WHAT CAN BE DONE?

Actually, much of the necessary work involves awareness more than anything else. The additional monies necessary to accomplish some of the following suggestions can easily be considered as product liability insurance. In addition, the selling points of deep quality don't have to be buried with the product. A good foundation performs best when it's out of sight and out of mind, but it's virtues can certainly be touted.

Site Preparation:

Initial Site Investigation

Nothing regarding a prospective building site should be taken for granted. If the site has received embankment fill soil or has been disturbed in any manner, all available details should be investigated. If embankment fill has been placed on the site in the past, either recent or long past, information regarding its condition is essential.

Even if the embankment fill had been placed under controlled conditions, which means it's been tested as it was placed, the age of the placement may be important. For example, the placement of a three foot thick layer of clay fill may have been subjected to years of wetting/drying cycles which had alternatively saturated and fissured the soil, in which case the soil must be treated as an unprepared site.

If the site has received considerable uncontrolled embankment fill, it may be possible to build on the site. However, a thorough sub-soil investigation followed by a foundation design prepared to account for uncontrolled fill can be designed. The cost of such an endeavor is high, though.

Most proposed home sites in Amarillo are part of a development where several other homes are being built. Knowledge of the site conditions of one site may be applicable to many other sites. This circumstance may be conducive to a thorough investigation for one site to represent several nearby sites. This can possibly act to reduce the investigative costs. Again, nothing should be assumed regarding a particular site's condition until it has been shown accordingly to be suitable.

Conditions to be determined regarding the site involve a number of factors. The type of soil, of course, is crucial. For example, a house built on an expansive clay will be much less forgiving than a house built on lean clayey sands, typically. The stiffness or denseness of the foundation soil is an issue, as is the in-situ moisture condition. The type of embankment soil used for leveling or raising the grade must be conducive to the on site soil condition. On a site consisting of expansive clays, the embankment fill should also be a clay, but it should be a clayey soil that is less expansive than the on-site soil if economically feasible.

Site Preparation for Construction

Whenever a site calls for the placement of embankment fill soil for the purpose of leveling or raising the floor level, the City Code dictates testing of each lift of soil to obtain a percent compaction according to the Standard Proctor of 90% with a moisture content within the range of +/-5% of optimum soil moisture content. Embankment fill placed at these standards does not necessarily prevent post construction soil movement (volume change), which can result in uplift with site wetting and shrinkage with site drying. It would be better to compact at 95% Standard Proctor at an optimum moisture content range of +/-3%. As previously stated, this embankment fill should be compatible with the site. City code does not state any requirement in this regard.

Local city code states that no site preparation work is required where no embankment fill soil is added for leveling purposes or when the existing site grading is sufficient. As stated earlier, though, a site such as this being built on during the height of the dry season on an expansive clay site is asking for post construction perimeter uplift problems. This situation can be alleviated to a degree by processing at least the top one foot of natural grade soil to the same compaction standards as advised earlier. This will cause the soils near the surface to be sealed and less likely to swell and uplift. Since a higher grade than surrounding terrain is almost always advisable, consideration for additional select embankment fill soil that is also properly prepared would be advantageous.

As previously noted, most residential structures end up having the floor level to be less than six inches higher than the surrounding ground level. This usually occurs because the perimeter footing is placed at the presumed new soil grade level, which will also act as the brick ledge for a brick veneer sided house.

This means that the six inch clearance between ground and sill plate is now obtained. However, the landscape guys haven't shown up yet. They shall proceed to place topsoil on this grading. The end result is a two to four inch floor to soil difference in grade. This circumstance should be anticipated in the design and/or in the site's final grading.

Of course, the Code requirement of positive site drainage should be anticipated as a final result after landscaping has been completed. This may require prior consideration during initial site preparation.

Foundation/Structural Foundation Design

Several basic residential foundation design practices exist that have proven to be suitable for many residential structures in the Amarillo area. Of course, these practices exceed the above mentioned minimal footing as required by the City Code Enforcement. A common design often used by astute builders for a single story unit consists of a 30" deep perimeter footing that is 12" wide with appropriate reinforcing steel. The floor slab is 4" thick on a sand layer with slab thickenings with additional steel beneath each interior wall. Instead of wire mesh, actual reinforcing bars are placed in two directions embedded one inch above the bottom of the slab. Generally, this is an acceptable design for even larger homes. However, nothing should ever be assumed.

Prior to acceptance of such a design, the structural framing loadings on the foundation system should be assessed. Anticipated load concentrations dictated by roof and wall loadings over wide spans may need additional foundation support. A qualified architect should be retained in the development of structure and framing plans.

All roof support requirements should be anticipated. The architect should be consulted to assure no structural incompatibilities are built into the roof support system. Wherever possible, architectural plans should identify roof support locations and guidance should be provided to relieve the framer of having to "think on his feet" for much of the roof support design any more than is absolutely necessary, particularly when special problems are anticipated.

With today's modern "open space" floor plans, the use of architect expertise in concert with the foundation engineer becomes crucial more than ever before.

"Engineered" Foundations

The Texas Section of the American Society of Civil Engineers (ASCE) has prepared a simple, but most appropriate two part document entitled "Recommended practice for the Design of Residential Foundations" and "Guidelines for the Evaluation and Repair of Residential Foundations". This document is very recent, having been presented to the Society on 3 April 2003. Access to this document is highly advised for every professional involved in residential construction. It can be downloaded for a fee from the Section website, www.texasce.org.

This document defines an "engineered foundation" as a state licensed professional engineer design which has available geotechnical information. The definition also states that the construction work is observed and documented.

This document provides guidance concerning the type of design procedure or rational and the circumstances for the performance of the foundation design.

The engineered foundation design provides a plan view with details of all structural components and reinforcements. In addition, the plan addresses the site preparation requirements and specifications as noted above in the discussion. This plan does not include the framing or architectural design. The foundation engineer should not be expected to "okay" a set of drawings. In such circumstances, an architect should be involved in the actual framing consideration.

Essentially, this document raises the level of the residential foundation design to that of engineering designs that have been traditionally associated with larger projects such as industrial, institutional, and public works engineering endeavors.

This does not mean that intense engineering presence is necessary on the typical residential structure project. It does not propose that all individual residential foundations be designed by a professional engineer. All that is being said is that the new home construction should receive the same

consideration, the same care, the same meticulous attention to the design/construct detail that is traditionally provided for the larger and more expensive engineering projects.

When one thinks about it, it's only reasonable to expect nothing less than whole hearted care and attention that is typically associated with the larger projects. What's more, the documentation of the design and its associated specification details serve to protect all parties involved in the project. Each project plan should provide written guidance and specification regarding documentation and specifications.

Job Monitoring

As noted by previous discussion, occasions do arise where deficiencies arise due to improper care or lack of craftsmanship during the installation process. Most technicians perform their areas of expertise with pride and confidence. As a result, craftsmanship is not always at issue, but it can be.

The rule of thumb for anyone involved in the construction endeavor is "you can't be too careful". To assume that people hired will do a good job would be nice, but it's not wise. This philosophy is particularly applicable to the site preparation and foundation construction phase of the project. After all, most of all good or bad foundation work is covered up when it's done. It's no fun to find out it wasn't placed in accordance with plans and specifications when a problem occurs. A lot of stuttering seems to take place at this point in time. This means the work must be monitored and documented with testing, if appropriate.

The site preparation must be tested, of course, in order to comply with city codes. It wouldn't be a bad idea for the job supervisor to be present during the testing to be certain the testing technician is properly representing the building site. He's not immune from error any more than the other building professional technicians will be.

The same goes for the forming and steel placement in the foundation system. The placement of the footing and slab concrete is by no means a slam dunk deal. The technician may be tempted to add too much water to the concrete mix so his finishing job will be easier and faster. The supervisor may be advised to obtain concrete test cylinder samples to assure himself the delivered concrete meets his

design standards. The presence of the builder's representative during these crucial times of the home construction tends to lift the standards of everyone involved when it has been clearly indicated he cares that the job is done properly. Documentation by the representative's witness can save a lot of heartache down the road if problems ever do occur.

The same goes for the plumbing installations. After all, the concrete and the soil are going to bury these features. It's best not to find a problem after the concrete's down and hard.

Landscape Procedures

The astute placement of landscape features to avoid severe absorption of water hungry trees and shrubs near the foundation should be helpful. At the same time, planters and landscape features that tend to cause accumulation of water against the outside walls should be only applied with due care.

No moisture retention landscape features should be allowed to rise above or near the floor level along outside walls.