Disregard Depth in Foundation Design

When performing the design of a drilled shaft or pile foundation for a bridge, an important parameter is the selection of the **disregard depth**. The disregard depth describes the amount of surface soil to be ignored in the design of the foundation due to potential erosion or scour, future excavation, soil shrinkage due to seasonal moisture variation, and other factors.

Grade separations not over water-

Abutments - For abutments placed within embankments, the entire depth of the embankment is disregarded for foundation design. Foundation design initiates at the top of the existing ground. For abutments placed in natural ground, the disregard depth is generally taken as 5 feet based on the assumption that concrete or flexible slope protection of some type will be placed adjacent to the abutment to prevent erosion and moderate moisture loss. If no protection is placed adjacent to the abutment the disregard may be increased to 10 feet.

A special consideration for abutments at grade separations is the potential future construction of a turn-around lane with an associated retaining wall. If any possibility exists that a vertical wall will be constructed in front of the existing abutment in the future, the entire depth to the lower roadway grade should be disregarded. It is not recommended to tip an abutment foundation above the grade of the lower roadway in any case.

Interior Bents - The disregard depth for interior bents is generally taken as 10 feet. High plasticity clay soils common throughout Texas can contract to depths of up to 8 feet during periods of drought. The recommended 10-foot disregard accounts for this potential shrinkage, as well as potential future excavations. At the designer's discretion, the disregard depth may be reduced to as little as 5' in areas where rock or low-plasticity soils extend to near the surface.

Bridges over waterways-

General – Design of foundations for bridges spanning waterways must take into account the potential for lateral migration of the waterway, long-term erosion, and short-term scour. The combination of all three of these mechanisms is often termed "scour", but it is useful to discuss them as three different problems.

Most foundation problems in Texas are caused by lateral migration of rivers and streams. Bridges with foundations that are significantly shortened at bents away from the main channel have collapsed or required expensive underpinning when waterways have shifted laterally, relocating the main channel into the area with shortened foundations. In severe cases rivers have migrated such a distance laterally that bridges have had to be lengthened to accommodate the movements. It is prudent to evaluate the possibility that a waterway may migrate laterally throughout the entire length of a bridge. Waterways in beds of sand, clay and gravel can be expected to exhibit significant migration. Waterways that are well established into sound, non-erodible rock are typically not subject to this phenomenon.

Long-term erosion has been an issue in some regions of the state. Past river training and straightening projects have caused rivers to initiate downcutting in order to re-establish equilibrium. In early stages of downcutting the rate may exceed one foot per year. As downcuttingcontinues the rate slows and eventually stops as equilibrium is established. Historical data from existing bridge structures in the region is the best indicator of history and current rate of downcutting. The Sulphur River in Northeast Texas is our best example of a river that has undergone long-term downcutting due to past river training projects.

Short-term scour describes changes that occur to a riverbed due to discrete flood events. Three components are generally considered. They are abutment scour, pier scour and contraction scour. Abutment scour describes the loss of ground that occurs because of turbulence and redirection of flow around bridge abutments, particularly those that project out into the channel. Pier scour occurs due to turbulence around the columns or piers in the channel. Contraction scour occurs as the channel flow is accelerated through a bridge opening that is restricted compared to the upstream channel. Although methods exist to predict the depth of scour for each of these components, they are based on very simple assumptions and generally lead to overly conservative predictions in Texas soils. Many predications have been found to be too deep by a factor of 3 or more. However, when a scour evaluation and prediction are provided for a structure, the prediction should be reviewed and considered by the designer. When available, historical data is the best indicator of potential scour. If an existing structure in the area has withstood several large storms with no significant scour documented, this information should be considered in determining the disregard depth. Also useful are the soil borings themselves. If borings show depths of soft or loose material overlying stiff or dense layers, it can be assumed that the upper materials are subject to being scoured and redeposited. These upper layers should be disregarded for design.

Lateral migration and long-term erosion are mechanisms that often result in permanent exposure of foundation elements. The disregard depth selected based on these factors should be considered in the initial design of the bridge foundations. Conversely, short-term scour is considered an extreme event, and loss of material due to a scour event is not assumed to be permanent. For this reason, additional disregard depth attributed to scour should be used only in evaluating a proposed foundation for a lower factor-of-safety in the fully scoured condition. The justification for this approach is that the structure will be inspected and repaired if necessary after the critical scour event. Design of structures to normal factors of safety is not justified for this extreme event. Discussion of this process can be found in Chapter 5 or the Geotechnical Manual.

Abutments - For abutments placed within embankments located well back from the channel, the entire depth of the embankment is disregarded and foundation design initiates at the top of the existing ground. For abutments placed in natural ground, the disregard depth is generally taken as 10 feet. If the possibility exists that lateral migration could eventually approach the abutment and require the bridge to be lengthened, the disregard should be the same as for the interior bents, and foundation tips should be based on the interior bent design.

Interior Bents - The disregard depth for interior bents is generally taken as a minimum of 10 feet. Factors noted above may require the disregard to be significantly higher for specific bents, especially those away from the main channel where the disregard may need to be taken as 10 feet below the flow line of the main channel.