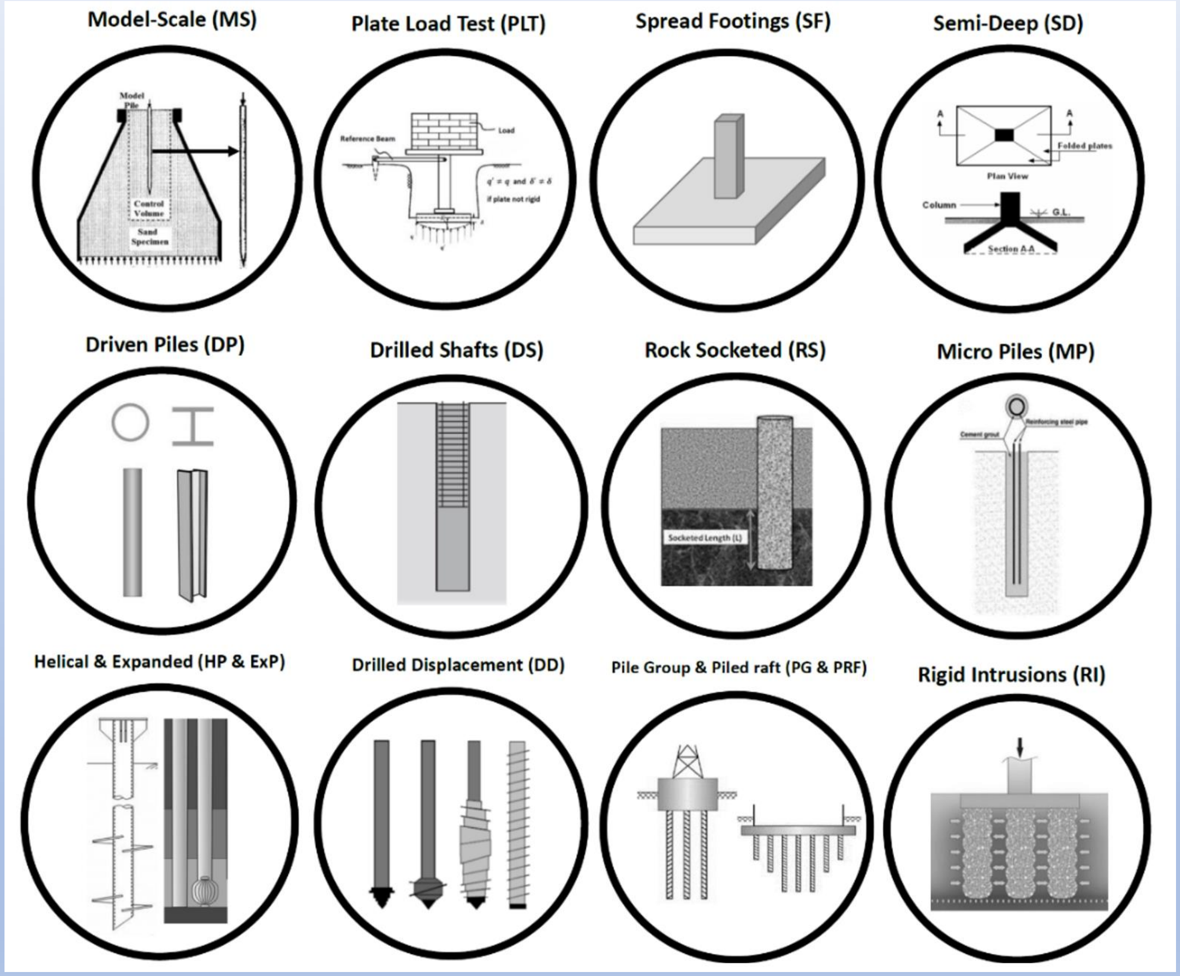
FELADD (Eslami et al., 2023 - Ongoing)

Foundation Engineering Load And Displacement Database

Foundation Categories for Database Arrangement

Categories		Foundation Types		Acronym
A	Physical Modeling	I	Model-Scale	MS
		II	Plate Load Test (PLT)	PLT
B	Shallow & Semi-deep Foundation	III	Spread Footings	SF
		IV	Semi-Deep	SD
C	Deep Foundations	V	Driven Piles	DP
		VI	Drilled Shafts	DS
		VII	Rock Socketed	RS
D	Special Deep Foundations	VIII	Micro Piles	MP
		IX	Helical & Expanded Piles	HP & ExP
		X	Drilled Displacement Piles	DD
E	Block & Massive Foundations	XI	Pile Groups & Piled Raft Foundations	PG & PRF
F	Rigid Intrusions	XII	Stone Columns, Deep Mixing & Jet Grouting	RISC, RIDM or IRJG

Foundation Categories



Cases Framework & Coding Demo

Case ID & Country	Reference	Installation & Media	Foundation Type & Dimensions	Confined Geomaterials	Load-Disp. Records	Geotech. Data Source	Remarks
001/UBC/DP1 Canada	Campanella et al., 1991	Driven/ Field	Pipe Pile: B=324 mm, t=9.5mm, D_f=14.3 m 	Sand, Soft Clay	P-δ	In-situ	Part of a research on in-situ tests application in pile design

Case Number

Source
Research Group & Location

Foundation Type
DP for Driven Pile

Order in the Source

001 / UBC / DP1

Relevant Publications

Contents lists available at ScienceDirect

Computers and Geotechnics

journal homepage: www.elsevier.com/locate/compgeo

Research Paper

Load-displacement appraisal and analysis for driven piles; a data-centric approach

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A R T I C L E I N F O

Keywords:
Data-centric
Load-displacement
Database
Driven piles
Normalization
Ultimate load
Linear stiffness

A B S T R A C T

Data-centric geotechnics is an ever-evolving field for facilitating dig
foundation design, bearing capacity, settlement and interactions o
emanated in load-displacement records. Considering the pivotal r
believed to be a data center in foundation engineering. In this stud
including twelve foundation types load–displacement records, 71 driv
the data-centric approach, records have been processed, organized and
load, three criteria of 10%B, Brinch-Hansen 80% and hyperbolic f
promising criteria for normalizing load–displacement, dominant fact
and surrounding soil type were appraised. The results indicated th
achieved for piles with higher embedment depth and larger breadth
normalization has revealed significant points. The relative displace
priate point in elastic stiffness calculation, somehow compatible with
trend is mobilized for relative displacement in the range of 5 to 10%. C
processing, as a data center proceeds value engineering in foundation

Geotechnical Engineering

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Hyperbolic load–displacement analysis of helical and expanded piles: database approach

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Recent years have witnessed a focus on improving geotechnical systems by implementing and constructing new deep foundations such as helical and expanded piles. In this study, the effects of parameters such as embedment depth, pile geometry and axial loading direction on the load–displacement behaviour of these piles were examined. To this end, a database was compiled consisting of 80 axial loading test records for different piles. The embedment depth of the piles was in the range 2.4–36.8 m and the diameter of the helices (D_H) or expanded parts (D_{EP}) was in the range 254–1500 mm. The ultimate load of the piles was determined using the 2.5% and 5% displacement ratio criteria and the Brinch Hansen 80% method. Hyperbolic functions were fitted to the load–displacement curves, allowing for consistent estimation of the limit load and the initial tangent modulus. Analysis of the results from the database revealed that the dominant factors influencing the ultimate load, limit load, maximum measured load, initial stiffness and load–displacement behaviour were the ratio of D_H or D_{EP} to the shaft diameter, the shaft area and the toe area, and the load direction. Correlations derived from the database were validated using measurements from eight full-scale helical and expanded piles.

Keywords: database/helical and expanded piles/hyperbolic function analysis/load–displacement/piles & piling/pull-out testing/ultimate load

Relevant Publications

MARINE GEORESOURCES & GEOTECHNOLOGY
https://doi.org/10.1080/1064119X.2024.2380530

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Appraisal of soil-cement columns load displacement behavior through full-scale tests database

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ABSTRACT
Soil-cement columns are implemented in coastal areas to improve the capacity of loose, soft, and dredged soils, reduce settlement, and mitigate liquefaction effects. Static load testing is used for quality control and the verification of design assumptions. Given the greater reliability of full-s testing results compared to physical and numerical modeling results and the lack of a datal for soil-cement columns, 42 full-scale loading records on these columns were compiled to as the behavior of these columns and identify the most influential factor in their behavior. The d base contains columns ranging in length from 5 to 19 meters with diameters ranging from 4 120 cm, as well as soil profiles ranging from clay to sand and mixed soil. Their behavior was e uated using a hyperbolic relationship. The results indicate that component materials, influer by implementation technique, in-situ soil properties, and reinforcing, more significantly influe the behavior of columns than the columns' length. The columns are categorized into three se ate groups, which are separated due to their different equivalent unconfined compres strengths and shapes. These categories allow for the prediction of the load-displacement ratio gram range of the column based on initial information such as the column diameter, length, properties of in-situ soil. The upper and lower bounds of categories were validated by the loac results of five soil-cement columns implemented in Iran coastal line.

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GEOMECHANICS AND GEOENGINEERING
https://doi.org/10.1080/17486025.2024.2438077

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Ultimate load bearing of helical piles prediction and evaluation using machine learning-based algorithms

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ABSTRACT
This study aims to predict the Ultimate Load-Bearing (ULB) capacity of Helical Piles (HP) using six Machine Learning Algorithms (MLA) on an in situ-based 110 pile load tests including a wide range of pile properties: shaft diameters (73–406 mm), helix diameters (254–762 mm), helix spacing (300–1000 mm), number of helices (1–6), pile lengths (2.4–16 m), and helix thicknesses (6–12 mm). The measured axial ULB is analysed using the Brinch-Hansen 80% criterion and 5% criterion of the average diameter of the helices. Load-displacement curves were fitted using the Hyperbolic Function. MLA including Multi Linear Regression (MLR), K-Nearest Neighbors (KNN), Decision Tree (DT), Random Forest, eXtreme Gradient Boosting, and Support Vector Regression were optimised to grid search for hyperparameters like neighbour count, tree depth, learning rate, and kernel type. Input parameters were categorised into Geometric and Soil Properties packages. Results indicate that the DT algorithm excelled in pullout loading, KNN in compression loading, and MLR for Brinch-Hansen 80% criterion estimations. The input parameters related to the soil surrounding the pile helices have the most impact on the ULB prediction of HP. This study enhances HP foundation design by enabling data-driven decisions for optimal pile selection and configuration.

ARTICLE HISTORY
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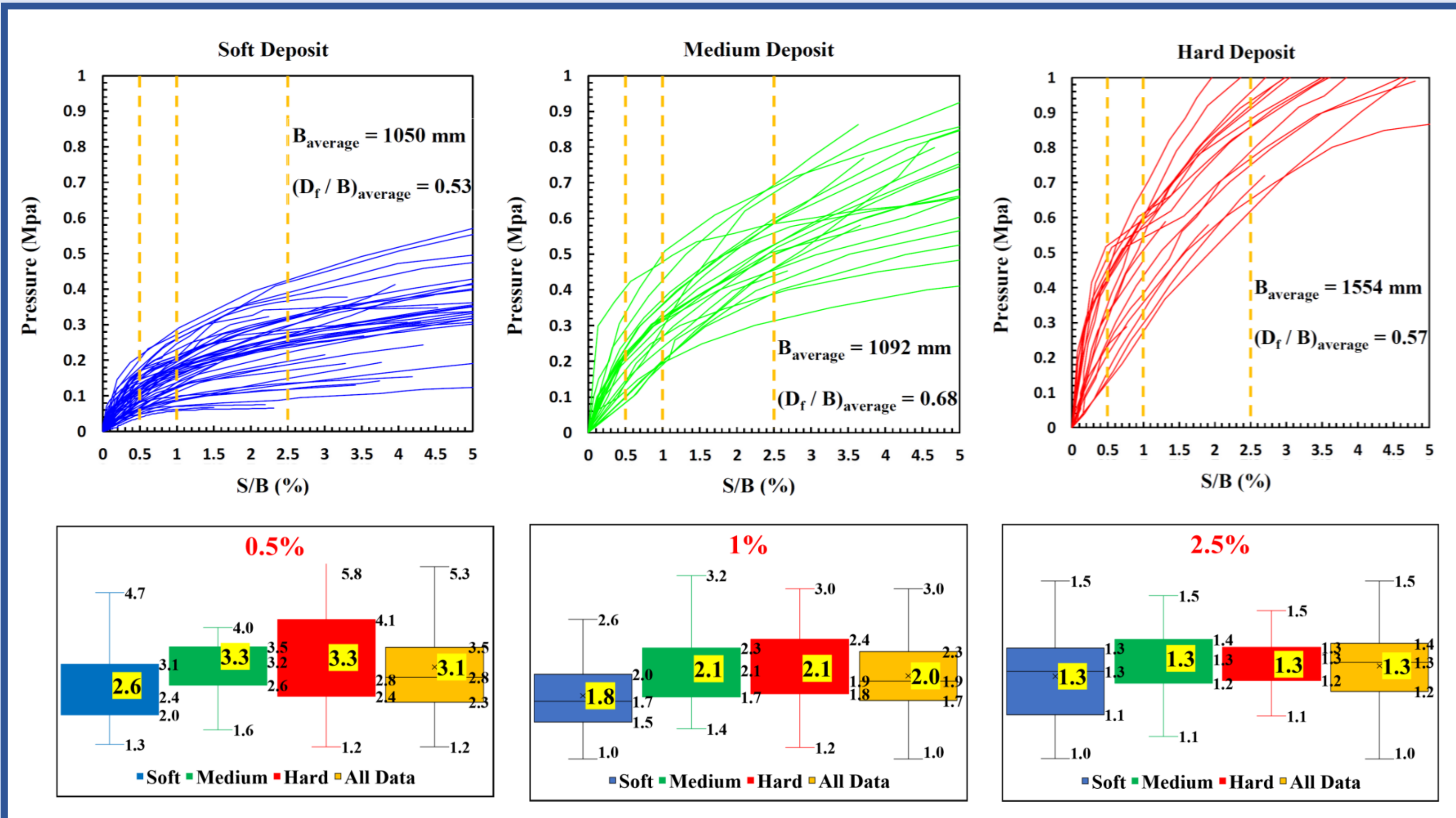
KEYWORDS
Ultimate load criteria; predictive model; machine learning-based algorithms; helical Piles

Spread Footings

- **70** Cases of Spread Footings
- Implemented on Sand, Clay and Mixed Deposits
- Embedment Depths between **0** to **3** m
- Breadth between **0.5** to **2.2** m

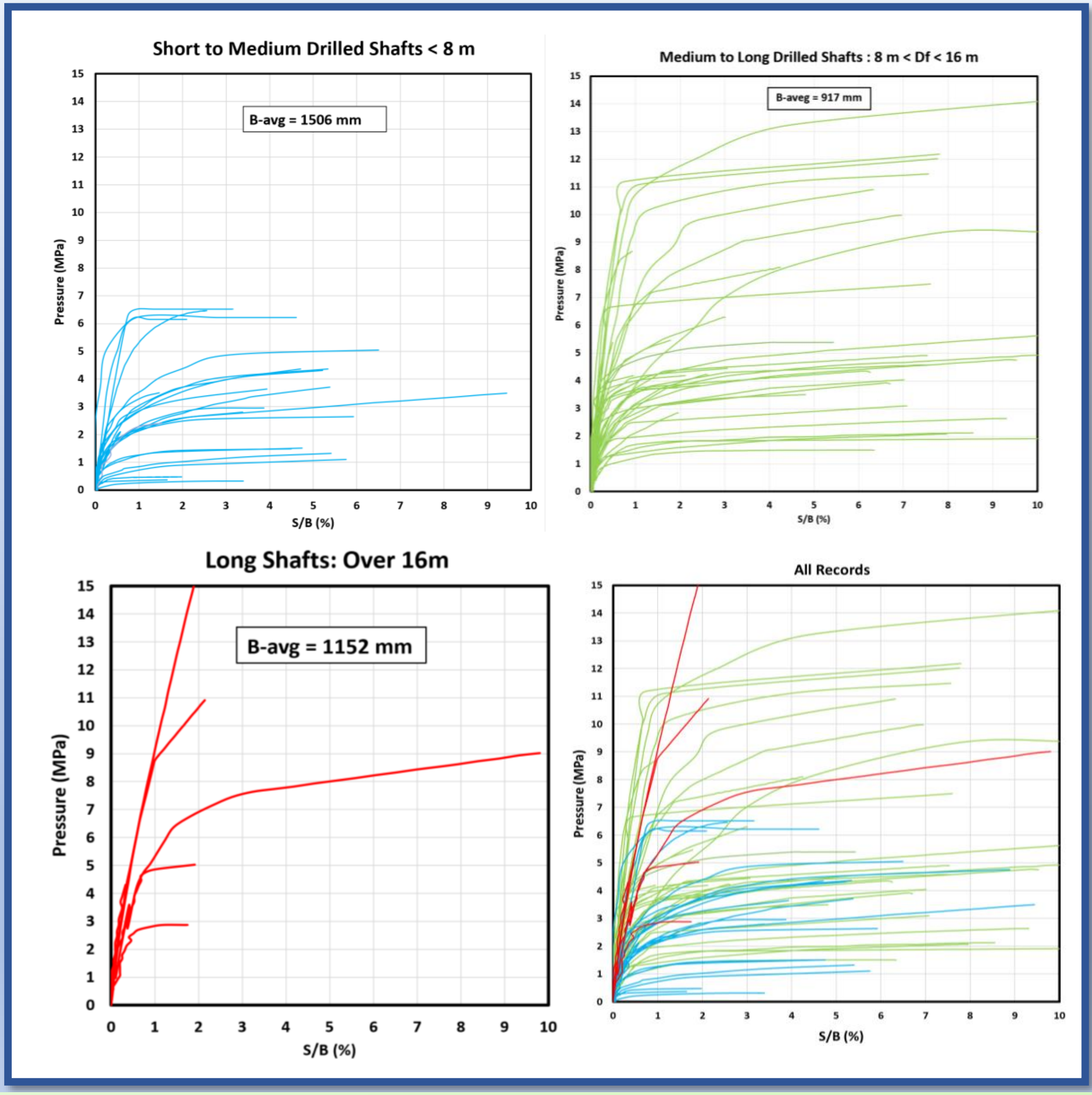
Assuming Ultimate Load at S/B = 5%



Evaluating factor of safety for spread footings based on displacement ratios

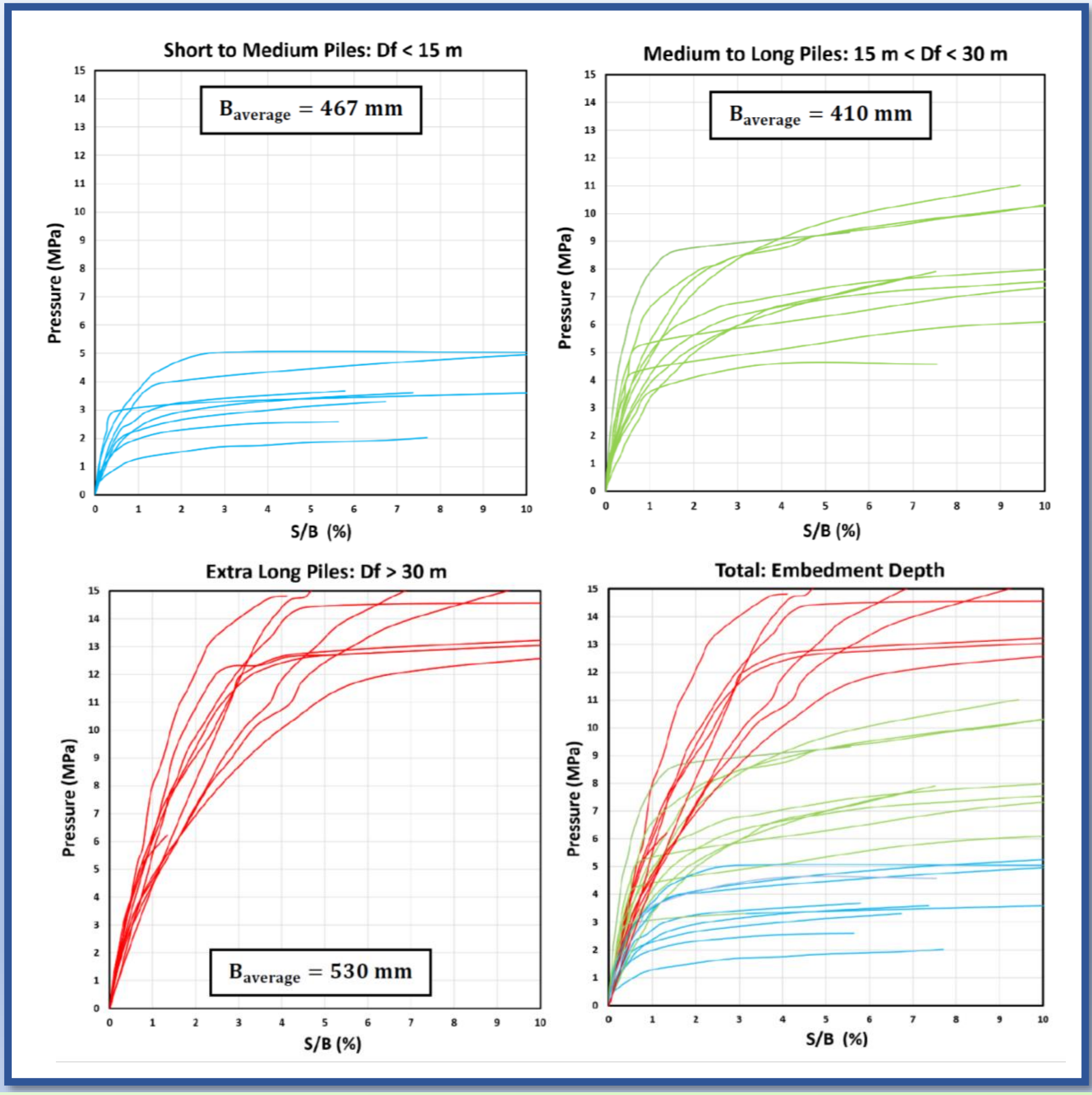
Drilled Shafts

- **67 Cases of Drilled Shafts**
- **Bored in:**
  - ✓ **Sand,**
  - ✓ **Clay**
  - ✓ **Mixed Deposits**
- **Embedment Depths between 6 to 22 m**
- **Diameter between 350 to 2440 mm**



Driven Piles

- **71 Cases of Driven Piles**
- **Driven in:**
  - ✓ **Sand,**
  - ✓ **Clay**
  - ✓ **Mixed Deposits**
- **Embedment Depths between 6 to 56 m**
- **Diameter between 235 to 914 mm**



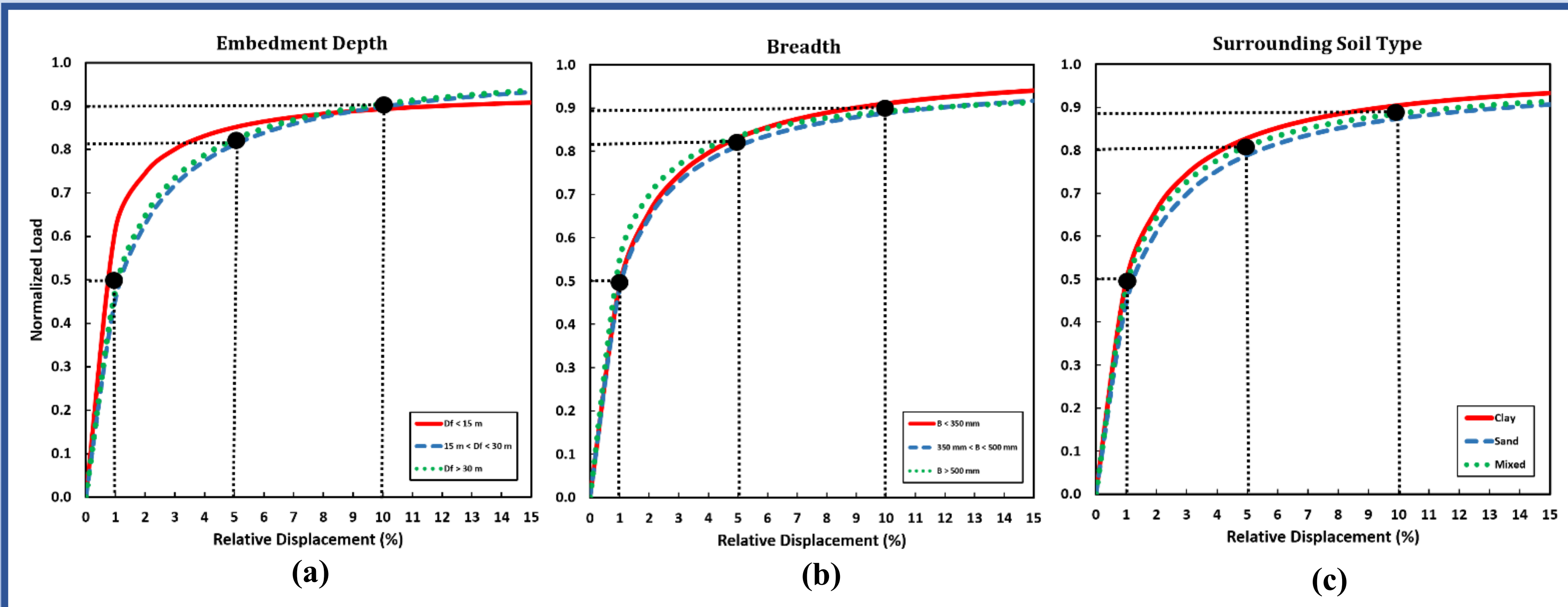
Driven Piles

Normalization Approach:

- Load: Brinch-Hansen 80% (1963)
- Displacement: Breadth

Relative Displacement & Normalized Load:

- 1 % → 0.5 Pu **(FS=2)**
- 5 % → 0.8 Pu
- 10 % → 0.9 Pu



Normalized hyperbolic trending of load-displacement for dominant factors: a) embedment depth, b) breadth, c) surrounding soil type (Eslami & Ebrahimipour, 2024)

Helical & Expanded Piles

- **Depth:**

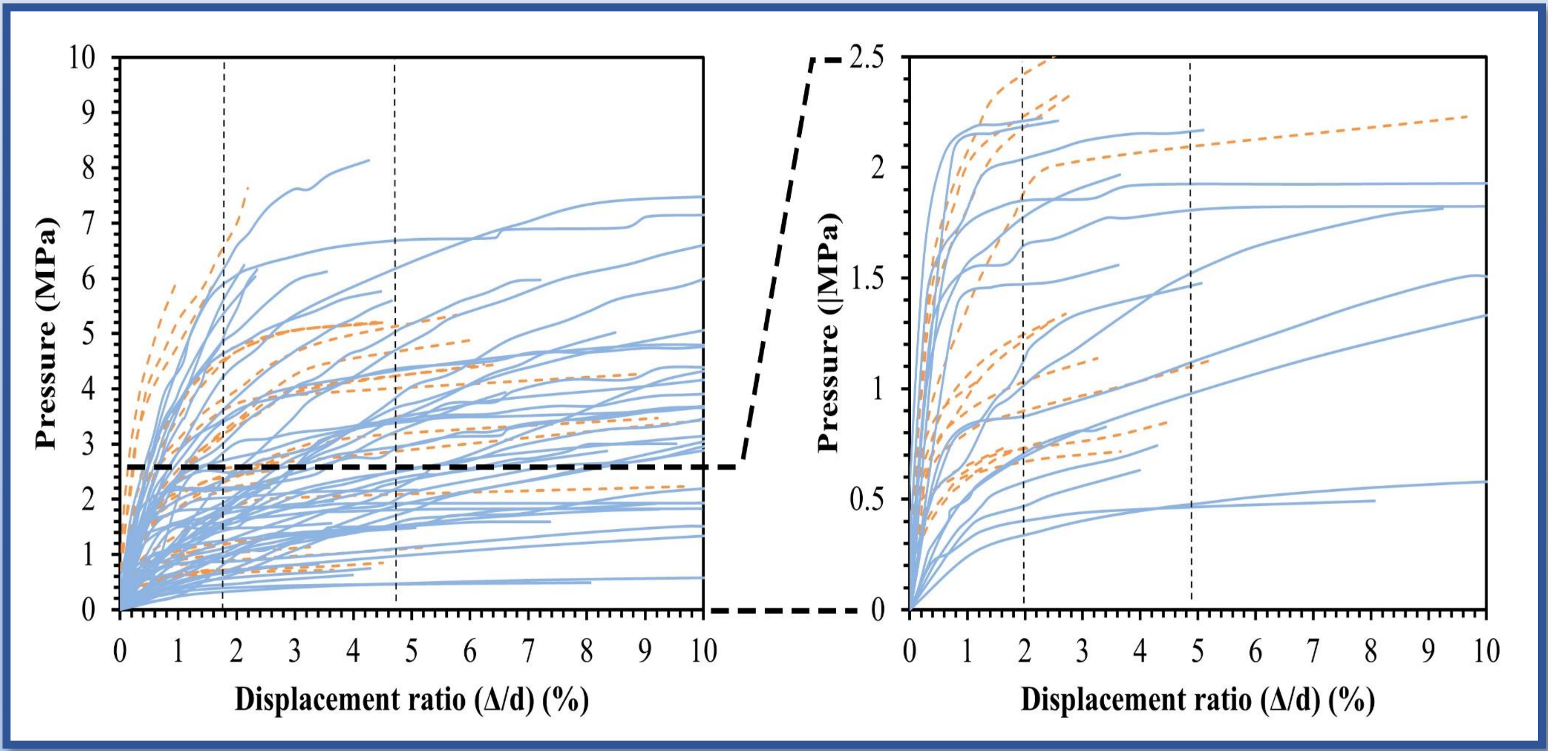
  1- Helicals: 3 to 16 m

  2- Others: 8 to 22 m

- **Diameter:**

  1- Helicals: 300 to 900 mm

  2- Others: 600 to 1500 mm



Pressure – S/B for helical and expanded piles