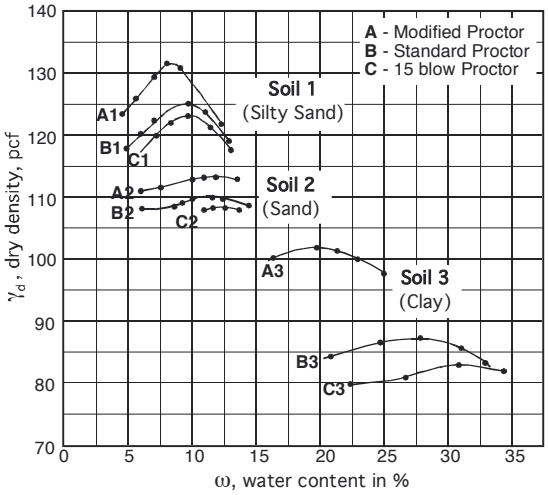
Soil Density - Standard vs Modified Proctor

Reinforced soil structures routinely specify that all soils be compacted to 95% of the maximum density determined by ASTM D698 - *Standard Proctor Density* for conformance with the design. However, *Standard Proctor* density criteria is typically utilized in the Eastern US whereas *Modified Proctor* density criteria is typically utilized in the Western US which can create some conflicting specification problems.

Research has been done showing the relationship between *Standard* and *Modified Proctor* density testing for different soils types as indicated below:



Moisture-Density Relationships
(Ref. Tschebotarioff - 1973)

Characteristics of Three Soils

Type	Sand	Silt	Clay	LL	PI
Soil 1 - Silty Sand	80%	15%	5%	17	1
Soil 2 - Sand	92%	5%	3%	NP	NP
Soil 3 - Clay	10%	28%	62%	68	47

Summary of Data

Type	Max Dry Density,pcf			Optimum Moisture,%		
	A	B	C	A	B	C
Soil 1 - Silty Sand	132	125	123	8	10	10
Soil 2 - Sand	113	110	108	ind	ind	ind
Soil 3 - Clay	102	88	83	20	28	31

95% Standard vs Modified Proctor Comparison

Type	Standard	95% Standard	% of Modified
Soil 1 - Silty Sand	125	119	90%
Soil 2 - Sand	110	105	93%
Soil 3 - Clay	88	84	82%

It is obvious from this limited data that a simple conclusion can not be drawn but some general guidelines can be established when using *Modified Proctor* density testing in lieu of *Standard Proctor* testing for quality assurance testing of reinforced soil structures:

* 90% - 92% of *Modified Proctor* density is roughly equivalent to the specified 95% *Standard Proctor* density except for fine grained soils (ie: clay) where the difference may be significantly larger.

* *Modified Proctor* testing typically requires a lower optimum moisture content for achieving maximum density which is desirable for Keystone retaining wall construction and performance especially with silts and silty soils.

* The density difference between *Modified Proctor* and *Standard Proctor* density testing appears to increase with the percentage of fines in the soil matrix while the optimum moisture content decreases . It may be prudent to utilize 90% of Modified Proctor density and optimum moisture content when working with fine grained soils such as clays for best results.