

PRODUCT FEASIBILITY
SECTION 3

CONTENTS

SYMBOLS USED IN THIS SECTION

DISCLAIMER

The information in this manual is provided as a guide to assist you with your design and in writing your own specifications.

Installation conditions, including soil and structure conditions, vary widely from location to location and from point to point on a site.

Independent engineering analysis and consulting state and local building codes and authorities should be conducted prior to any installation to ascertain and verify compliance to relevant rules, regulations and requirements.

Hubbell Power Systems, Inc., shall not be responsible for, or liable to you and/or your customers for the adoption, revision, implementation, use or misuse of this information. Hubbell, Inc., takes great pride and has every confidence in its network of installing contractors and dealers.

Hubbell Power Systems, Inc., does NOT warrant the work of its dealers/installing contractors in the installation of CHANCE® Civil Construction foundation support products.

FEASIBILITY of USING CHANCE® HELICAL or ATLAS RESISTANCE® PRODUCTS

Hubbell Power Systems, Inc. manufactures steel foundation products that can be designed for a wide range of soil conditions. In order to assist the designer/user in selecting the proper product for the application, Figure 3-1 shows the product type suitable for various soils and rock conditions. When reviewing Figure 3-1, the designer/user should note the following items:

- The most common selection of soil parameters for design is from field testing using the ASTM D 1586 Standard Penetration Test (SPT) and field or laboratory testing of shear strength (cohesion "c" and friction angle "φ"). Refer to Section 2 in this manual for a detailed discussion of geotechnical investigation requirements and to Section 4 for a detailed discussion of structural load requirements for projects using CHANCE® Helical Piles/Anchors and/or ATLAS RESISTANCE® Piers.
- A range is noted based on SPT "N-" values where the ATLAS RESISTANCE® type of pier will provide the foundation underpinning support in an end-bearing mode. This "N-" value is generally above 30 to 35 in cohesionless (sands and gravels) soils and above 35 to 40 in cohesive clay soils.
- A range is indicated for use of the helical piles (compression) and helical anchors (tension). As noted on the chart, there are certain conditions for weathered rock and cemented sands where an initial predrilling will permit the installation of helical plates under relatively high installing torque (generally above 10,000 ft-lbs). Helical piles/anchors have been successfully installed on projects where the target depth is not homogenous or consists of hard clays, cemented sands or weathered rock. These factors must be considered and evaluated before a design can be finalized. Modifications may have to be made to the design to be able to accomplish embedment into the target stratum such as:
  - Cutting a "sea shell" shape into the leading edge of one or more of the helical plates.
  - Predrilling prior to the installation of a helical pile/anchor.
  - Using a shaft configuration that provides adequate torques and resistance to "spikes" during installation.

The product selection chart shown in Figure 3-1 is intended for use on a preliminary basis. Hubbell Power Systems, Inc. assumes no responsibility for the accuracy of design when based solely on Figure 3-1. A Preliminary Design Request Form is provided at the end of this section. This form can be copied and then completed with the required information to request a preliminary design (application) by the Hubbell Power Systems, Inc. engineering department. The completed form can be sent to Hubbell Power Systems, Inc. or directly to your local CHANCE® Distributor.

⚠	*All foundation systems should be designed under the direct supervision of a Registered Professional Engineer knowledgeable in product selection and application.*

Hubbell Power Systems, Inc. steel foundation products offer simplicity in design and flexibility in adapting to the project. The design for ultimate and allowable bearing capacities, anchor or tieback loads for helical products, is established using classical geotechnical theory and analysis, and supplemented by empirical relationships developed from field load tests. In order to conduct the design, geotechnical information is required at the site. The design and data shown in this manual are not intended for use in actual design situations. Each project and application is different as to soils, structure, and all other related factors.

FACTORS of SAFETY

To recognize the variability of soil conditions that may exist at a site, as well as the varied nature of loading on structures and how these loads are transferred through foundations, Hubbell Power Systems, Inc. recommends an appropriate Factor of Safety (FS) when using CHANCE® Helical and ATLAS RESISTANCE® Pier foundation products. Generally, the minimum FS is 2 on all permanent loading conditions and 1.5 for any temporary load situation. National and local building codes may require more stringent Factors of Safety on certain projects. Refer to Section 5 for a discussion of Factors of Safety when using ATLAS RESISTANCE® Piers for underpinning (remedial repair) applications.

SITE ACCESS

The proximity to other structures, rights-of-way and obstructions are some of the first considerations for any construction or improvement. Equipment access may be restricted due to overhead limits and safety issues. The designer needs to consider all the possible limitations when selecting a foundation system. CHANCE® Helical Piles/Anchors and ATLAS RESISTANCE® Piers can generally be used anywhere a soil boring can be taken and are virtually the most access-problem-free foundation systems available today. Restricted access and similar concerns should be shown on the bid documents with the usual notes concerning site conditions.

Vibration and noise can be another limitation to conventional deep foundations (i.e., driven piles, drilled piers). CHANCE® Helical Piles/Anchors and ATLAS RESISTANCE® Piers have been installed inside office buildings, restaurants, retail shops and hospitals without interrupting their normal routines. CHANCE® Helical Pile and ATLAS RESISTANCE® Pier certified installers can assist the designer in determining the best type of product for the application.

WORKING LOADS

Helical piles have been used in the compressive mode to working (design) loads of 200 kip, in the form of the CHANCE HELICAL PULLDOWN® Micropile which is detailed later in this manual. In a "normal consolidated" soil, the working load per foundation is typically less than 100 kip, but special cases may apply.

Working tension loads are typically 100 kip or less. The soil is generally the limiting factor as the number and size of helical piles/anchors can be varied to suit the application. The designer should determine the shaft series of products to use from the information provided in Section 7 – Product Drawings and Ratings.

ATLAS RESISTANCE® Piers have been used in the compressive mode to working (design loads) of 70 kip+. The soil conditions, weight of the existing foundation, and type of foundation are generally the limiting factors when determining the number and size of ATLAS RESISTANCE Piers to use in a given application. The designer should determine the shaft series of products to use from the information provided in Section 7 - Product Drawings and Ratings.

SOILS

Soil may be defined for engineering purposes as the unconsolidated material in the upper mantle of the earth. Soil is variable by the nature of its weathering and/or deposition. The more accurately one can define the soil at a particular site; the better one can predict the behavior of any deep foundation, such as a CHANCE® Helical Pile, HELICAL PULLDOWN® Micropile or ATLAS RESISTANCE® Pier. In the absence of sufficient soil data, assumptions can be made by the designer. The field engineer or responsible person needs to be prepared to make changes in the field based on the soil conditions encountered during construction.

As noted earlier, ATLAS RESISTANCE® Piers will provide the foundation underpinning support in an end-bearing mode provided N-values are generally above 30 to 35 in cohesionless (sands and gravels) soils and above 35 to 40 in cohesive clay soils. CHANCE® Helical Piles can be installed into residual soil and virgin or undisturbed soils other than rock, herein defined as having a SPT "N-value" less than 80 to 100 blows per foot per ASTM D1586. This implies that the correct shaft series of helical piles must be chosen to match to the soil density. For example, a standard 1-1/2" shaft, Type SS helical pile with a total helix area of 1 square foot may require so much installing torque that it may have difficulty penetrating into the bearing stratum without exceeding the torsional strength of the shaft.

Water-deposited soil, marine, riverene (terraces or delta) and lacustrine have a high degree of variability. They may be highly sensitive and may regain strength with time. In these conditions, it is good practice to extend helical piles and and resistance piers deeper into more suitable bearing soil.

Very soft or very loose natural, virgin or undisturbed soils overlying a very dense soil layer, such as unweathered rock, present an ideal situation for the installation of ATLAS RESISTANCE® Piers. Similar soil profiles could present a challenge to the installation of helical piles depending on the weathered nature of the underlying rock. The helices may not develop enough downward thrust in upper soils to penetrate into the hard underlying material. Down pressure is often applied to the shaft to assist in penetration of the helices into the hard underlying material.

The use of helical piles/anchors in controlled or engineered fill is another good application. For example, helical tiebacks are used in the controlled fills of roadway and railway fills to make improvements to the infrastructure.

Helical piles should be capable of penetrating the collapsible soils (such as loess) and poorly cemented granular soils in the southwestern United States.

EQUIPMENT

Equipment suitability consideration and selection is the domain of the contractor. Certified CHANCE® Installers are familiar with the various spatial requirements for his equipment and is best able to determine the type of mounted or portable equipment they can utilize to do the work. The designer may contact the local CHANCE® Distributor or certified installer for guidance on this matter. A wide variety of equipment can be utilized for projects based on such considerations as interior vs. exterior construction and headroom. Mini-excavators have been used indoors to install helical piles.

CONTRACTORS

Certified CHANCE® Installers are available in nearly all areas of North America. These installers should be experienced in the type of work specified. A current project list should be submitted as evidence of experience.

CODES

Building codes may have restrictions regarding the foundation type. Generally, CHANCE® Helical Piles and ATLAS RESISTANCE® Piers fall under the category of deep foundations, such as driven piles or drilled piers. The underpinning shaft series of CHANCE® Helical Piles and ATLAS RESISTANCE® Models AP-2-3500.165 and AP-2-3500.165 (M) have been evaluated to show compliance with past and also the latest revisions of the International Building Code (IBC). CHANCE® Type SS5 and SS175 helical piles and bracket assemblies have been evaluated per International Code Council Evaluation Services (ICC-ES) Acceptance Criteria AC358 for Helical Systems and Devices. In Canada, CCMC Report 13193-R shows compliance with the latest revisions of the Canadian Building Code (CBC). The current evaluation reports can all be found at www.abchance.com.

SHAFT SIZE SELECTION BASED on SOIL PARAMETERS

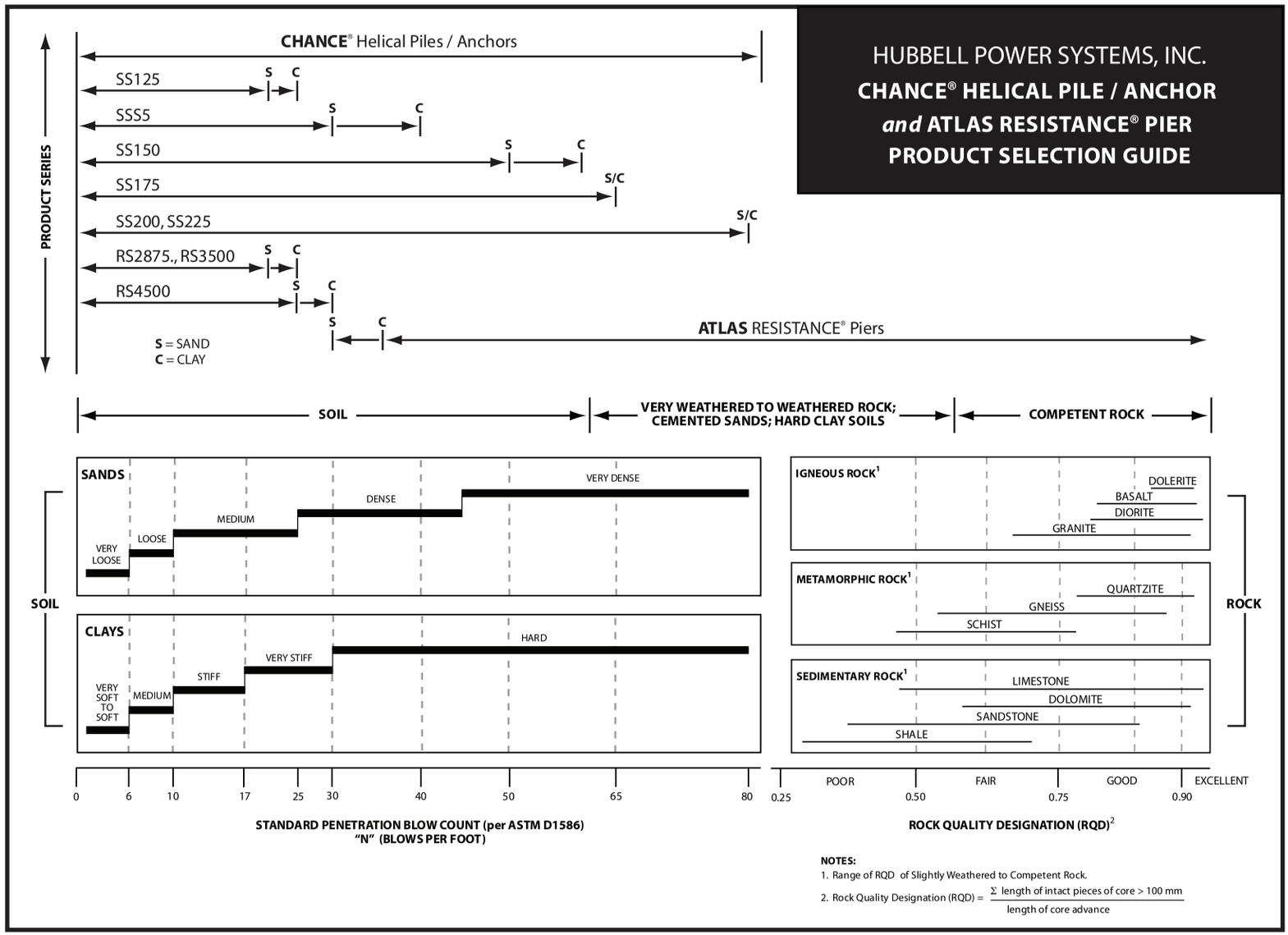
An additional condition that must be evaluated is the ability of the helical pile to penetrate soil to the required depth. For example, a foundation design may require an installation that penetrates a dense fill layer consisting of compacted construction debris (concrete, rubble, etc.) through a compressible organic layer below the fill and finally into the bearing strata. A helical pile shaft with a higher torque rating may be required to adequately penetrate through the fill even though a helical pile shaft with a lower torque rating would satisfy the ultimate capacity requirement. Table 3-1 outlines the maximum blow count or N-value that a particular shaft will typically penetrate. Note that the Type SS helical piles with higher strength shafts and helix material will penetrate harder/denser soils than the Type RS helical piles. Penetrating into harder/denser soils is generally required to support larger loads. The N-values listed in this table are intended to serve as a guide in the preliminary selection of the appropriate shaft series based on using multi-helix configurations. The limits are not intended to be absolute values and higher N-value soils may be penetrated by varying helix diameter, quantity and geometry. Therefore, local field installation experience may indicate more appropriate maximum N-values.

CHANCE® Helical Shaft Series Selection, Table 3-1

SHAFT SERIES	SHAFT SIZE in (mm)	TORQUE RATING Ft-lb (N-m)	MAX N-VALUE* Clay	MAX N-VALUE Sand
SS125	1-1/4 (32)	4,000 (5,400)	25	20
SS5	1-1/2 (38)	5,700 (7,730)	40	30
SS150	1-1/2 (38)	7,000 (9,500)	60	50
SS175	1-3/4 (44)	10,500 (14,240)	65	65
SS200	2 (51)	16,000 (21,700)	<80	<80
SS225	2-1/4 (57)	21,000 (28,475)	<80	<80
RS2875.203	2-7/8 (73)	5,500 (7,500)	25	20
RS2875.276	2-7/8 (73)	8,000 (10,847)	25	20
RS3500.300	3-1/2 (89)	13,000 (17,600)	25	20
RS4500.337	4-1/2 (114)	23,000 (31,200)	30	25
Large Diameter Pipe Pile (LDPP)		Varies based on Shaft Size	30	30
*N-value or Blow Count, from Standard Penetration Test per ASTM D 1586				

Figure 3-1 on page 3-7 shows the same information as contained in the above table along with soil conditions suited for ATLAS RESISTANCE® Piers. This figure does not address the proper product selection based on its application. ATLAS RESISTANCE Piers are used primarily for remedial repair applications involving an existing structure. CHANCE® Helical Piles/Anchors are used for not only remedial repair applications, but for new commercial and residential construction, tieback walls, SOIL SCREW® walls, telecommunication towers, electric utility towers, pipeline buoyancy control, etc.

HUBBELL POWER SYSTEMS, INC.
CHANCE® HELICAL PILE / ANCHOR *and* ATLAS RESISTANCE® PIER PRODUCT SELECTION GUIDE



NOTES:

1. Range of RQD of Slightly Weathered to Competent Rock.
2. Rock Quality Designation (RQD) = $\frac{\Sigma \text{ length of intact pieces of core} > 100 \text{ mm}}{\text{length of core advance}}$

Product Selection Guide, Figure 3-1

PRELIMINARY CHANCE® HELICAL PILE/ANCHOR and ATLAS RESISTANCE® PIER DESIGN GUIDE

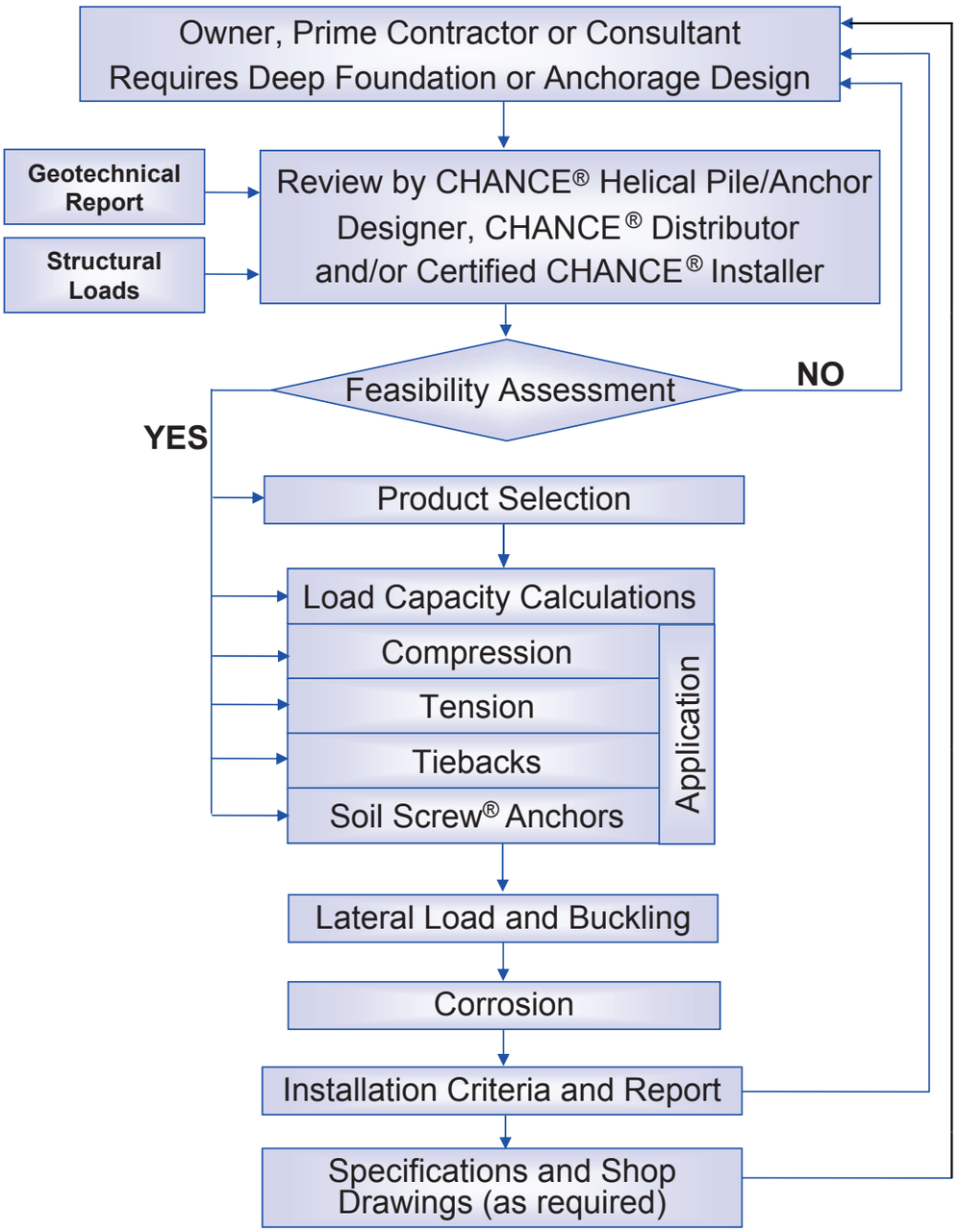
Hubbell Power Systems, Inc. manufactures CHANCE® Helical Piles/Anchors and ATLAS RESISTANCE® Pier products for use as tension anchors and/or compression piles for varied foundation support applications. There are many different applications for these end bearing piles and each application will require:

- An evaluation of the soil strata and soil characteristics of that stratum in which the helical plates or ATLAS RESISTANCE® Pier tip will be seated.
- A selection of the appropriate ATLAS RESISTANCE® Pier, including shaft type and bracket type or CHANCE® Helical Pile foundation, including shaft type, helical plate size, number and configuration. (Note: Type RS piles or CHANCE HELICAL PULLDOWN® Micropiles are strongly recommended in bearing/compression applications where the N-value of supporting soil around the shaft is less than 4. These piles have greater column stiffness relative to the standard CHANCE® Type SS piles. Refer to Buckling/Slenderness Considerations in Section 5 of this Technical Design Manual for a detailed discussion of this subject).
- A determination of the ultimate bearing capacity and suitable FS.

The preliminary design guide shown in Figures 3-2 and 3-3 is intended to assist certified installers, general contractors and consulting engineers in the selection of the appropriate CHANCE® Helical Pile or ATLAS RESISTANCE® Pier.

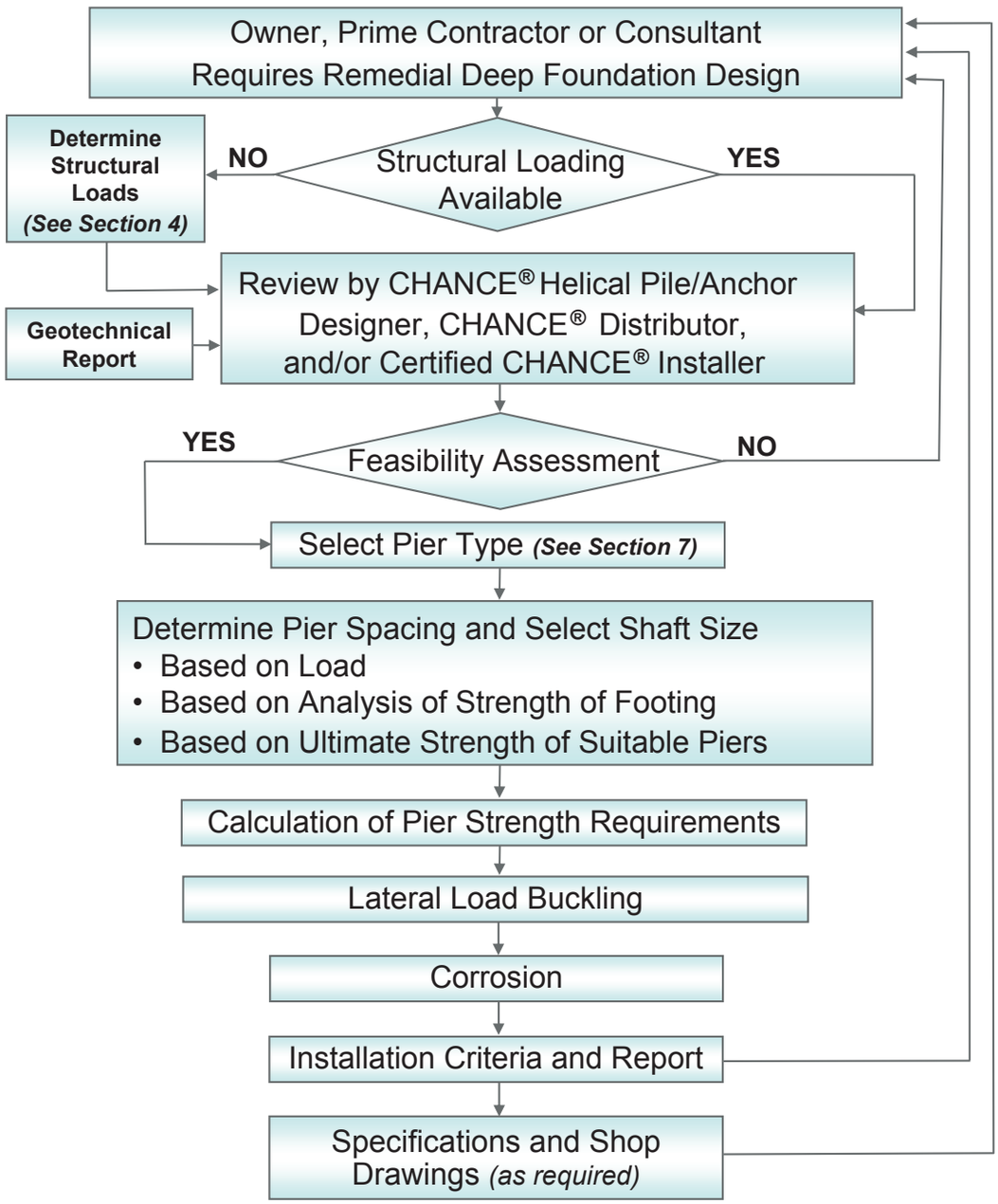
Design should involve professional geotechnical and engineering input. Specific information involving the structures, soil characteristics and foundation conditions must be used for the final design.

Preliminary Design Flowchart for New Construction
CHANCE® Helical Piles / Anchors



Design Flowchart for CHANCE® Helical Piles and Anchors (New Construction), Figure 3-2

Design Steps
Atlas Resistance® Piers



Design Flowchart for ATLAS RESISTANCE® Piers (Remedial Repair Applications), Figure 3-3

PRELIMINARY DESIGN REQUEST FORM

Contact at Hubbell Power Systems, Inc., CHANCE® Civil Construction: _____

Installing Contractor

Firm:	Contact:	
Phone:	Fax:	Cell:

Project

Name:	Type:	☐ Foundation	☐ Underpinning/Shoring
Address:		☐ New Construction	☐ Rock
		☐ Tieback Retaining	☐ Other:
		☐ Soil Nail Retaining	

Project Engineer? ☐ Yes ☐ No

Firm:	Contact:
Address:	Phone:
	Fax:
	Email:

Geotechnical Engineer? ☐ Yes ☐ No

Firm:	Contact:
Address:	Phone:
	Fax:
	Email:

Loads

	Design Load	FS (Mech) #1	FS (Geo) #1	Design Load	FS (Mech) #2	FS (Geo) #2
Compression						
Tension						
Shear						
Overturning						

Define the owner's expectations and the scope of the project:

_____

_____

_____

The following are attached: ☐ Plans ☐ Soil Boring ☐ Soil Resistivity ☐ Soil pH

If any of the above are not attached, please explain:

_____

_____

Date:_____ Requested Response:_____ CHANCE® #:_____ Response:_____

Please copy and complete this form to submit a design request.

