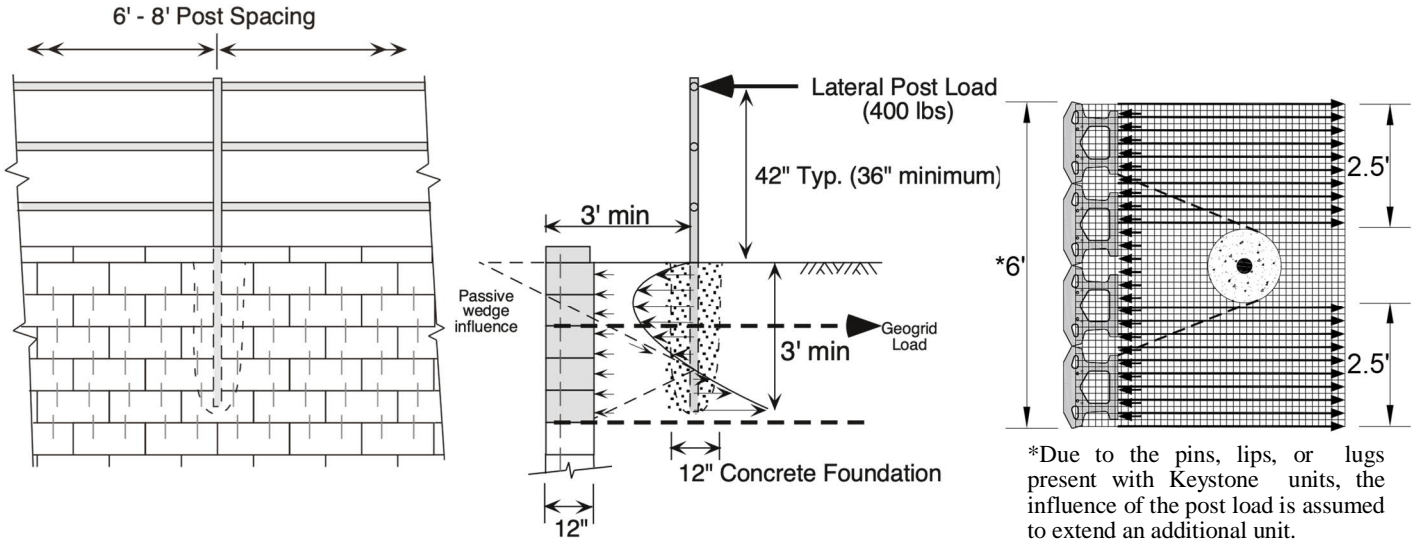


# Typical Railing Design

## Offset Installation - 50 plf - 12" Depth Unit



**Typical Railing Elevation**

**Typical Railing Sections**

### Introduction

The effect of offset railings on the wall design is a function of the depth and size of the foundation and distance back from the wall. Offset foundations have no significant effect on the wall structure if they fall outside the passive wedge that is created when soil is pushed. The benefit of soil reinforcement is obvious from the design section where the reinforcement picks up the lateral thrust from the foundation.

### Railing Analysis

Shear resistance of Keystone units is not a critical evaluation when soil reinforcement is utilized. The placement of a reinforcement level (geogrid with LTDS = 1200 plf) within the upper 2' of the wall permits the facing to absorb the distributed loading through tensile and pullout resistance.

Driving Thrust (200 lb load & soil)

$$\begin{aligned} \text{Railing } & 400 \text{ lbs} \times 5.5'/1.0' \pm \text{ ratio} = 2200 \text{ lbs} \\ \text{Soil } & 0.5 \times 120 \times (2.33)2 \times 0.3 \times 6' = 587 \text{ lbs} \\ \text{Total} & = 2787 \text{ lbs} \end{aligned}$$

Resisting Strength @ Post

$$\begin{aligned} \text{Geogrid } & 5' \times (\text{LTDS @ } 1200 \text{ plf}) = 6000 \text{ lbs} \\ \text{Geogrid } & 5' \times (\text{Connection @ } 960 \text{ plf}) = 4800 \text{ lbs} \\ \text{Passive Soil Shear} & \\ & 2' \times 1.5' \times 1' \times 120 \text{ pcf} \times \text{Tan } 30^\circ = 207 \text{ lbs} \end{aligned}$$

$$FS = (4800+207)/2787 = 1.80 < 1.50 \text{ minimum, OK}$$

Note: Only thrust is calculated above. Moments could also be calculated but the concept is to have the reinforcement placed high enough to absorb the thrust.

### Design Note:

The design shown is the minimum requirement. Larger loadings will require greater offset, greater depth, and/or additional reinforcement to provide local design stability.

The same approach can be applied to fence and post foundation loadings where the influence of the upper foundation section is distributed to the wall system and sufficient resistance is provided.

AASHTO 2020 requires a 50 plf and 200 lb post load to be applied simultaneously. With a 6' post spacing and the additional 200 lb post load included, the resulting factor of safety decreases to the minimum 1.50 requirement.