

# The Bearing Characteristics of Large Diameter Rock Socketed Pile

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**Abstract:** With the continuous development of China's economic construction, our country's infrastructure construction is in a period of vigorous development. So, it results in a large number of foundations with complex environments. Because of the advantages of high capacity, low cost, simple construction and seismic performance, rock-socketed pile used in building such as high, heavy, large-scale problem, and has been widely applied in the engineering practice, and has made tremendous economic and social effects.

**Keywords:** Infrastructure Construction; Rock-socketed Pile; High Capacity

## 1. Introduction

At present, the large diameter of rock socketed piles, which are widely applied in large-scale bridge foundation, towering structure foundation and high rise building. Gradually attract more and more attention in academic circles and engineering field and become a hotspot for study. However, it is notoriously difficult to gain true ultimate bearing capacity of pile tip in reality because of its great bearing capacity, high testing cost and hard destructive test. The determination of the ultimate end resistance, the choice of socketed depth, as well as varying regularity have not yet form a unified understanding among scholars. In 2002, SERRANO and OLALLAB studied the relationship between the ultimate bearing capacity and embedment ratio using Hoek-Brown model. RADHAKRISHNAN and LEUNG believed that the socketed piles were generally inelastic state under work load and the end bearing capacity reduced with the increase of socketed depth. While the lateral friction increased. SONG and ZHENG deemed that the end bearing gradually reduced with the rock-socketed depth and tended to obtain a certain value through analyzing the wealth of test pile data in soft soil ground.

About the definition of embedded rock pile, both at home and abroad there is not a small difference. That, no matter how the bedrock weathering degree, degree of hard, as long as the pile embedded in rock, known as the rock socketed pile, Chinese scholars also agree with this view. In the related specification to guide the practical engineering design of rock socketed pile did not give a clear definition.

In practical engineering, rock socketed pile is not only affected by the pile, pile diameter ratio, rock socketed depth, influence of process factors such as pile, rock socketed pile can also be friction end bearing pile, end bearing friction pile, even friction pile.

## 2. Block Bearing Properties and Classification of Rock Pile

### 2.1. The Bearing Property of Rock Socketed Pile

The bedrock socketed pile as shown in figure 1. In the Q under the action of external load, the pile deformation, relative to the pile of soil (or rock) has a downward displacement, which makes the pile of soil (or rock) on the pile side surface to the side friction of the pile side resistance, such as the outer part of the load sharing. With the increase of depth, the pile to pile soil (or rock) the smaller displacement, pile side resistance is small, the relative displacement of pile side resistance is zero position. Along with the load gradually increased, compression of pile and pile soil (or rock) the relative displacement of pile side resistance increases gradually, gradually to the pile during the second half of the development. Until the pile end is generated by the external load compression, the relative displacement between the pile and the soil around the pile, the pile side resistance of further play. When the rock socketed pile under the external load, the pile of soil (or rock) the side resistance of pile has reached the limit, and no settlement, at this time, bearing on the bed rock pile will bear all the load increment. Can be drawn from the block transfer mechanism of pile, with the increase of loads, rock socketed pile first form of friction end bearing pile, the pile of soil (or rock) after the lateral resistance of rock socketed pile reaches limit, and the performance of end bearing pile. Therefore, the rock socketed pile is assumed to be single end bearing pile is not appropriate. Although it is safe to the side friction resistance of the overlying soil is negligible, when the thickness of overlying soil overlying soil or not extremely soft thick rock socketed piles by end bearing pile assumption is appropriate. But for the large aspect ratio of long rock socketed pile, or hole cleaning operation is not completely lead to the pile bottom have a certain thickness of the residual soil rock socketed pile, settlement deformation will bear external load, lateral resistance of pile has enough space to play, is the main component of load balance. If this kind of rock socketed pile according to the assumption of end bearing pile are calculated, one hand there is no efficient use of the bearing capacity of rock socketed pile; on the other hand, in order to ensure safety, in-

crease the rock socketed depth, resulting in the problems of the construction cost increase, difficult project, affect the economic and reasonable design.

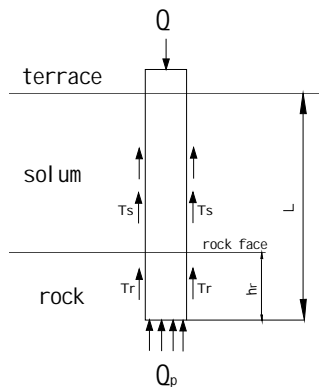


Figure 1. Rock socketed pile

## 2.2 Classification of Rock Pile

Analysis of the bearing capacity of rock socketed pile was obtained, its bearing capacity is composed of 3 different kinds of force, these 3 forces are: the overlying soil of pile side friction resistance, tip resistance of friction block rock on pile side and pile end rock socketed pile, in different load stages, they are accounted for in the bearing capacity in different proportion. For the block type pile, China has not a classification authority. Liu Shuya, according to the friction of the overlying soil of pile side friction resistance of rock block end section of rock on pile side and pile end rock of the 3 force in the bearing capacity of rock socketed pile in different proportion, the rock socketed pile is divided into 3 categories, namely: the side resistance of rock socketed pile, end bearing resistance of rock socketed pile and rock socketed pile. Side resistance of rock socketed pile is a hole cleaning condition is not good, there is a deep hole bottom sediment, rock socketed pile subjected to external loads, the pile buried in the sediment in the end that caused the settlement of pile side friction can give full play to the great, the pile and the side resistance can be neglected compared No. End bearing rock socketed pile hole cleaning condition refers to the amount of sediment at pile end is excellent, very few, under the action of external loads, the settlement of pile embedded in rock is very small, the pile side friction no space to play, the end resistance of the pile bear most of the load, and the lateral resistance of the pile bear little to share, in the design calculation without considering the pile side friction resistance of rock socketed pile. The resistance of rock socketed pile is between the lateral resistance of rock socketed pile and end bearing pile embedded in rock between, when it is exposed to the outside load, the pile side friction resistance and end resistance are obtained in different levels

of play, share the loads, so the lateral resistance of rock socketed pile and end bearing rock the resistance of rock socketed pile is the 2 Extreme cases.

## 3. Conclusions

- (1) The rock socketed pile has been used in China for more than half a century, but the definition of rock socketed pile is still controversial. I believe that, regardless of the weathering degree of the pile foundation is embedded in how it should be considered the rock socketed pile.
- (2) According to the bearing capacity of rock socketed pile, which is divided into 3 categories: the lateral resistance of rock socketed pile, rock socketed pile and end bearing resistance of rock socketed pile. In the estimation of bearing capacity of rock socketed pile, should be in accordance with the calculation formula of embedded rock pile type selection reasonable.
- (3) The largest pile embedded in rock socketed depth and optimal socketed depth should not be a fixed value, but should make a concrete analysis of concrete engineering, give full play to the bearing capacity of rock socketed pile, reduce project cost, saving construction resources.
- (4) When the rock socketed depth is large, the end resistance of pile shows the phenomenon of a small, load transfer mechanism of pile with, for weathered rock soft rock as bearing layer, pile with the friction force, the bearing layer can be appropriate to enter. The rock pile shaft resistance of the recommended value and the actual difference, should further comprehensive analysis of the adjustment and optimization of pile design.
- (5) The rock socketed pile, bearing capacity, critical stability of bridge foundation pile embedded depth of bedrock.

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