

## 10.6 SHALLOW FOUNDATIONS

### 10.6.1 GENERAL

This policy addresses design requirements and limitations of shallow foundations (spread footings) used to support bridges and earth retaining systems.

### 10.6.2 NOTATIONS

$q_{g,u}$	= Applied gross uniform bearing stress; used for foundations resting on soil
$q_{g,max}$	= Applied gross maximum bearing stress; used for foundations resting on rock
$q_{net,u}$	= Applied net uniform bearing stress; used for foundations resting on soil
$q_{net,max}$	= Applied net maximum bearing stress; used for foundations resting on rock
$q_R$	= Factored nominal bearing resistance
$q_{p,net}$	= Permissible net contact stress calculated based on superstructure tolerable settlement

### 10.6.3 DESIGN REQUIREMENTS

Shallow foundations shall be designed for AASHTO-CA BDS load combinations of the service, strength, and extreme event limit states. Construction load combinations defined in AASHTO-CA BDS for abutments shall be evaluated at the strength limit state.

A column's seismic over-strength moment and associated shear force shall be applied to the top of a shallow foundation in 15-degree increments to determine the maximum effects. In multi-column bents, both the minimum and maximum axial forces resulting from seismic overturning shall be considered in design.

#### 10.6.3.1 BEARING STRESS REQUIREMENTS

Spread footings must satisfy the following requirements:

- For the service limit state (settlement):
  - $q_{net,u} \leq q_{p,net}$  for footings on soil
  - $q_{net,max} \leq q_{p,net}$  for footings on rock
- For strength and extreme event limit states:
  - $q_{g,u} \leq q_R$  for footings on soil
  - $q_{g,max} \leq q_R$  for footings on rock

#### 10.6.3.2. ECCENTRICITY LIMITS

For shallow foundations bearing on Class S2 soil (refer to SDC for soil classification), a detailed tilting/rotation deformation analysis is required.



#### 10.6.4 REFERENCES

1. AASHTO (2017), *AASHTO LRFD Bridge Design Specifications*, 8<sup>th</sup> Edition, American Association of State Highway and Transportation Officials, Washington, DC.
2. Caltrans (2019), *California Amendments to AASHTO LRFD Bridge Design Specifications* 8<sup>th</sup> Edition, California Department of Transportation, Sacramento, CA.
3. Caltrans (2019), *Caltrans Seismic Design Criteria 2.0*, California Department of Transportation, Sacramento, CA.