C6.4 Spread footings

C6.4.4 Footings on rock

C6.4.4.1 Analysis and design

Historic Presumptive Bearing Capacities on Rock
Historically, Iowa specified the use of two separate presumptive bearing capacities for spread footings on rock based on the classification of the rock as soft rock or hard rock. Shale, uncemented siltstone, and uncemented sandstone were generally considered to be soft rock. Limestone and cemented sandstone were generally considered to be hard rock. By standard penetration test blow count, rock generally was classified as hard rock when blow counts were above 200. This classification was subject to the judgment of the Soils Design Unit. The ASD bearing capacities for soft rock, such as shale, were typically 5 tsf and for hard rock, such as limestone, were 10 tsf. These ASD capacities were presumptive values which have their origin in the AASHTO Standard Specifications (the 1983 specification and earlier lists presumptive values).

Around 2007 the Bureau moved to an interim LRFD procedure that fitted the ASD presumptive values to LRFD using an approximate average load factor of 1.45 and a strength resistance factor of 0.45 for spread footings on rock from AASHTO LRFD Table 10.5.5.2.2-1.

Conversion of bearing capacity from ASD to LRFD for soft rock:
LRFD Nominal Resistance = (5 tsf)*(1.45)/(0.45) = 16.1 tsf = 32.2 ksf
LRFD Factored Resistance = (0.45)*(32.2 ksf) = 14.5 ksf

Conversion of bearing capacity from ASD to LRFD for hard rock:
LRFD Nominal Resistance = (10 tsf)*(1.45)/(0.45) = 32.2 tsf = 64.4 ksf
LRFD Factored Resistance = (0.45)*(64.4 ksf) = 29.0 ksf

The spread footing designs contained in the H-standards are still based on the interim LRFD bearing resistance for soft rock per the plan note:

> The foundation rock shall have a minimum LRFD nominal bearing resistance of 30 kips per square foot (allowable service load bearing value of at least 10 kips per square foot).

2010 ~ Location of Fixity for Frame and T-Piers on Spread Footings
Column analysis and design is sensitive to slenderness, and the designer should not model a column taller than the structural configuration allows. Although it would be acceptable to model a pier column as fixed at 2 feet below top of footing or at mid-depth of footing, the column is restrained significantly at the top of footing, and the designer should assume fixity at that elevation to minimize slenderness. Available pier software makes it relatively easy to analyze alternate models, and for pile and footing design the designer should assume pier columns extend to bottoms of footings.