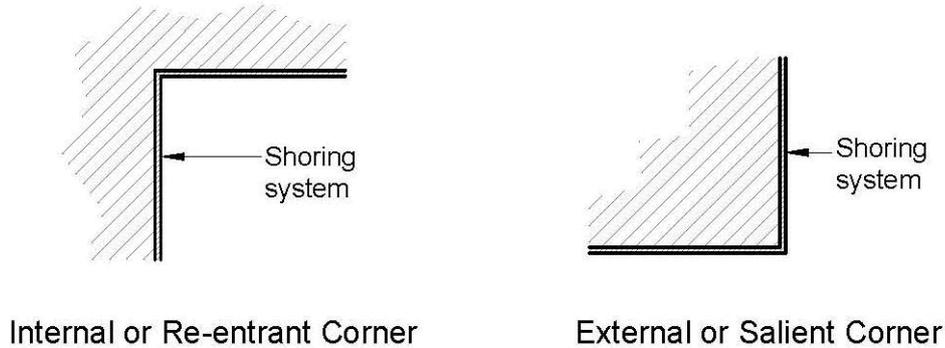


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**Insights into Ground Engineering**  
**Anchored Shoring Systems with External Corners**

by Simon Fagg

Over the last several years, SCE has been engaged to investigate many failures where an anchored shoring system has failed around an external or 'salient' corner [see Figure 1], with another engagement last week.



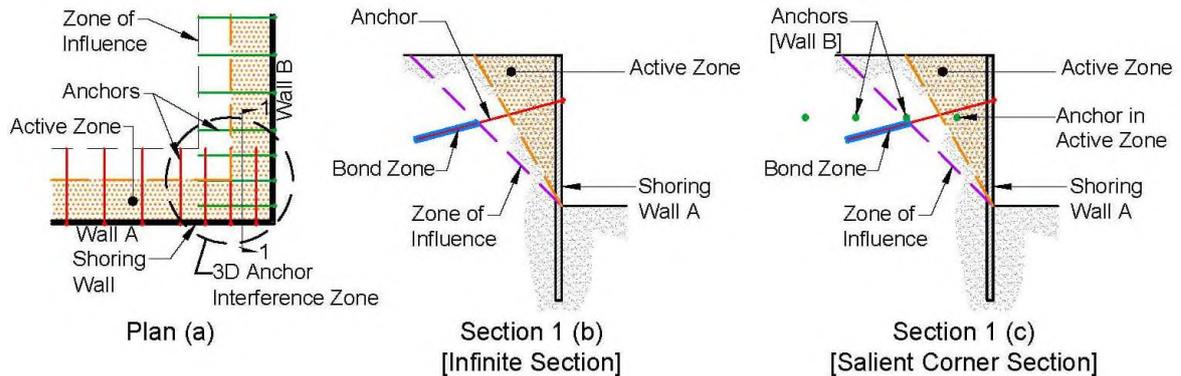
**Figure 1 : Corner Definition**

In each failure, the shoring system designer has only considered the design in two dimensions [2D], and has not considered the three-dimensional [3D] effect of the salient corner and its impacts on the Design.

The main 3D impacts of a salient corner for an anchored shoring system include:

1. The anchors crossing over, or interfering with each other over the length of the anchors [Figure 2a]
2. The anchors from one wall being restrained within the active 'zone of influence' of the other wall of the 'salient' corner [Figure 2c].

In addition, the theoretical basis for most of these design calculations assumes a homogeneous, infinite wall [Figure 2b]; this theoretical basis is incorrect around a salient corner, and the design method needs to be locally changed in these areas.

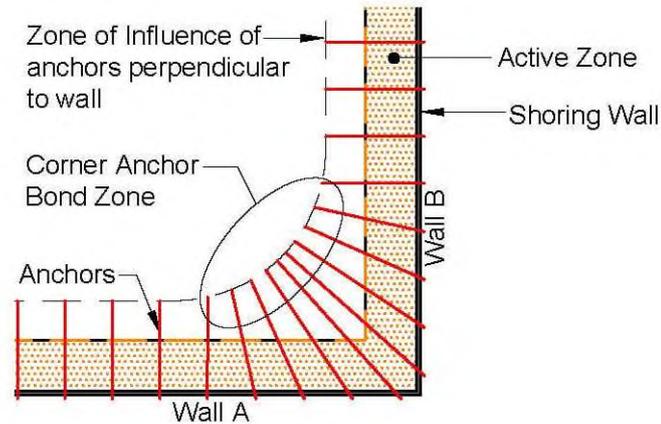


**Figure 2 : Anchor Impacts**

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The design method needs to be adjusted to take into account the salient corner, which would normally include specifying the plan alignment of the anchors, to account for the changed out-of-plane loading, for example as shown in Figure 3.



**Figure 3 : Correct plan alignment of Anchors**

It is also to be noted that where these failures occur, especially where there are two or more rows of anchors, there is not usually a collapse of the wall, but rather large displacements of the wall into the excavation. As a consequence, there is substantial settlement and damage to any structures supported on the retained soil.

So, if you see a shoring wall design with:

- a) Elevations of the anchors.
- b) An external or salient corner.
- c) No plan of the alignment of the anchors around the external, or 'salient' corner.

Then it is likely that the shoring designer has failed to consider the 3D effects, with it being likely that there will be large '*unexpected*' movements of the shoring system and consequent damage to any supported structures.

If you are involved in a project that includes a shoring design with a salient corner and need professional engineering advice, we would be pleased to assist.