigation. No measurements are required, and no tests are required. A written report is optional.

Not to be trite, but the engineer has to start somewhere, and a Level A investigation can provide both engineer and client a cost-effective way to determine what the next step should be, or even if there is a next step. Because the Level A interview with the client often is an excellent opportunity for the engineer to dispel common misconceptions about foundation behavior atop expansive soil, both may find that the client's original perception of required remediation changes.

In the author's practice, the interview begins with the request, "Tell me about your house." Follow-on questions include, "What is your concern about your house?" and before the engineer begins the detailed observation, "Is there something you want to be certain that I don't miss?" Often the engineer will find that the client's anxiety is about something that truly is not an issue.

3.1.2 Level B. In addition to the steps taken in a Level A investigation, a written report should be made, foundation elevation measurements should be made, and a drawing should be included that shows the relative floor elevation values.

The *Guidelines* do not require reference to an elevation benchmark, nor do they require that the drawing show the elevation values via contour lines.

Some of the engineers on the Committee always reference external benchmarks, some always draw elevation contour lines, some always include the raw data so that others could reproduce the data, and some include three-dimensional representations of the foundation surface. Again, engineering judgement should be used to determine the appropriate measuring method and reporting.

The author's practice is to reference at least one external benchmark and assign it an arbitrary elevation of 10.00 feet. A second, or back-up benchmark, often is chosen. In areas with deep expansive soil, utility poles, manholes, tree trunks, and curbs cannot be relied upon to remain fixed in elevation. When a series of elevation measurements is anticipated in these areas, a fixed benchmark is recommended and installed by a geotechnical firm.

The author's practice is to survey with a laser level, recording elevation values to the nearest 0.01 foot. Every survey loop is closed. A hardened steel probe is used on the base of the elevation rod, so that it can penetrate carpet to measure atop the hard floor surface. The resulting elevation data are plotted with 0.02-foot contour lines. Others routinely show ¼-inch contours.

3.1.3 Level C. This level of investigation includes the steps taken in a Level B investigation, plus whatever else the engineer deems necessary. It should be a comprehensive investigation.

Regarding photographs, in the author's practice, wide-angle photographs typically are taken that show an overview of a side of the building or as much of a room as is practical. Close-up photographs then are taken, preferably at locations that are visible in the wide-angle photograph. The close-up photographs show distress symptoms of concern, but when the same type of distress is seen in other locations, another close-up photograph generally serves little purpose. Some method is advised to record which area is represented by a particular close-up view, because often the typical distress symptom, such as a gypsumboard crack, is not discernable from another.

Regarding a detailed distress survey, in the author's practice this includes measuring cracks widths, which are reported to the nearest 0.25 mm. A transparent crack comparator is used. Measuring crack widths can be most beneficial when follow-up observations are made, either by the engineer or another investigator, and provides an excellent gauge of whether conditions are truly worsening.

The author's practice is to describe cracks using definitions modified from those used by the U.S. Bureau of Mines:

- Threshold-type cracks. Threshold-type cracks are as narrow as "at the threshold of detectability" and as wide as 3 mm. They occur at joints between either similar or dissimilar materials, but do not progress diagonally across the material.

- Minor-type cracks. Minor-type cracks have thicknesses ranging from 3 to 6 mm if they occur at joints, or from hairline to 6 mm if they occur diagonally across the material.

- Major-type cracks. Major-type cracks are those wider than 6 mm.

Section 4. EVALUATION METHODOLOGY

4.1 General. The *Guidelines* require the engineer to [illegible] the analysis. The method suggested is the *scientific meth[illegible]*

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4.2 Anal[illegible] causes of the condition[illegible]e suffered a plumbing[illegible]used by the plumbing[illegible]ve? Where was the le[illegible] unusually hydrated?[illegible]ld the site drainage h[illegible]ould trees have affect[illegible]

The docum[illegible]ns of the quality of t[illegible] trying to evaluate the[illegible] not the concern: it is that evaluati[illegible]ssumptions about the condition of the floor at the[illegible] published statistics may show about as-built floor surface roug[illegible]t an as-built survey the engineer must speculate about the original condition of the floor.

Section 5. EVALUATION CRITERIA

5.1 General. The patent assumption of the *Guidelines* is that residential foundations are expected to be (and to remain) reasonably flat and level. The foundation should not bend so much that