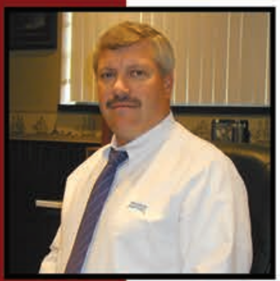
MAGNUM FOUNDATION SYSTEMS AND DESIGN MANUAL FOR COASTAL CONSTRUCTION (ISO9001 DOC. M54-13)






We bring the foundation team together with architects, engineers, the owners, and the contractors.



Letter from The Owner

Hello,

Allow me to introduce myself. My name is Brian Dwyer. I live in Bay Head, New Jersey in a home that my father built in 1957. Like many others along the New Jersey, New York, and Mid Atlantic States, my home has been subjected to the tyrant Hurricane Sandy and now our own Government Agencies. I have spent my life in the foundation industry growing a family business. That business has become a powerful and respected network serving the industry with engineering, manufacturing, and distributing of the best foundation products made in the U.S.A.

I have been listening to the Sandy victims concerns and the mass confusion about building codes, FEMA, and how do I lift my house. Because I am very passionate about both the Jersey Shore and my company's ability to rebuild it, I took it on my own to direct my engineers to help me offer to the public an information manual written from both owners and designers perspective. My Company and my family are committed to helping everyone rebuild for the future in the best, fastest, and safest manner possible. As our family embarks on the same journey to raise our home as you will, there is that urge to work together to rebuild the shore.

Please feel free to visit our Point Pleasant Borough design and showroom center located at 2150 Bridge Ave. Point Pleasant N.J. 08742. At this one location, you can talk with representatives from our local distributor, Slabjack Foundations, our manufacturing company, Magnum Piering, Inc., and the support engineers at Magnum Geo-Solutions, LLC.

Sincerely,

Brian Dwyer

SLABJACK FOUNDATIONS & MAGNUM PIERING, INC.

Letter from The Director of Engineering

Dear Homeowners, Engineers, and Architects,
By way of introduction, my name is Howard Perko. I have a Ph.D. degree in Geotechnical Engineering. I am also author of several papers and books on foundation construction. For the last 20 years, my team of engineers has been helping owners, engineers, and architects with the design of foundations and other soil-structure interactions.

It is our job to help owners and their design team use Magnum products and systems in a way that meets both FEMA guidelines for flood resistant construction and your local building codes. We realize that elevating your home above new FEMA base flood elevations is both frustrating and costly. Our goal is to make the design and construction process as smooth as possible by creating products and tools like this manual. At the end, we want your new house elevation and construction to meet all the applicable codes and regulations so that you never have to be displaced from your home again as a result of hurricane and flood effects.

The Magnum Foundation Systems and Design Manual for Coastal Construction is intended to provide a brief summary of the rules and regulations of government affecting coastal construction, an overview of the A-zone and V-zone design and construction process, and a guide for construction materials selection. This manual is primarily written for homes in New Jersey and New York, but its contents are generally applicable for all Mid-Atlantic states and other coastal areas of the U.S.

Please feel free to visit our support engineers at Magnum Geo-Solutions' Point Pleasant Borough design and showroom center located at 2150 Bridge Ave. Point Pleasant N.J. 08742.

Sincerely,

MAGNUM GEO-SOLUTIONS, LLC

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HELICAL PILES • PUSH PIERS • DEEP FOUNDATIONS • UNDERPINNING

PROJECT NAME:

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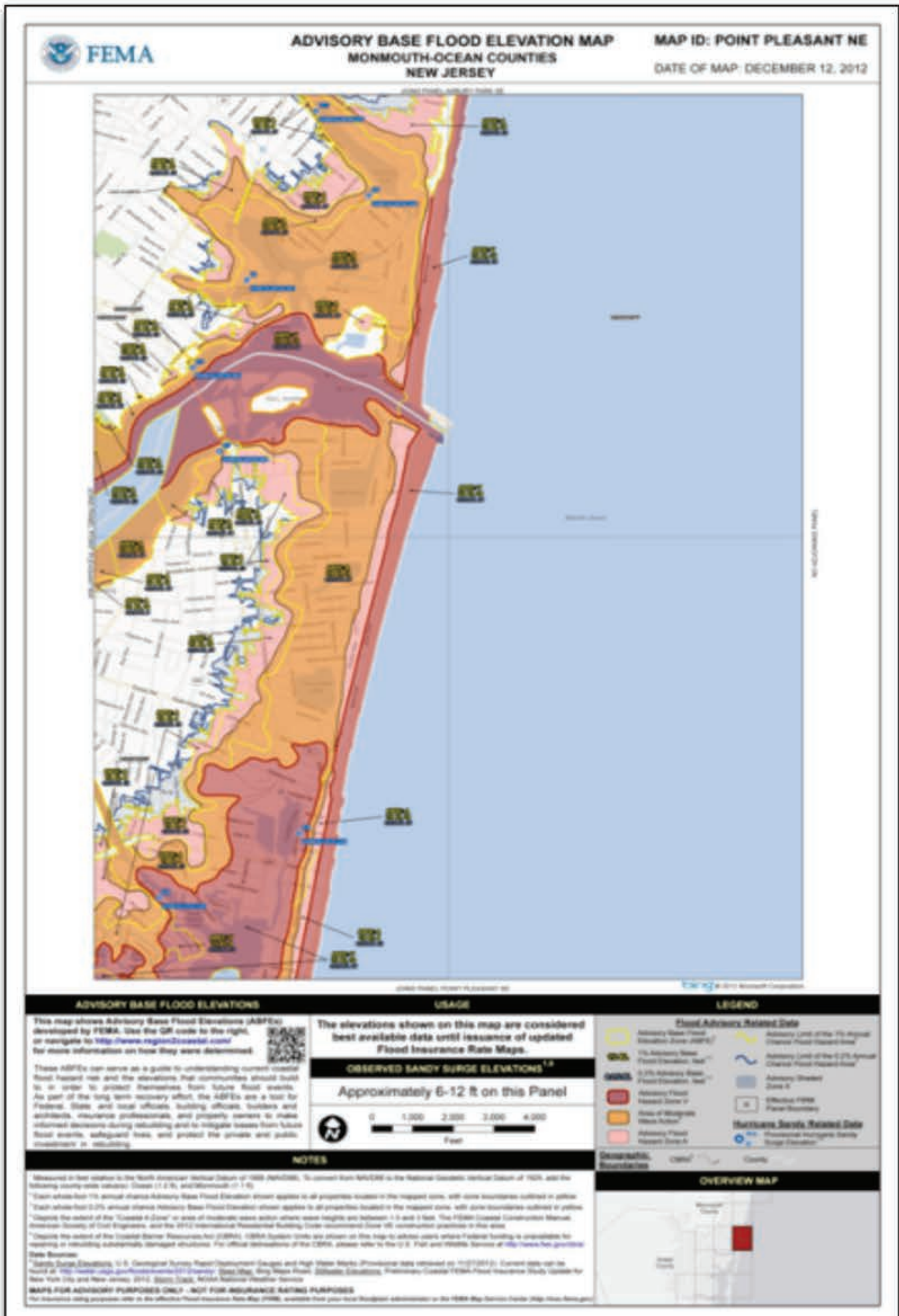

FEMA
ADVISORY BASE FLOOD ELEVATION MAP
MONMOUTH-OCEAN COUNTIES
NEW JERSEY
MAP ID: POINT PLEASANT NE
DATE OF MAP: DECEMBER 12, 2012
ADVISORY BASE FLOOD ELEVATIONS
USAGE
LEGEND
The elevations shown on this map are considered best available data until issuance of updated Flood Insurance Rate Maps.
OBSERVED SANDY SURGE ELEVATIONS
Approximately 6-12 ft on this Panel
NOTES
OVERVIEW MAP

1.ROLE OF GOVERNMENT

Section 1.1 Regulations

Two government agencies play the most important roles in determining how homes should be elevated and the standards by which foundations should be designed and constructed in Flood Hazard Areas. They are your local building department (DOB) and the Federal Emergency Management Agency (FEMA).

The DOB is in charge of enforcing state and local building codes. Your local building official issues building permits and certificates of occupancy. If a building code violation is found, the building official can issue stop work orders, assess fines, or in some cases condemn buildings until the violations are corrected.

FEMA is part of the U.S. Department of Homeland Security. A few of FEMA's responsibilities are to develop flood hazard area maps, provide guidelines for coastal construction, and to administer the National Flood Insurance Program (NFIP). NFIP backed flood insurance companies use these maps and guidelines to determine insurance eligibility, judge risk for policy coverage, and to set flood insurance premiums.

One of the common misconceptions is that compliance with building codes automatically means the owner will be able to get affordable flood insurance and vice-versa. This is not always correct. The elevation and construction of foundations in flood hazard areas should take into consideration both building codes and FEMA guidelines.

Section 1.2 Flood Hazard Maps

As a result of Hurricane Sandy, FEMA initiated a coastal flood study and is in the process of updating its Flood Insurance Rate Maps (FIRMs). FIRMs are used to determine who must buy flood insurance and where floodplain development regulations apply. Compliance with FIRMs is a requirement for obtaining NFIP backed flood insurance.

You can find current FIRM information in two ways; 1.) search by map on the website http://fema.maps.arcgis.com/, or if you live in New Jersey or New York, you can 2.) search by address on the website www.region2coastal.com. Both of these sites will be updated as progress on the coastal flood studies continue. FIRMs identify flood zones and provide base flood elevations (BFE). BFE's are given in feet above sea level.

FEMA FIRM's provide flood elevations with a 1% and 0.2% annual chance of occurring. This is more or less the same thing as saying the chance of flooding at this location and to this elevation is once every 100 years or once every 500 years, respectively. Your BFE is the flood elevation with 1% annual chance of occurring.

It is important to note that BFE's are measured relative to sea level in the North American Vertical Datum of 1988 (NAV88). Google Earth and other on-line mapping programs may use a different datum such as the National Geodetic Vertical Datum of 1929. Corrections have to be made when switching between survey elevation datum. The most reliable approach when planning your project is to hire a local surveyor who can measure the current elevation of your home's foundation and compare that with FEMA BFE to the same datum.

Section 1.3 Flood Zone Definitions

In general, FEMA defines three flood zones: V-zone, Coastal A-zone, and A-zone. Each of these zones has different construction requirements as described below.

1.3.1. V-Zones

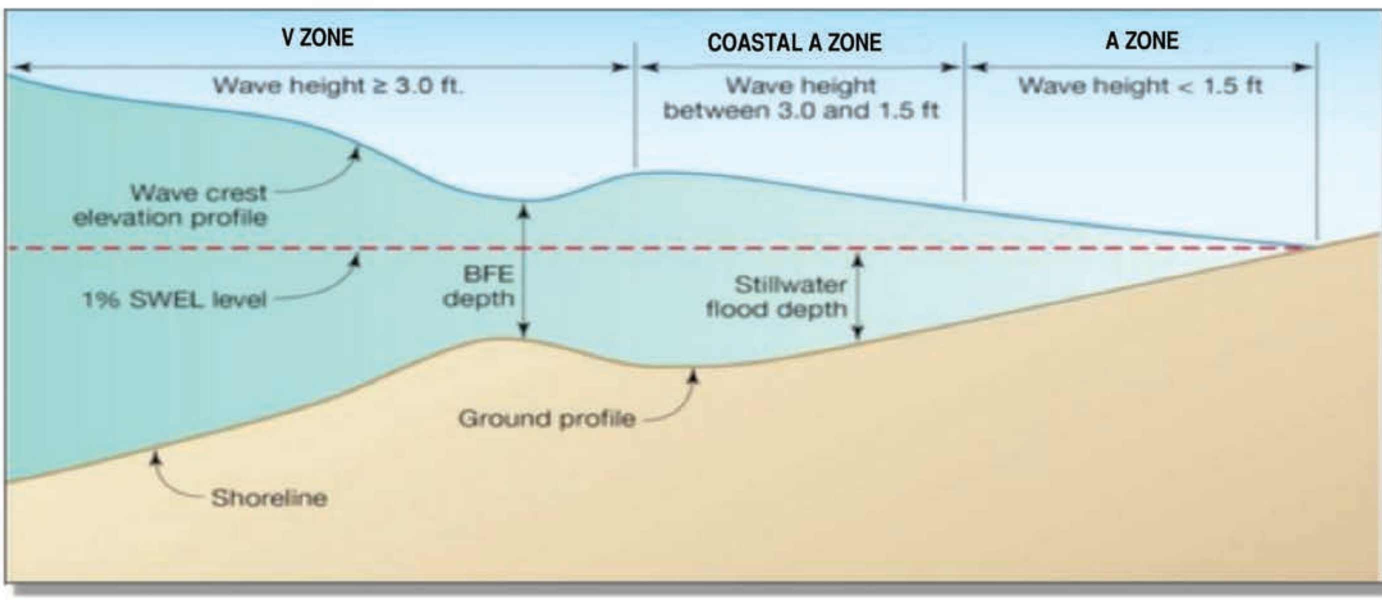
V-zones are coastal areas with risk of flooding and severe wave action. These areas have computed wave heights in excess 3 feet during the base flood event. Homes in V-zones must be supported on piling to resist scour due to wave action. Walls constructed below the BFE must be break-away or open lattice type construction.

1.3.2. Coastal A-Zones

Coastal A-zones are areas immediately adjacent V-Zones and have a risk of flooding and moderate wave action. These areas have computed wave heights from 1.5 to 3 feet during the base flood event. Many local DOB's currently do not require special construction in these areas beyond that prescribed for other A-zones. However, the FEMA Coastal Construction Manual (FEMA P55), American Society of Civil Engineers Flood Resistant Design Manual (ASCE 24), and the 2012 International Residential Building Code (IRC2009) recommend following V-zone construction practices in Coastal A-zones. To reduce the risk of structural damage during flooding, avoid excess flood insurance premiums, and help ensure future building code compliance, homeowners and their design professionals are strongly encouraged to follow V-zone construction practices in these areas.

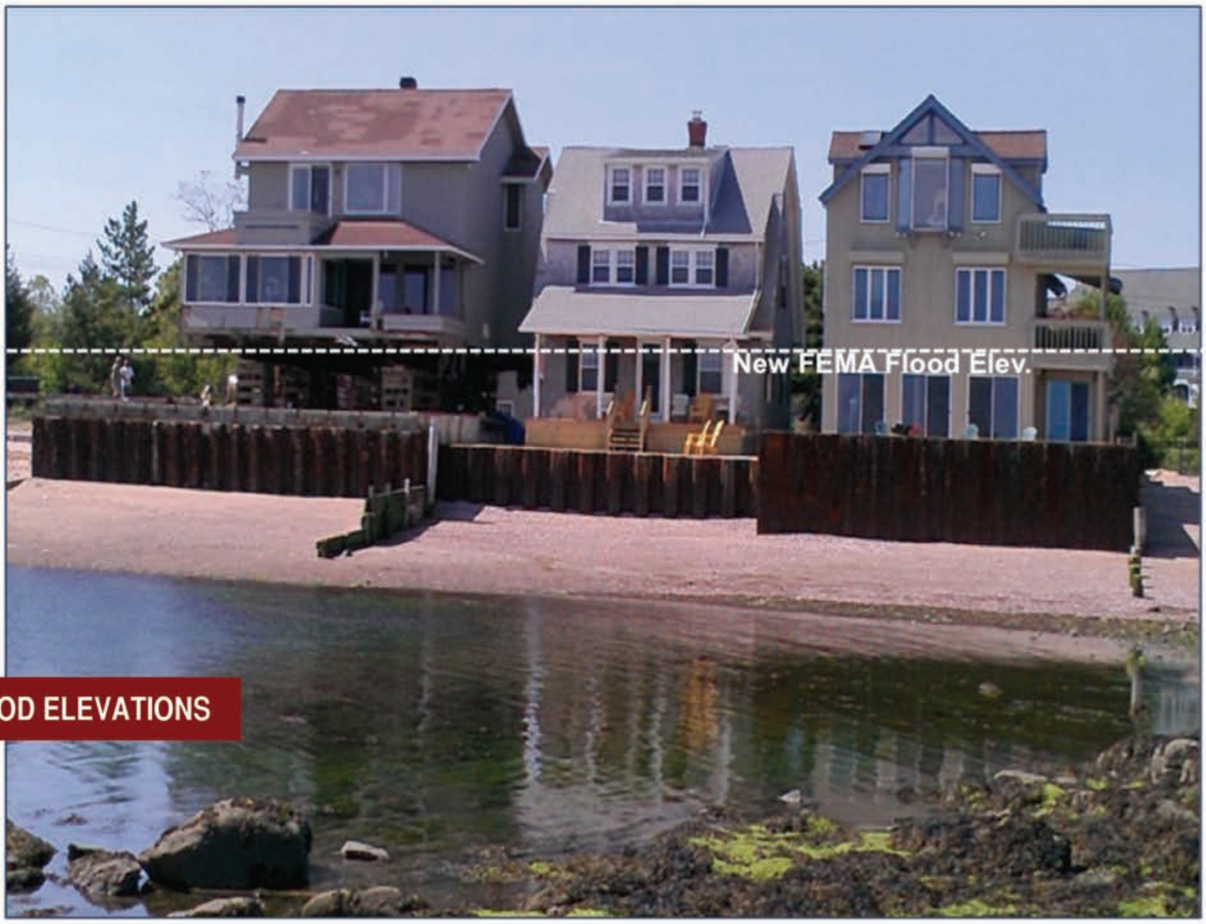
1.3.3. A-Zones

A-zones are areas further inland where there is a risk of flooding and limited wave action. These areas have computed wave heights less than 1.5 feet during the base flood event. Homes in A-zones do not require piling to resist scour and can be supported on footing foundations provided the soil conditions are stable with good bearing characteristics. Often existing foundations can be re-used in whole or in part. In some cases, it is necessary to augment existing foundations to carry new loads imposed by elevation of the home. Enclosed areas below the ABFE shall be vented to avoid uneven flood water elevations and associated forces.



Section 1.4 Minimum Home Elevation

To determine the minimum elevation that your home must be lifted, subtract your home's current foundation elevation above sea level from the BFE. The 2009 International Residential Code-New Jersey Edition, Section R322 states that buildings in A-zones shall have the lowest floor at or above the BFE, whereas buildings in Coastal A-zones and V-zones shall have the lowest floor at 1 foot above the BFE. To satisfy FEMA P55, the bottom of the lowest structural framing member must be above the BFE. Other state and local building codes may require additional freeboard, which is extra distance that your home must be elevated above the BFE. As discussed in Section 2.4, Homeowner's should consider several other factors besides the minimum elevation required by code when planning desired home elevation.



FLOOD ELEVATIONS

Section 1.5 Government Funding

In addition to normal NFIP backed insurance coverage for assessed damage, FEMA is providing Increased Cost of Compliance (ICC) grants of up to $30,000 which can be used to help with the cost of elevating your home. One of the pitfalls of this grant program is that when you apply, you agree to bring your home to current building code standards and compliance with FEMA guidelines. This means that if your home is in a V-zone, most likely it will be necessary to construct a new scour resistant foundation on piling. Likewise, if you are in an A-zone, your foundation may need to be augmented to support the new loads and/or to meet modern construction standards. The cost of your new foundation can be far in excess of the ICC grant.

2. HOMEOWNER DECISIONS

Section 2.1. Homeowner Perspectives

"I'm not going to lift my home because I'm not going to get flood insurance." Unfortunately, mortgage companies require flood insurance in flood hazard areas. The ability to obtain financing is critical to your home's value. In addition, your local borough may levee additional taxes on non-compliant homes in the future in order that your community can participate in the NFIP.

The unfortunate truth is that residents in flood hazard areas eventually will need to lift their homes and upgrade their foundation to comply with FEMA guidelines for flood resistant construction. The good news is that proper elevation and construction will help increase the value of your home and finally give you and your family peace of mind.

If done properly, house lifting should result in very little damage to a home's interior and exterior finishes and should have no effect on the functionality and stability of the structure. However, lifting is only a small component of the overall project of flood resistant construction. All the components should be designed and planned prior to starting the lift. Otherwise, homeowners can be stuck paying high fees to the house lifting company for every month that your home rests on their cribbing and has not been set back down onto a proper foundation.

If properly planned and executed, the whole process of house lifting, foundation construction, lowering the home onto the new foundation, proper tie-down, and architectural finishes typically takes 2 to 3 months. Improper contractor qualifications, changed site conditions, redesign, or waiting for materials from inferior suppliers can add time to projects. Following the suggestions contained in this manual can help projects stay on schedule and on budget.

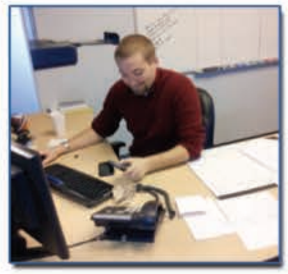
Section 2.2. Selecting the Design Team

Proper design of your home's new foundation requires several specialized individuals. Each plays an important role. Slabjack Foundations can assist homeowners in assembling their design team or can work with individuals or firms that you select.

2.2.1. Architect

The architect's primary role is to help the homeowner visualize the home's appearance after lifting, to plan for and design a means of egress, and to recommend finishes. Architects also conduct as-built surveys of homes and provide drawings showing existing conditions. Architects often can assist with construction permitting. Depending on the qualifications, the architect also may be able to take on the responsibilities of the structural engineer below.

2.2.2. Structural Engineer



The structural engineer's role is to calculate the forces imposed on the home from gravity, wind, snow, and flood forces and to translate these to the foundation. The structural engineer may inspect the existing foundation to determine if it can be re-used and will often measure and record the size and orientation of existing structural members. The structural engineer sizes the foundation piling, structural beams, connections, and other engineered systems.

2.2.3. Geotechnical Engineer

The geotechnical engineer's role is to verify subsurface conditions. In areas where information about the subsurface is lacking, the geotechnical engineer may sample and log soils with a soil boring. Reliable subsurface information helps the structural engineer select and size the appropriate foundation system and helps avoid delays and cost overruns due to changed site conditions.

2.2.4. Surveyor

The surveyor's role is to measure the current elevation of your home, to set a benchmark on the property, and to confirm the BFE. The surveyor also certifies the final elevation of the home after lifting and new foundation work is complete. The surveyors certificate is necessary for insurance and final inspection by the DOB.

2.2.5 Inspector

Some of the home's various phases of construction will be inspected by the local building department. Foundation piling and other specialized aspects of construction, may be inspected by the structural engineer, geotechnical engineer, or independent 3rd party inspection agency. The inspectors role is to help assure that the completed construction work complies with the engineer's plans, specifications, and local building codes.

2.2.6 Owner's Representative

Homeowner's that are less familiar with construction and want the help of a professional may choose to hire an owner's representative like Slabjack Foundations. The professionals at Slabjack Foundations will work with you in selecting the right team of contractors and design professionals. They will guide you through the design and construction process. They can even help with paperwork for financing and grant applications. For some homeowners, the cost of an owner's representative is covered by certain grants and insurance policies.

Section 2.3. Selecting the Contractor

The selection of the right contractor is imperative to the success of your project. Slabjack Foundations can recommend contractors upon request or we can work with contractors that you select through referrals or previous experience. Here are a few guidelines for contractor selection.

2.3.1 General Contractor

The general contractor's role is to coordinate the construction, hire and supervise subcontractors, furnish all materials, and to ensure all work complies with plans, specifications, and local codes. The general contractor is perhaps the most critical partner to the homeowner from the perspective of overall quality, schedule, and budget. Choose your contractor carefully.

The general contractor (GC) should be licensed by the State of New Jersey. Licensing ensures that the GC has taken and passed an examination on relevant construction standards and building codes. The GC should have many years in business under the same company name. Continuous operation provides evidence that the company is both solvent and reputable. The GC should be able to provide you with a copy of the company's builder's risk, workers compensation, vehicle, and general liability policy coverage. The contractor should be able to provide written safety policy that includes compliance with Occupational Safety and Health Administration (OSHA) standards. The safety policy should include provisions to fence-off, post, or otherwise block the site from public access during construction until the home is securely attached to the new foundation. If someone stumbles onto your site and gets hurt and your contractor is not both solvent and insured, the injured party is going to look for the property owner.

2.3.2. House Lifting Company

Because of the special qualifications, training, and insurance required for house lifting, sometimes the house lifting company is hired separately from the general contractor. The role of the house lifting company is to separate your home from its current foundation and to raise your home above the planned BFE and then to set it down onto the new foundation. Selection of an experienced house lifting contractor is very important for minimizing damage to the home as a result of the lift. Choose your contractor carefully.

There are several quality house lifting companies in the U.S. Many have been in business for multiple generations. A quality company should be insured specifically for house lifting, should have an extensive resume of experience, and should utilize the unified lifting system (a machine that allows house lifters to accurately control movement). Like the GC, the house lifting company should be able to provide a copy of the company's workers compensation, vehicle, and general liability insurance policy coverage (including special coverage for house lifting).

The house lifting company should be able to describe their safety plan. The safety plan should include temporary lateral bracing after the lift by cables, diagonal struts, or other means to provide stability in the event of wind loads on the structure.

Section 2.4. Choosing the Correct Elevation

One of the most important considerations when choosing the new elevation of your home is future cost of flood insurance. An example showing flood insurance premiums for homes in New Jersey is given in the table. Flood insurance premiums are expected to decrease for every foot up to 3 feet that a home is elevated above the BFE. Using an example offered by FEMA, Governor Chris Christie in January, 2013 explained the kind of flood insurance premium increases property owners could anticipate if they don't elevate their home to the new BFE. According to his example, if a property is in an A-zone and the home is 4 feet below the BFE, the owner can expect to pay up to $31,000 in flood insurance per year. If the home is elevated to the BFE, that premium drops to $7,000 per year. Add two feet above the BFE and the premium is cut in half.

ANNUAL NFIP BACKED FLOOD INSURANCE PREMIUM*

	Coastal A-Zone (Effective 1/13) $250,000 Residential Coverage		V-Zone (Effective 1/13) $250,000 Residential Coverage	
Lowest Floor Elevation	No Contents Covered	$100,000 Contents Coverage	No Contents Covered	$100,000 Contents Coverage
3 ft Above	$376	$561	$2,403	$2,923
2 ft. Above	$448	$633	$3,278	$4,048
1 ft Above	$660	$845	$4,728	$5,918
at BFE	$1,359	$1,724	$6,803	$8,603
1 ft Below	$4,527	$5,255	$9,008	$11,583
2 ft Below	$5,924	$8,308	$12,074	$15,764
3 ft Below	$7,204	$10,554	$15,524	$20,474
4 ft Below	$9,551	$14,370	$17,334	$23,304
6 ft Below	$18,830	$28,535	$23,449	$32,019

*Actual flood insurance premium data obtained April, 2013 from Jeresey Shore insurance company.

Another important consideration when planning the correct elevation is the planned use of the newly created space below the home. Will this new area be used for storage or parking? Vehicle parking likely requires at least 7.5 feet clear space between the ground surface and the lowest structural members. The homeowner should discuss future use with the architect to make sure elevations will permit the intended purpose.

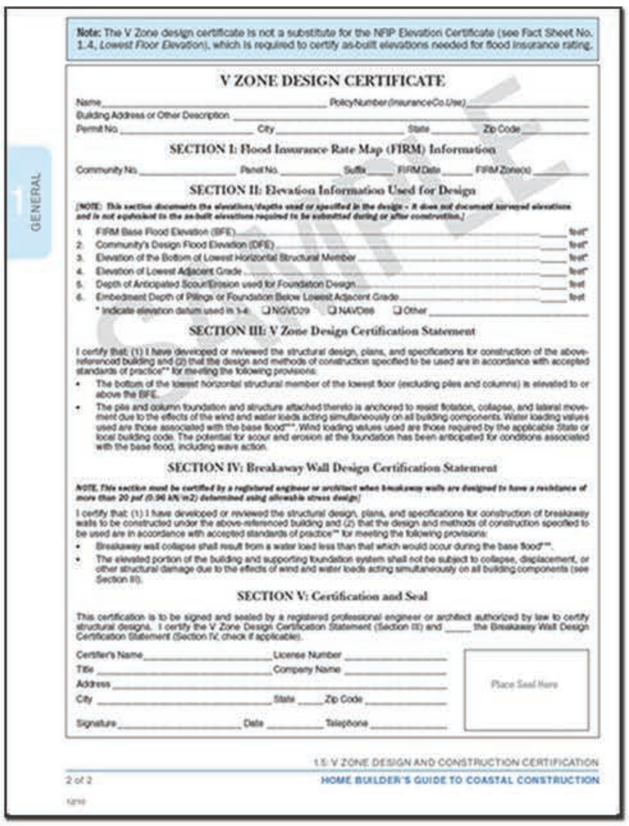
Engineers, architects, and builders also should consider local zoning ordinances that govern maximum building heights. Most DOB's have waved these ordinances to allow for home elevation in flood hazard areas. However, some municipalities such as Atlantic City, do not allow homes to be elevated above certain levels. Homeowners and design professionals should consult local authorities for maximum building heights when planning home elevation.

Section 2.5. Understanding the Elevation Process

The elevation process starts with design and planning. A surveyor measures the home's existing elevation and compares that to the BFE. An architect conducts an as-built survey and prepares drawings of the home before and after the lift. Local geologic information is accumulated or a geotechnical engineer is employed to conduct soil borings and issue a report. Next, the structural engineer prepares the foundation plan including any reinforced concrete details, pile sizing and layout (if necessary), and drawings of the structural framing system. Once the plans are complete, general contractors and house lifting companies are pre-qualified and asked to bid on the home's reconstruction.

During the design phase, the homeowner should be preparing for construction by removing all personal items from inside the home and clearing the yard to provide access for the work. The general contractor can work on getting utilities and services disconnected. Exterior landscaping should be removed from around the home. All or part of the floor sheathing may be removed, as well as the bottom portion of the home's siding. Once the construction permit is issued, the house liter will separate your house from its current foundation and will lift it using hydraulic rams to an elevation a few feet above the planned final elevation. For the next several weeks or longer, the home will rest on beams and cribbing supplied by the house lifting contractor.

The construction process continues with the augmentation and/or demolition and replacement of the home's foundation. See Section 2.6 for a discussion about foundation alternatives. Once the new foundation is complete, the house lifter set the home down into its final elevation. Beams and cribbing are removed from the site. Hurricane tie-down and wind shear straps are used to connect the home to its new foundation. At this time, architectural finishes can be placed as discussed in Section 2.7. Final inspections are conducted and the certificate of occupancy is issued.



Note: The V Zone design certificate is not a substitute for the NFIP Elevation Certificate (see Fact Sheet No. 1.4, *Lowest Floor Elevation*), which is required to certify as-built elevations needed for flood insurance rating.

V ZONE DESIGN CERTIFICATE

Name ______ Policy Number (Insurance Co. Use) ______
Building Address or Other Description ______
Permit No. ______ City ______ State ______ Zip Code ______

SECTION I: Flood Insurance Rate Map (FIRM) Information

Community No. ______ Panel No. ______ Suffix ______ FIRM Date ______ FIRM Zone(s) ______

SECTION II: Elevation Information Used for Design

[NOTE: This section documents the elevations/depths used or specified in the design – it does not document surveyed elevations and is not equivalent to the as-built elevations required to be submitted during or after construction.]

1. FIRM Base Flood Elevation (BFE) ______ feet*
2. Community's Design Flood Elevation (DFE) ______ feet*
3. Elevation of the Bottom of Lowest Horizontal Structural Member ______ feet*
4. Elevation of Lowest Adjacent Grade ______ feet*
5. Depth of Anticipated Scour/Erosion used for Foundation Design ______ feet
6. Embedment Depth of Pilings or Foundation Below Lowest Adjacent Grade ______ feet

* Indicate elevation datum used in 1-4: ❑ NGVD29 ❑ NAVD88 ❑ Other ______

SECTION III: V Zone Design Certification Statement

I certify that: (1) I have developed or reviewed the structural design, plans, and specifications for construction of the above-referenced building and (2) that the design and methods of construction specified to be used are in accordance with accepted standards of practice** for meeting the following provisions:

- The bottom of the lowest horizontal structural member of the lowest floor (excluding piles and columns) is elevated to or above the BFE.
- The pile and column foundation and structure attached thereto is anchored to resist flotation, collapse, and lateral movement due to the effects of the wind and water loads acting simultaneously on all building components. Water loading values used are those associated with the base flood***. Wind loading values used are those required by the applicable State or local building code. The potential for scour and erosion at the foundation has been anticipated for conditions associated with the base flood, including wave action.

SECTION IV: Breakaway Wall Design Certification Statement

NOTE: This section must be certified by a registered engineer or architect when breakaway walls are designed to have a resistance of more than 20 psf (0.96 kN/m2) determined using allowable stress design.]

I certify that: (1) I have developed or reviewed the structural design, plans, and specifications for construction of breakaway walls to be constructed under the above-referenced building and (2) that the design and methods of construction specified to be used are in accordance with accepted standards of practice** for meeting the following provisions:

- Breakaway wall collapse shall result from a water load less than that which would occur during the base flood***.
- The elevated portion of the building and supporting foundation system shall not be subject to collapse, displacement, or other structural damage due to the effects of wind and water loads acting simultaneously on all building components (see Section III).

SECTION V: Certification and Seal

This certification is to be signed and sealed by a registered professional engineer or architect authorized by law to certify structural designs. I certify the V Zone Design Certification Statement (Section III) and ______ the Breakaway Wall Design Certification Statement (Section IV, check if applicable).

Certifier's Name ______ License Number ______
Title ______ Company Name ______
Address ______
City ______ State ______ Zip Code ______
Signature ______ Date ______ Telephone ______

Place Seal Here

1.5: V ZONE DESIGN AND CONSTRUCTION CERTIFICATION

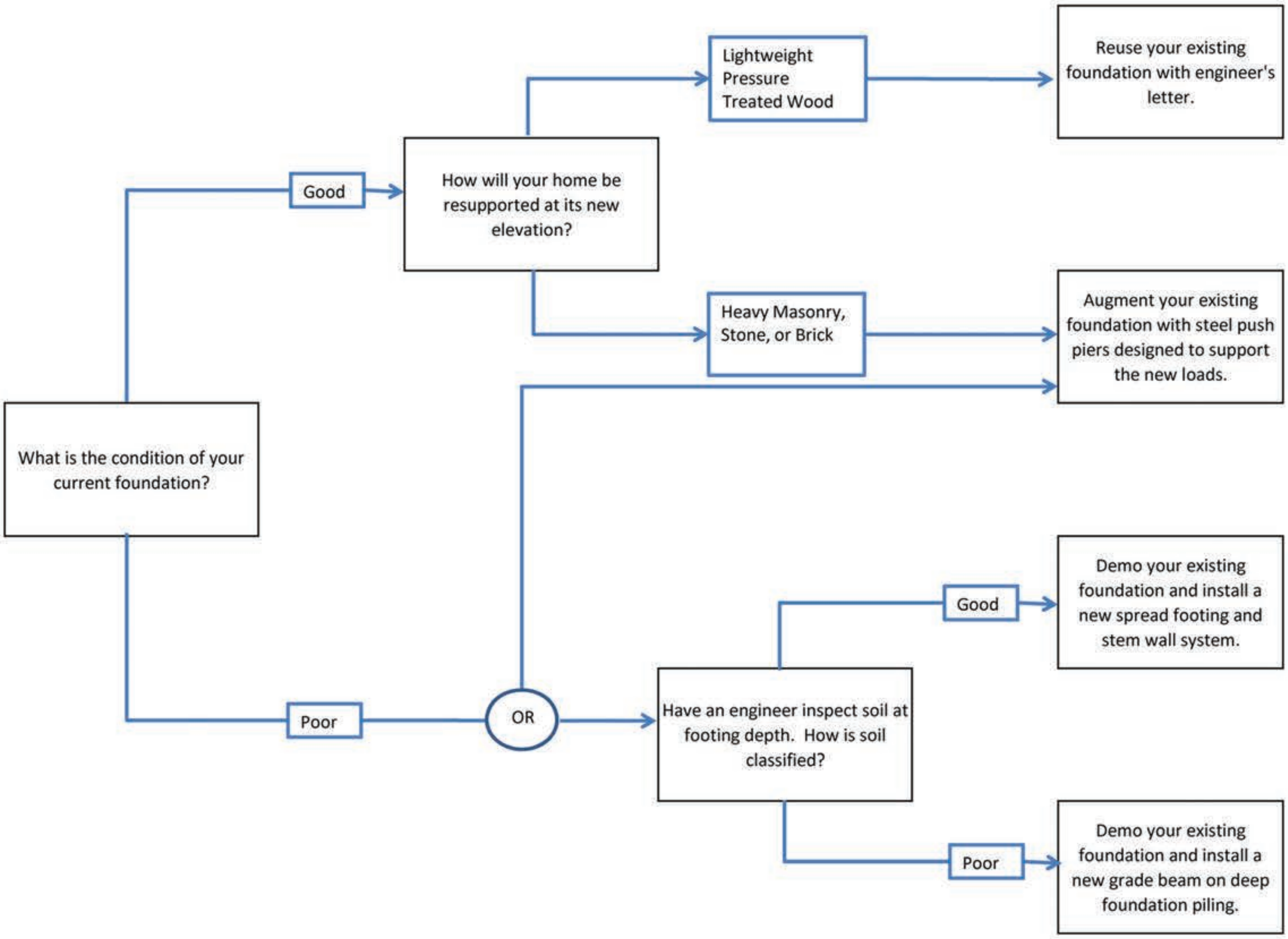
2 of 2 HOME BUILDER'S GUIDE TO COASTAL CONSTRUCTION

Section 2.6. Knowing the Correct Foundation

Construction of the new foundation depends on flood zoning. The three main flood zones were descibed in Chapter 1. This section outlines a few of the options available when selecting the correct foundation for the future. If your home is in an A-Zone, read Section 2.6.1. If your home is in Coastal A-Zone or V-Zone, read Sections 2.6.2 or 2.6.3, respectively.

2.6.1. Foundation Solutions in A-Zones

Foundation construction in A-zones begins with an evaluation of the existing foundation system. Depending on the outcome of this evaluation, there are several options for re-use, repair, or removal and replacement. These options include re-use of the existing foundation as-is, repair of the existing foundation using steel push piers, replacement with a new spread footing and stem wall, or replacement with a new grade beam and piling system. The process diagram below helps you choose the right option for your re-support of your home.



2.6.2. Foundation Solutions in Coastal A-Zones

Existing foundations of good quality that have withstood the test of time can be re-used provided the weight of the newly elevated home does not change significantly. A structural engineer should inspect the condition of the existing foundation and compute the increased loads due to home elevation and new support system. The engineer may be able to write a letter certifying the existing foundation can be reused. This letter can be turned into the building department to satisfy foundation design and inspection requirements. One technique for keeping newly applied loads on the existing foundation small is using all-weather wood knee wall components rather than building-up the foundation with masonry block, brick, or stone.

When heavy materials such as reinforced concrete, stone, brick, or masonry block are used to fill-in the space between the old foundation and the newly elevated home, the implied loads can often exceed the bearing capacity of an existing foundation even though it appears to be in good condition. Two feet of cast concrete or five courses of masonry block can weigh as much as a one-story home. Existing foundation were not designed and constructed for higher loads compared to those which they are accustom. For this reason, existing foundations either need to be replaced or repaired/augmented when heavy materials are used in A-zone foundation elevation.

Many old brick and stone foundations under homes in New Jersey and New York have exhibited some settlement and shifting. Cracks can be observed in the corners of the foundation and floors may be uneven. Foundations with cracks or other signs of movement cannot be relied upon for continued support. Why would a homeowner want to go through the expense of elevating their home and refinishing it only to have the home settle and crack in a few years time? For this reason, homeowners should consider replacement or repair/augmentation of cracked foundations.

Steel push piers are a common method of foundation repair/augmentation and can be used to re-support a portion or all of an existing foundation. Steel push piers consist of pipe piles that are jacked into the ground alongside your existing foundation using hydraulic rams. Push piers provide good quality assurance because each pier is proof tested during installation. Push piers should be installed prior to lifting the home because the weight of the home is used as a reaction to resist jacking forces. A factor of safety is achieved by using more than one pipe pile per length of foundation wall. These systems are described in more detail in Section 4.3 of this manual.

A new spread footing and stem wall system is used when the soil conditions at the footing depth are good but the existing foundation condition is poor. In this case, the existing foundation is demolished and removed after the home is lifted. The exposed soils are scarified and compacted. The subgrade is inspected by an engineer or building official. Spread footings are formed and cast against the compacted soil. The width of the new footings is designed by an engineer to carry the existing home plus any loads added during home elevation. A reinforced concrete or masonry block stem wall of appropriate height for the planned home elevation is constructed on the new footing.

A new grade beam and piling system is used when both the existing foundation and the soil conditions at the footing depth are poor. In this case, the shallow soils are deemed inappropriate to support a shallow foundation. The existing foundation is demolished and removed after the home is lifted. New helical piles are installed under the home in accordance with the structural engineer's plan. A reinforced concrete grade beam is formed and cast over the tops of the piling provide lateral bracing. A reinforced concrete or masonry block stem wall of appropriate height for the planned home elevation is constructed on the new grade beam. More information about foundation piling can be found in Sections 5.1 of this manual.

Knee walls are defined as short walls built on top of an existing foundation to fill the gap below the newly elevated home. Knee walls can be built of pressure treated wood or other materials. Stem walls are defined as short walls that are constructed on footings or grade beams and span the distance from these elements to the floor system of the home. Stem walls are often constructed of reinforced concrete or masonry block. In A-zone construction, both knee walls and stem walls that enclose below grade spaces must be fitted with flood vents.

2.6.3. Foundation Solutions in Coastal A-Zones

According to New Jersey residential building codes, houses in Coastal A-zones may be constructed following the same standards as described above for other A-zone areas. However, for the reasons cited in Section 1.3.2, it is highly recommended that foundations in Coastal A-zones be constructed following the higher standards for V-zones.

2.6.4. Foundation Solutions in V-Zones

All homes in V-zones must be supported on foundations with piling to resist the effects of wave action and scour. Conventional foundation piling consists of driven timber piles or steel H-piles. The installation of these piles requires crane supported pile driving hammers and clear headroom. Pile driving also can induce vibrations that can settle timber cribbing supporting the elevated home or cause settlement and damage to your neighbor's home. Moving your home into the street and driving a piled foundation and then moving it back is typically not possible in coastal areas of New Jersey and New York. Most of these areas are too developed to make this type of construction plausible.

The favored piling system for home elevation in New Jersey and New York is helical piles. Helical piles are recognized in the 2009 International Building Code - New Jersey Edition and in NYC Buildings Bulletin 2011-011. They consist of one or more helix-shaped circular bearing plates attached to a central steel shaft. The shaft is rotated into the ground like a large earth screw. The piling is manufactured in short sections that couple together so that it can be installed from beneath an elevated home. Quality control for these systems is good because like other kinds of piling systems, the driving resistance is monitored during installation. All helical piles are driven to a specific resistance. For helical piles, driving resistance is measured by the torque required to turn the pile. Extension sections are added until the pile reaches a specific torque and capacity. The number and size of helical bearing plates depends on the anticipated area geology and the required working capacity of the pile. These systems are described in more detail in Section 5.1 of this manual.

Hint: Choosing a Magnum Moment Frame over other construction methods can reduce cost, speed up installation, provide assurance of an engineered factory manufactured product, and provide more useable space under your home.

After the foundation piling are selected, the next important decision is whether to extend the piling up to the newly elevated home or to construct a grade beam and use a column and beam system. Extending the piling up to the home almost always means that some type of x-bracing or diagonal ties will be needed to resist lateral loading. These braces are discouraged by FEMA because they can trap debris during storm events and break. Bracing and diagonal ties also block access and limit homeowner options for use of the newly created space below the home.

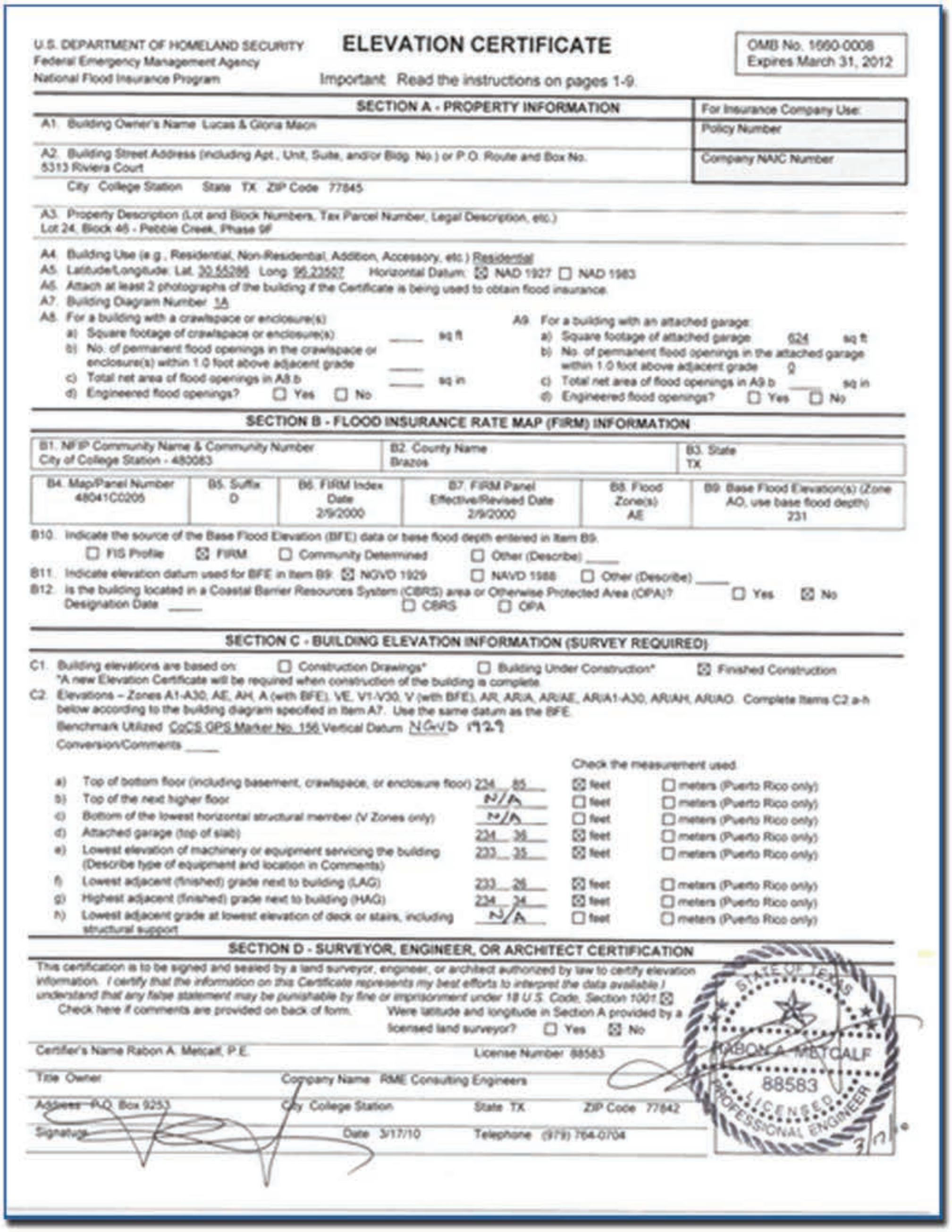
A better option for support of your home is construction of a grade beam that ties together the tops of piles and allows for a beam and column framing system. A grade beam is cast reinforced concrete and is totally permissible by FEMA. The columns resting on the grade beam can be masonry, cast concrete, or steel. The beams that support the home above the columns can be engineered wood or steel. A cost effective and time saving method of constructing a column and beam system is the use of a steel moment frame. Magnum moment frames are described in more detail in Section 5.2."

Section 2.7. Selecting Architectural Finishes

After successful attachment of the home to the new foundation system, architectural details such as beam and column wraps, siding, lattice enclosures, and staircases are constructed. Depending on the appearance desired by the homeowner, columns and beams can be wrapped in siding, stucco, or stone/brick veneer. Steel posts can be hidden in architectural columns. Ramps, staircases, decks, and patio features can be added. Cosmetic finishes are done inside the home and landscaping is restored.

Section 2.8. What to Expect on Completion

All inspections should be completed by the engineers and building officials. A certificate of occupancy should be issued. A surveyor should check final elevations and a flood zone design certificate should be completed. Before you move back-in and release the general contractor from the site, you and your architect or owner's representative should do a final walk-through of the home. The purpose of the final walk-through is to inspect the home for safety concerns and to prepare a final "punch list" of items that need to be finished, if any. That list is given to the general contractor as a stipulation for final payment. After the contractor completes the items on the punch list, final payment can be issued and the home is ready to move in.



U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

ELEVATION CERTIFICATE

Important: Read the instructions on pages 1-9.

OMB No. 1660-0008
Expires March 31, 2012

SECTION A - PROPERTY INFORMATION

For Insurance Company Use:
Policy Number
Company NAIC Number

A1. Building Owner's Name Lucas & Gloria Macn
A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.
5313 Riviera Court
City College Station State TX ZIP Code 77845
A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
Lot 24, Block 46 - Pebble Creek, Phase 9F
A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) Residential
A5. Latitude/Longitude: Lat. 30.55286 Long. 96.23507 Horizontal Datum: ☒ NAD 1927 ☐ NAD 1983
A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.
A7. Building Diagram Number 1A
A8. For a building with a crawlspace or enclosure(s):
a) Square footage of crawlspace or enclosure(s) ____ sq ft
b) No. of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade ____
c) Total net area of flood openings in A8.b ____ sq in
d) Engineered flood openings? ☐ Yes ☐ No
A9. For a building with an attached garage:
a) Square footage of attached garage 624 sq ft
b) No. of permanent flood openings in the attached garage within 1.0 foot above adjacent grade 0
c) Total net area of flood openings in A9.b ____ sq in
d) Engineered flood openings? ☐ Yes ☐ No

SECTION B - FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number	B2. County Name	B3. State
City of College Station - 480083	Brazos	TX

B4. Map/Panel Number	B5. Suffix	B6. FIRM Index Date	B7. FIRM Panel Effective/Revised Date	B8. Flood Zone(s)	B9. Base Flood Elevation(s) (Zone AO, use base flood depth)
48041C0205	D	2/9/2000	2/9/2000	AE	231

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9.
☐ FIS Profile ☒ FIRM ☐ Community Determined ☐ Other (Describe) ____
B11. Indicate elevation datum used for BFE in Item B9: ☒ NGVD 1929 ☐ NAVD 1988 ☐ Other (Describe) ____
B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No
Designation Date ____ ☐ CBRS ☐ OPA

SECTION C - BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☒ Finished Construction
*A new Elevation Certificate will be required when construction of the building is complete.
C2. Elevations – Zones A1-A30, AE, AH, A (with BFE), VE, V1-V30, V (with BFE), AR, AR/A, AR/AE, AR/A1-A30, AR/AH, AR/AO. Complete Items C2.a-h below according to the building diagram specified in Item A7. Use the same datum as the BFE.
Benchmark Utilized CoCS GPS Marker No. 156 Vertical Datum NGVD 1929
Conversion/Comments ____

Check the measurement used.

a)	Top of bottom floor (including basement, crawlspace, or enclosure floor)	234.85	☒ feet	☐ meters (Puerto Rico only)
b)	Top of the next higher floor	N/A	☐ feet	☐ meters (Puerto Rico only)
c)	Bottom of the lowest horizontal structural member (V Zones only)	N/A	☐ feet	☐ meters (Puerto Rico only)
d)	Attached garage (top of slab)	234.36	☒ feet	☐ meters (Puerto Rico only)
e)	Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	233.35	☒ feet	☐ meters (Puerto Rico only)
f)	Lowest adjacent (finished) grade next to building (LAG)	233.26	☒ feet	☐ meters (Puerto Rico only)
g)	Highest adjacent (finished) grade next to building (HAG)	234.34	☒ feet	☐ meters (Puerto Rico only)
h)	Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	N/A	☐ feet	☐ meters (Puerto Rico only)

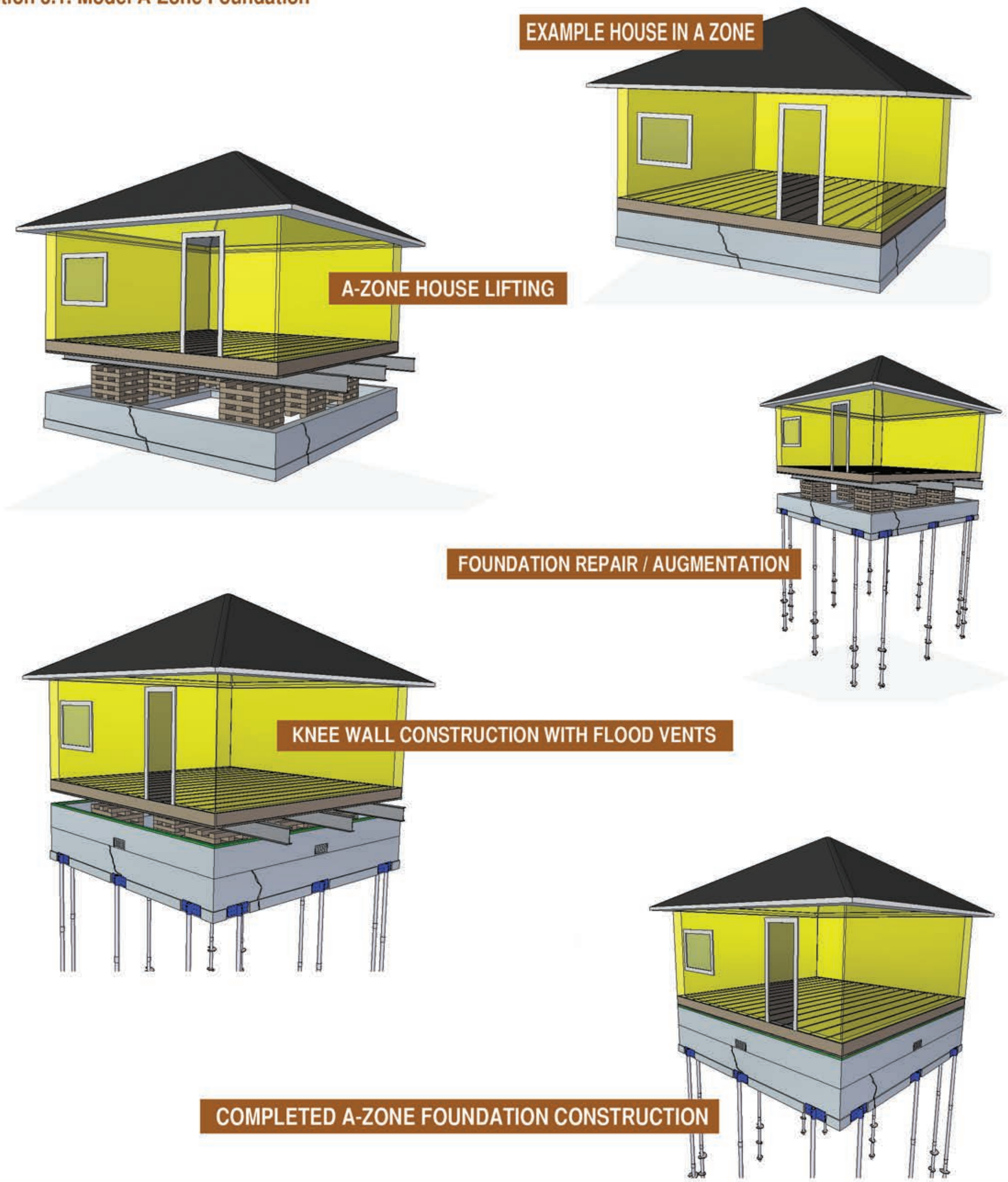
SECTION D - SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*
☒ Check here if comments are provided on back of form.
Were latitude and longitude in Section A provided by a licensed land surveyor? ☐ Yes ☒ No

Certifier's Name Rabon A. Metcalf, P.E. License Number 88583
Title Owner Company Name RME Consulting Engineers
Address P.O. Box 9253 City College Station State TX ZIP Code 77842
Signature Date 3/17/10 Telephone (979) 764-0704

3. CONSTRUCTION METHODOLOGY

Section 3.1. Model A-Zone Foundation



Section 3.2. Model V-Zone Foundation

4. DESIGN CONSIDERATIONS

Section 4.1. Objectives

The objective of the design professional should be to provide the homeowner with a house lifting and new foundation plan that considers economics, aesthetics, and functionality. Above all, the new foundation should comply with FEMA and DOB codes and should be designed to resist future flooding and wave action so that homeowner's are never again displaced by hurricane damage.

Section 4.2. Economics

There are many different ways to design foundations in A and V-zones. One of the most important factors in determining the most economical method is time savings. The preferred construction method is that which minimizes the time that the house is elevated on cribbing. Every month that the house is on cribbing can cost the homeowner fees to the house lifter and overhead costs to the GC. The foundation design and construction methods provided herein were developed by Magnum Geo-Solutions, LLC after 20 years of residential foundation design experience, consulting with numerous house lifting companies in the Mid-Atlantic area, conversations with FEMA representatives, and interviewing state and local building officials. It is with confidence that we present these methods of construction which we believe to be the most economical for this area.

Section 4.3. Code Compliance

In order to obtain a building permit and certificate of occupancy, the design of a residential foundation in New Jersey must meet the 2010 International Residential Code (IRC)- New Jersey Edition (New York State Code is similar). However, the IRC section on foundations construction covers shallow foundations only. It does not contain prescriptive specifications for piled foundations. Section R301.1.3 states, "When a building of otherwise conventional construction contains structural elements... not conforming to this code, these elements shall be designed in accordance with accepted engineering practice... Engineering design in accordance with the International Building Code is permitted..."

The International Building Code - New Jersey Edition (New York State Code is similar), references the Flood Resistant Design and Construction manual of the American Society of Civil Engineers (ASCE 24). Hence, to obtain a certificate of occupancy, the design and construction of a piled foundation must meet the IBC and ASCE24.

NFIP flood insurance companies may reference the FEMA Coastal Construction Manual (P55) which was written to help designers and contractors identify and evaluate practices that will improve the quality of construction in coastal areas and reduce the economic losses associated with coastal disasters. In order to obtain the best rates on flood insurance, it is in the homeowner's best interest if the design and construction of the house lift and foundation meet FEMA P55.

The three documents, IBC, P55, and ASCE24 cross-reference each other. There is no real rank of command. To the extent possible, the design professional should endeavor to satisfy all three codes. Unless more guidance is given by FEMA and borough building departments in the future, the suggestion of this manual is that wherever a conflict between these three codes exists, the more conservative code should be followed.

The design professional also should consult local borough building and zoning requirements at the start of the design process.

4.3.1. Specific Codes Affecting Piled Foundations in Coastal Zones

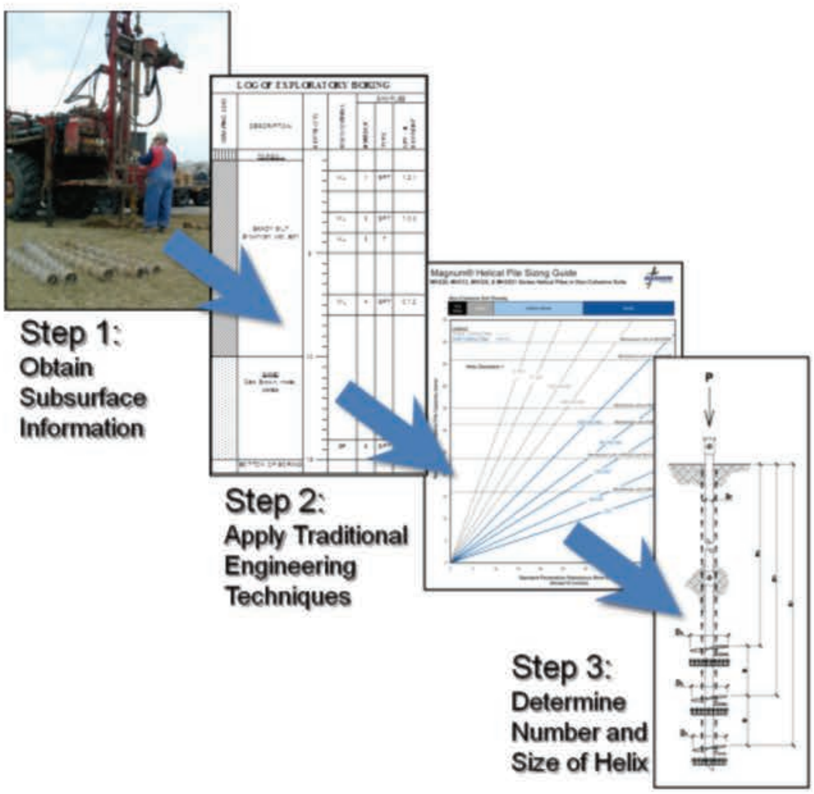
- Helical piles are a recognized deep foundation in the 2009IBC – New Jersey Edition Section 1810
- Helical piles are permitted in the 2010 New York State Building Code subject to approval of the building official per Section 1808.2.3
- Geotechnical investigations are required for deep foundation design unless local building official waves requirement because there exists satisfactory local data per 2009IBC-NJE Section 1803.2.
- Helical piles shall be sized for local soil and subsurface conditions and installation torque shall be used as a termination criteria per 2009IBC-NJE Section 1810.3.1.9.
- Static load tests are required on helical piles if design stresses are in excess of allowable values shown in 2009IBC-NJE Table 1810.3.2.6.
- Tops of helical piles shall be laterally braced per 2009IBC-NJE Section 1810.2.2. One method to achieve lateral bracing is the use of reinforced concrete grade beams.
- Per FEMA P-55 2011 pg. G10, "Grade beams… are not considered lowest horizontal structural members." Therefore, grade beams are allowed below the BFE.
- Per Section 2.4.2.5 of FEMA P-550, grade beams in V Zones can be used for lateral support for pile and column foundations, but the grade beams must be designed to span between supporting piles.
- NFIP, IBC, and IRC require that grade beams cannot be made monolithic with a floor slab, connected to a floor slab with reinforcing steel, or support a slab in anyway, less they be deemed the lowest horizontal structural member and must be located at or above BFE.
- Section 10.5.6 of FEMA P-55 Coastal Construction Manual (Fourth Edition), states that grade beams can become exposed by moving floodwaters and have to be designed for scour.
- Pile foundations shall be designed for unbraced length equal to the scour depth described in FEMA P-55 2011 eq. 4-18 or local standards.
- Per 2009IBC-NJE, Section 1810.2.1, any deep foundation elements standing in air (after scour) shall be designed as a column with a depth of fixity of 5 feet in firm soil or 10 feet in soft soil.
- Helical pile bearing plates shall have uniform screw pitch per 2009IBC-NJE, Section 1802. Helical bearing plates shall be generally perpendicular to shaft at all locations.

Section 4.4. Obtaining Subsurface Information

Local building codes in many boroughs do not require soil borings for residential construction. In these areas, design professionals often make assumptions about ground conditions based on soil conservation surveys, geologic maps, and/or anecdotal information about subsurface conditions in order to complete the foundation design. Inspections of exposed soils in excavations and review of pile driving resistance records can be used to verify these assumptions during construction. Although a common practice, this method of assuming soil conditions carries a higher risk of changed conditions claims and pile overruns. The potential cost of these extra charges need to be weighed against the cost of a soil boring and discussed with the homeowner in order to make a decision if additional subsurface exploration is merited.

When a home's existing foundation is in poor shape or in areas that require a pile foundation, it is highly advisable to engage the services of a local geotechnical engineer. Verification of subsurface information can help ensure proper foundation design and avoid cost overruns. Subsurface information is primarily used to evaluate the ability of existing shallow foundations to support new loads in A-zones. In V-zones, subsurface information is primarily used to determine the size and probable length of piling for proper bearing capacity. Subsurface information also may be used in corrosion, lateral pile, buckling, and pullout capacity analysis.

Soil borings should extend to a suitable bearing stratum and should incorporate standard penetration testing, cone penetrometer testing, unconfined compression tests, or other measures of soil strength and consistency. Soil boring logs should identify and classify each major soil or rock stratum, should list the drilling techniques employed, and should list ground water level measurements during and after drilling. Tests of pH and soil resistivity can be useful for determining the corrosivity of the soil and for corrosion and design lifespan analysis. It is also highly beneficial if the geotechnical engineer identifies the most suitable bearing stratum for founding the piles.



Section 4.5 Shallow Foundation Engineering

Re-use or reconstruction of shallow foundations is permissible in A Zone flood areas provided the soil and groundwater conditions are favorable for this type of construction. Shallow foundations should not be used on uncontrolled fill, hydraulically placed or dredged fill, soils high in organic content, loose shifting sands, and soft marine clays. The most common example of shallow foundations in the Mid-Atlantic area is footings with stem wall. Footing foundations should bottom below frost depth. Design considerations for shallow foundations are covered in the 2009 International Residential Code - New Jersey Edition and the 2010 Residential Code of New York State.

Section 4.6 Foundation Repair/Augmentation

In A Zone flood areas where ground conditions are poor and/or the existing shallow foundation is insufficient to support the weight of the new elevated home, it may be appropriate to repair/augment the existing foundation using steel push piers (also known as jacked piles). Jacked piles are recognized in the 2008 New York City Building Code. The process of push piering involves advancing steel pipe piles into the ground by jacking using a hydraulic ram. The dead weight of the home provides the reaction for pile installation. A factor of safety against total dead and live loads is achieved by using more than one push pier and jacking them into the ground independently, one-at-a-time.

When forward advancement of a push pier is halted because the maximum jacking pressure is reached or the home begins to lift, the force exerted by the ram indicates the ultimate capacity of the push pier. The final jacking pressure is typically held for 15 minutes to ensure that the pile is not moving. In this way, each push pier is proof tested during installation. Allowable or design capacity is determined by dividing the ultimate capacity from the proof test by a factor of safety. The American Society of Civil Engineers Publication 20_96, "Standard Guidelines for Design and Installation of Pile Foundations", explains that a factor of safety of 1.5 is acceptable for pile foundations with an independent means of determining capacity. The 2008 New York City Building Code states that the allowable capacity of a pile installed by jacking shall be 50% of the final jacking force.

The hydraulic pressure measured at the input to the installation ram can be converted to installation force by multiplying by the surface area of the ram piston. Since this calculation does not account for friction of the piston within the ram housing, wear on the ram surface, and pressure losses through hoses and fittings, a better indication of applied force may be obtained by physically calibrating each hydraulic ram. Push pier installation contractors should be able to provide a calibration certificate for their hydraulic rams. Calibration should be performed at least annually.

Push piers are bracketed to existing foundations using plate or angle brackets. The capacity of a plate or angle bracket is as much a function of the strength of the existing concrete as it is a function of the pier and bracket itself. Application of lateral load and overturning moment to an existing structure through the process of underpinning is an unavoidable consequence of any underpinning system. Installation contractors must evaluate the condition of an existing structure in the field to estimate the maximum installation pressure that can be applied safely to an existing structure without causing distress. Installation of push piers provides a field verification that the bracket and its connection to the structure can resist the ultimate load applied to the pier. Application of a factor of safety as described previously safeguards against failure of the bracket and connection to the structure.

Push piers can be used to lift and re-level A zone structures. When properly designed, hydraulic ram pressure during lifting should be approximately 1/3 to 1/2 the maximum installation proof test pressure. If the lift pressure exceeds this value, it may be appropriate to add piers in those areas to ensure proper factors of safety.

Section 4.7. Pile Foundation Engineering

Residential foundations subject to flooding and potential wave action such as those in V Zones and Coastal A Zones should be supported on piling in order to resist the effects of scour and flood forces. Houses on loose sand, soft marine clays, or other poor soils also should be supported on piling to avoid settlement regardless of flood zoning. This section provides an overview of load calculations, pile layout, and pile sizing.

4.7.1. Load Calculations

The tributary area method is commonly used for proportioning loads on piling for residential structures. In the tributary area method, live and dead loads are proportioned along perimeter and interior foundation walls based on floor and roof truss spans. The outcome of this proportioning is an effective distributed load per unit length of foundation, w. To be rigorous, ASCE 7 allowable stress load combinations should be used to combine gravity, wind, snow, and flood loading. Example foundation loads for a few different styles of Mid-Atlantic homes are shown in the table below.

Image	Description	Typical Foundation Loads, w
	One-story wood frame home, wood siding, composite roof, 18"x24" concrete grade beam	700 plf - 1,800 plf
	Two-story wood frame home, stucco siding, composite roof, 18"x24" concrete grade beam	900 plf - 2,300 plf
	Three-story wood frame home, vinyl siding, 18"x 24" concrete grade beam	1,100 plf - 2,700 plf
	Three-story wood frame home, stone veneer, 18"x24" concrete grade beam	1,700 plf - 3,300 plf

4.7.2. Pile Layout

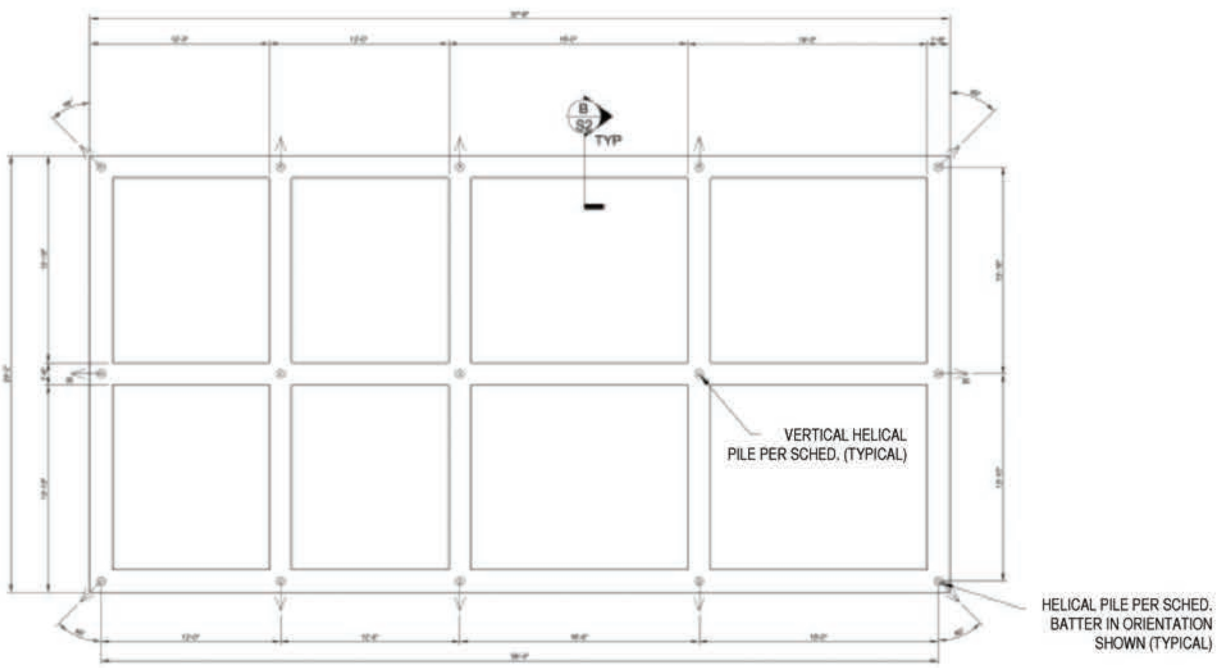
The first step in preparing a pile layout plan is to select a pile working capacity, p, based on experience and then compute a maximum pile spacing, s_{max}, from the following formula.

$$s_{max} = p/w$$

Hint: A common helical pile working capacity for residential construction is 15 tons (30 kips) per pile. A single-story wood frame home with wood siding has a maximum pile spacing of approximately 30,000 / 1,800 plf = 16.7 ft.

Begin the pile layout by placing piles at corners and under load bearing columns. Then, arrange piles in between so that the maximum pile spacing, s_{max}, is not exceeded. The most effective foundation is one that attempts to balance the dead load amongst all the piles. This technique typically results in the least differential movement. One way to accomplish this is to try to space the piles somewhat evenly around the perimeter and interior of the home. If you finish your preliminary pile layout and the spacing between piles is very different from s_{max} for most piles, then one can revise the pile working capacity, p, and try another iteration if desired.

Once the layout and load balancing are complete, the engineer or architect drafts a pile layout plan and indicates the final required capacity, p, of the piles. Rather than list the exact tributary load on every pile, it is often simpler to group the piles into only one or two pile types based on required capacity. An example pile layout plan is given below.



4.7.3. Pile Sizing

After the layout and pile loads are determined, it is now time to size the helical piles for these loads. One way is to simply note that the contractor's engineer shall size the piles for the loads shown on the plans and require the contractor to supply engineered stamped shop drawings and calculations. This is known as a performance specification and is probably the most common method of specification regarding specialty types of foundations.

Some design professionals prefer to be more prescriptive. Different helical pile manufacturing companies have various software, spreadsheets, and other tools for sizing helical piles. The sizing method described here is from Magnum Piering, Inc.'s product catalog. Several charts are contained at the front of the helical pile section of this catalog. These charts can be used to prescribe a specific pile size, number and shape of helical bearing elements, and a product number. These charts were derived from conventional geotechnical engineering principles and have been used successfully by engineer's specifying Magnum products for nearly 20-years. The following provides a step-by-step process for pile sizing using Magnum's 2012 Product Catalog (2012MPC).

STEP 1: Select a helical pile from the table on 2012MPC page 9 with a rated allowable "geotechnical capacity" equal to or greater than the required capacity.

STEP 2: Look-up the capacity/torque ratio, K, for the selected helical pile shaft size on the same table.

Hint: The MH325BRG is a good example of a helical pile shaft size that works for most residential construction.

Hint: Helical piles have different capacity/torque ratios depending on size. The MH325BRG has a recommended capacity/torque ratio of 8 ft^{-1}.

	System Ratings & Capacity Specifications													
	Shaft Wall Gauge (in)	Shaft O.D. (in)	Approx Weight (plf)	End Bearing Capacity		Maximum Torque (ft-lbs)	Capacity to Torque Ratio (ft^{-1})	Capacity by Torque (Tension & Comp)		Helix Sizes (*available in standard & dual cutting edge*) (in)	Helix Gauge (in)	Bolted (B) or Welded (W) Connection	Hot Dip Galvanized ASTM A153	Standard Section Lengths (*custom sizes available*) (ft)
				Ultimate (tons) Bare / Galv	Allowable (tons) Bare / Galv			Ultimate (tons)	Allowable (tons)					
MHL313	0.13	3.00	3.8	26 / 35	13 / 17	4,000	8.0	16	8	8,10,12,14	0.375	B (1)	standard	6, 12, 24
MHL313R	0.13	3.00	3.8	26 / 35	13 / 17	6,000	8.0	24	12	8,10,12,14	0.375	B (1)	standard	6, 12, 24
MHL325	0.25	3.00	7.3	60 / 68	30 / 34	8,700	8.0	35	17	8,10,12,14	0.375	B (1)	standard	6, 12, 24
MHL325R	0.25	3.00	7.3	60 / 68	30 / 34	12,700	8.0	51	25	8,10,12,14	0.375	B (1)	standard	6, 12, 24
MHL425	0.25	4.50	11.6	93 / 105	47 / 53	24,000	5.7	68	34	10,12,14,16	0.625	B (2)	optional	7, 10, 24
MHL425R	0.25	4.50	11.6	93 / 105	47 / 53	28,000	5.7	80	40	10,12,14,16	0.625	B (2)	optional	7, 10, 24
MHL431	0.31	4.50	14.3	118 / 131	59 / 65	29,000	5.7	83	41	10,12,14,16	0.625	B (2)	optional	7, 10, 24
MHL431R	0.31	4.50	14.3	118 / 131	59 / 65	34,000	5.7	97	48	10,12,14,16	0.625	B (2)	optional	7, 10, 24
MHL625	0.25	5.72	15.0	120 / 136	60 / 68	40,000	4.6	92	46	12,16,20,24	0.875	W or B (3)	optional	6, 9, 18, 24
MHL625R	0.25	5.72	15.0	120 / 136	60 / 68	45,000	4.6	104	52	12,16,20,24	0.875	W or B (3)	optional	6, 9, 18, 24
MHL637	0.37	5.72	21.2	180 / 196	90 / 98	58,000	4.6	133	67	12,16,20,24	0.875	W or B (3)	optional	6, 9, 18, 24
MHL637R	0.37	5.72	21.2	180 / 196	90 / 98	65,000	4.6	150	75	12,16,20,24	0.875	W or B (3)	optional	6, 9, 18, 24
MHL646	0.46	5.72	27.2	238 / 253	119 / 127	74,000	4.6	170	85	12,16,20,24	0.875	W or B (3)	optional	6, 9, 18, 24
MHL646R	0.46	5.72	27.2	238 / 253	119 / 127	83,000	4.6	191	95	12,16,20,24	0.875	W or B (3)	optional	6, 9, 18, 24

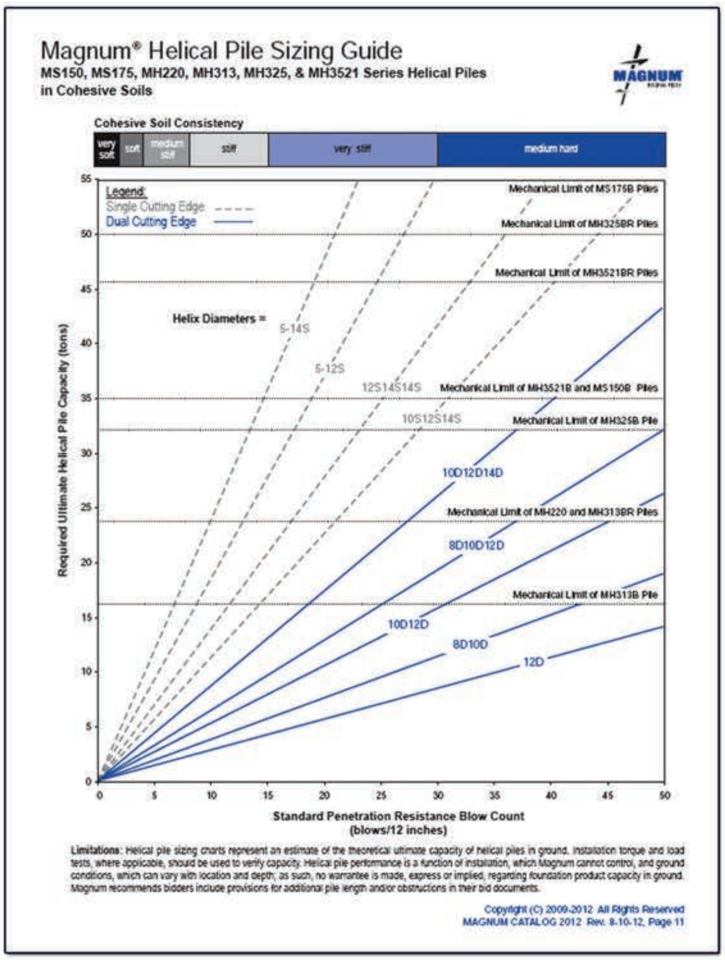
STEP 3: Determine the minimum required final pile driving resistance (final installation torque) using the following simple equation,

T = p x FS / K

> **Hint: The required final torque of a MH325BRG helical pile for 30 kips holding capacity with factor of safety of 2.0 is 7,500 ft-lbs.**

where T is final installation torque, p is required pile working capacity, FS is the factor of safety, and K is the capacity/torque ratio. A FS = 2.0 is suggested when good subsurface information is available and 2.5 when subsurface information is poor or missing.

STEP 4: Determine the size and number of helical bearing plates required to achieve torque and capacity in the planned bearing stratum. Depending on weather a cohesive soil (silt and clay) or non-cohesive soil (sand and gravel) is anticipated at the bearing depth, refer to 2012MPC page 11 or page 12, respectively. These charts show ultimate capacity on the y-axis standard penetration test (SPT) blow count on the x-axis. If SPT's are unavailable, then the general density or consistency classification is shown on the top of the chart. To use these charts, simply determine the required ultimate capacity of the pile (i.e. p x FS) and trace a horizontal line from this point on the y-axis. Next identify the most likely range of SPT N-values or general soil density/consistency and trace a vertical line from this point on the x-axis. The helical pile label nearest the intersection of the horizontal and vertical lines is the recommended helix arrangement.



> **Hint: A common configuration for medium to dense beach sands along the Jersey shore is 10D12S14S, which stands for 10" diameter dual-edge helix plus 12" and 14" diameter single cutting edge helices.**

STEP 5: Estimate the bid length of the helical piles. This estimate can be obtained from the geotechnical engineer, from a review of soil borings, assumed based on anecdotal evidence from nearby projects, or based on the engineer's/architect's experience in the area.

STEP 6: Determine the protective coating. Bare steel (NG) is availablefor non-corrosive to moderate/high corrosive soils. Galvanizing (G) is available for severely corrosive soils.

Hint: Most designers in coastal areas select G to be conservative.

STEP 7: Select a cap for connection of the helical pile to the structure. A number of different manufactured caps, their capacities, and their configurations are contained in the 2012MPC Section 3, pages 49 to 113.

Hint: The most common cap used for coastal construction and cast into a concrete grade beam is the MHC1300-3K66BR1G.

STEP 8: Combine the shaft size, working capacity (P), capacity/torque ratio (K), minimum installation torque (T), number and size bearing plates, bid length, and connection cap on a pile schedule similar to the one shown below. This schedule should be printed on the same plan sheet at the pile layout plan.

EXAMPLE HELICAL PILE SCHEDULE

Desig.	Qty.	Type	Helices	Cap	Working Capacity	Capacity /Torque Ratio	Min. Final Torque	Coating	Bid Length
A	12	MH325BR	10D12S14S	MHC1300-3K66BR1	20 tons	8.0 ft^{-1}	10,000 ft-lbs	G	18 ft
B	14	MH325BR	10D12S14S14S	MHC1300-3K66BR1	25 tons	8.0 ft^{-1}	12,500 ft-lbs	G	18 ft

Section 4.8 Grade Beam Design

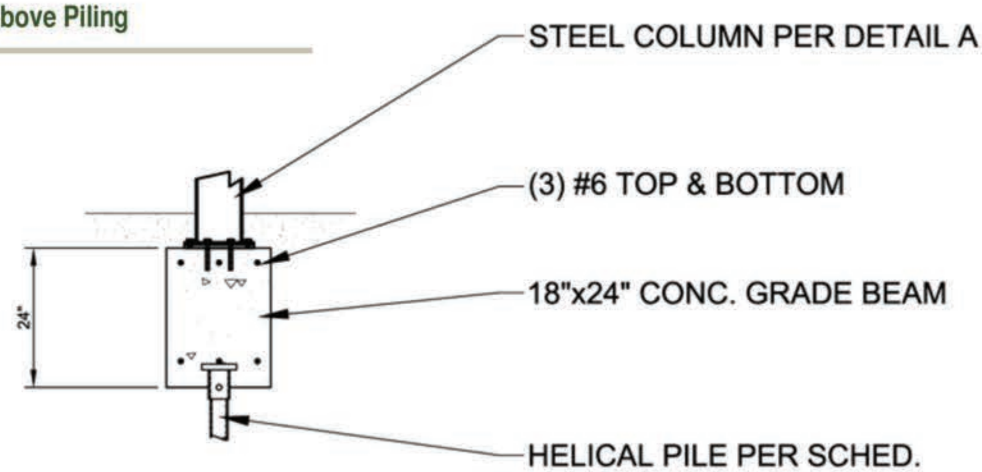
Chapter 18 of the New Jersey and New York building codes specify that the tops of pile foundations shall be laterally braced. Furthermore, much of the Jersey shore and Long Island, NY are located in Seismic Design Category C. New Jersey and New York building codes require a tie-beam for pier and pile stability for structures in Seismic Design Category C. Construction of a grade beam is necessary to satisfy Seismic Design Category C criteria and the criteria for pile stability and bracing in IBC-NJ/NYBC Chapter 18.

Grade beams should be designed to span between piling elements and support the vertical and lateral loads of the home's framing system above. Grade beams also need to be designed for flood forces and scour per Section 4.9. Grade beam design should be performed by a registered design professional familiar with reinforced concrete design per ACI318 and the CRC Handbook. The amount of reinforcing steel and size and shape of the grade beam depends on the span between piles, the weight of the home, and lateral loads.

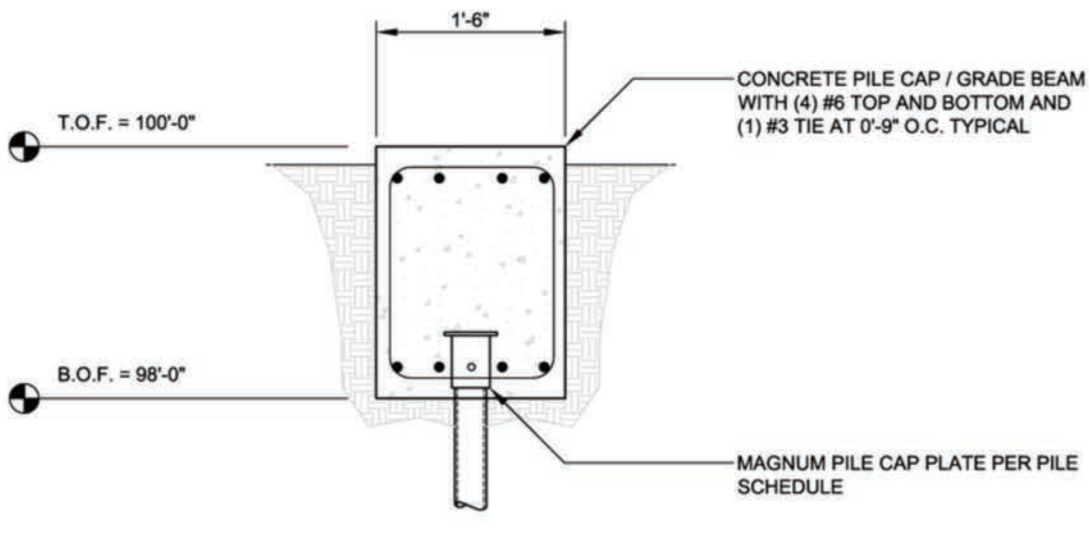
Hint: An example reinforced concrete grade beam for 16 ft span between piles in V zone with piles located directly under load bearing columns is 18"x24" in dimension with 3#6s top & bottom.

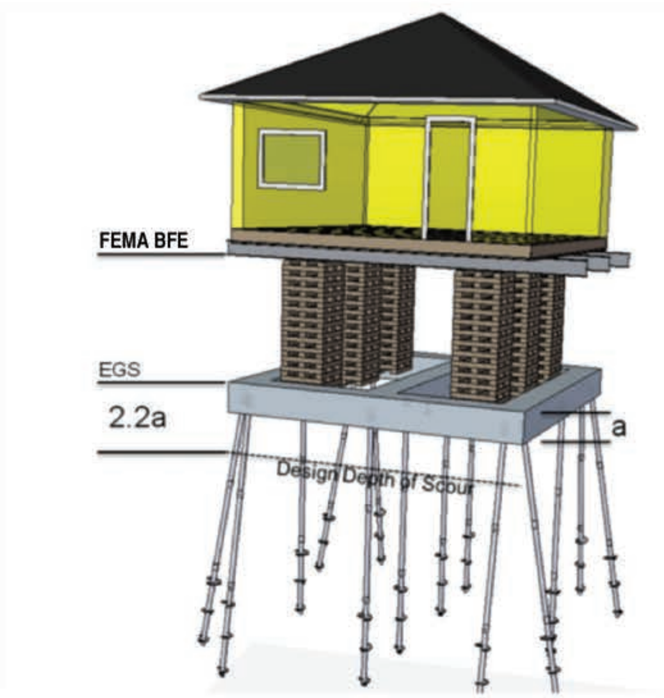
The amount of shear and flexure in grade beams depends on whether the building columns are located directly over pile locations. Typically more horizontal reinforcing steel and stir-ups are required when house columns are not located directly over piles.

Example Grade Beam Detail
Building Columns Located Directly Above Piling



Example Grade Beam Detail
Building Columns Not Directly Above Piling





Note: Per FEMA P55 pg. G10, "Grade beams installed to support vertical foundation members where they enter the ground are not considered lowest horizontal structural members." Therefore, grade beams do not have to be above flood elevation and can be perpendicular to flood waters.

Hint: For a 2-foot tall grade beam, the design depth of scour for the base flood event is 4.4 feet.

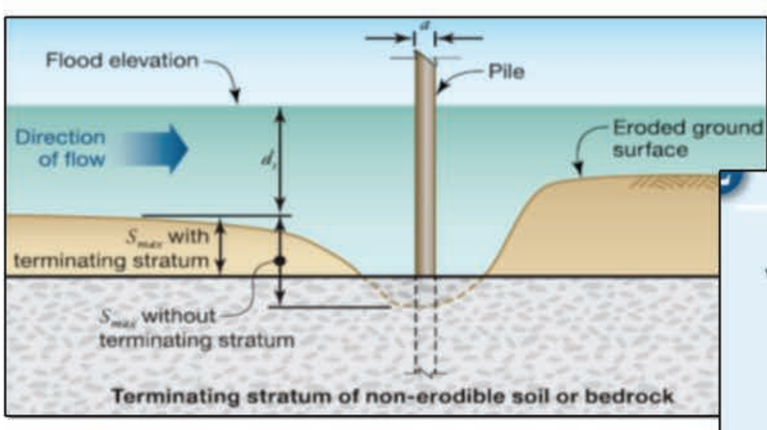
Section 4.9. Flood Hazard Effects

According to FEMA Building Science Helpline, below-ground grade beams are allowed in Zone V and Coastal A Zone flood plains under the following conditions:

1.Grade beams are designed to be self-supporting between vertical foundation members such as helical piles.

2.Grade beams do not support any other load carrying elements such as floor slabs so these grade beams cannot be considered the lowest horizontal structural member supporting the lowest floor.

3.Grade beam design considers lateral loading from flooding, both hydrodynamic forces and flood-borne debris impacts. Foundation design in V-zones should take into account wave action and scour. According to FEMA P55, the design depth of scour shall be 2.2 times the pile shaft diameter or 2.2 times the grade beam height, whichever is greater.



EQUATION 4-18: LOCALIZED SCOUR AROUND VERTICAL PILE

$$S_{max} = 2.2a \quad \text{(Eq. 4-18)}$$

where:

S_{max} = maximum potential depth of scour hole (ft)

a = diameter of a round foundation element, or the maximum diagonal cross section dimension for a rectangular element (ft)

NOTE

Equation 4-18 can also be used to approximate local scour beneath grade beams – set "a" equal to the depth (vertical thickness) of the grade beam.

In order to design for scour, helical piles need to be checked for buckling per the AISC360 steel code using the applied loading, FEMA scour depth, and the section properties and material strengths of the helical pile. Per 2009IBC-NJE, Section 1810.2.1, any deep foundation elements standing in air, water, or fluid soils (after scour) shall be designed as a column with a depth of fixity of 5 feet in firm soil or 10 feet in soft soil. New York building codes have similar provisions.

Hint: For 4.4 feet of scour and a 2 ft grade beam in firm soil, the unbraced length of the pile is (4.4 ft - 2 ft) + 5 ft = 7.4 ft. A Magnum MH325BRG helical pile with head fixed in a grade beam (i.e. k=0.67) has an allowable buckling strength of 28 tons. This value is higher than the maximum geotechnical capacity so buckling due to scour does not govern the design in this case.

Section 4.10. Lateral Load Resistance

Foundations in the Mid-Atlantic area must be designed for lateral loads due to hurricane wind forces. This section briefly reviews wind analysis on structures and provides a simple method for estimating the lateral wind loads on foundations. Lateral resistance of vertical and battered piles are summarized.

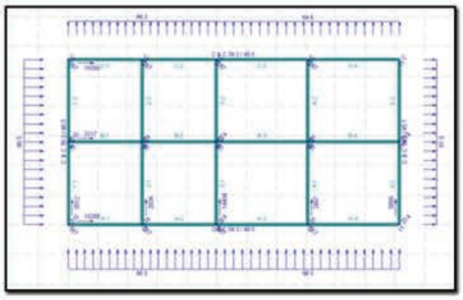
Before Storm Erosion

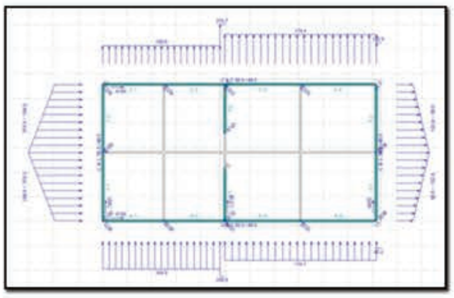
After Storm Erosion

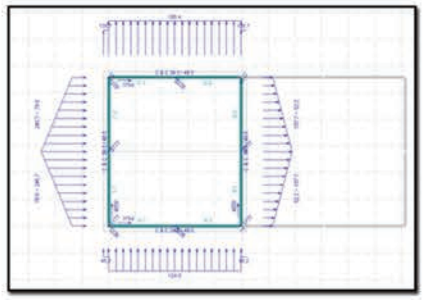
4.10.1. Wind Shear Analysis

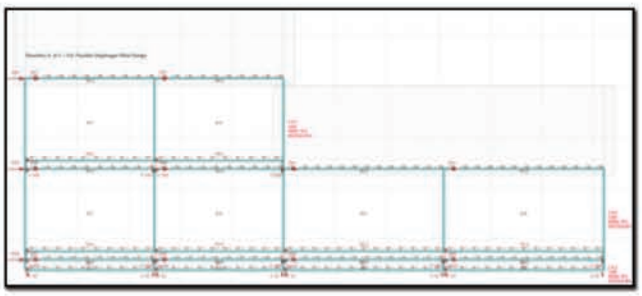
Most residential structures are designed according to the IRC. The IRC provides prescriptive specifications which include minimum shear wall sizes, shear wall construction requirements, and minimum hold down requirements. The IRC does not provide prescriptive methods for estimating the distribution of lateral loads on a foundation due to hurricane wind pressure on homes. The transfer of wind loads to the foundation and elevation system are determined following methods in ASCE7.

The Canadian Wood Council offers a software package called Woodworks that assists the designer in ASCE7 wind analysis. If a model is built including the foundation, the software provides shear on each foundation element and required hold down forces. Examples of output from Woodworks are shown here. The top figure shows a layout of a Moment Frame used to support the elevated home. The second image shows shear walls within the 1st floor of the home. The third image shows shear walls on the second floor. The forth image is an elevation view of the home showing shear between floor elevations and required hold downs.









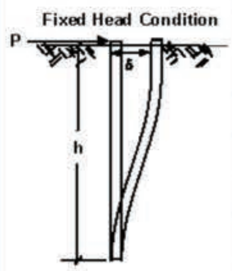
The ASCE7 method of analysis is very detailed. All of this detail is not necessary for design of the foundation. If the moment frame is utilized for support of the home, a simple method can be used to obtain the lateral loads on the frame and piling system with reasonable results. When properly attached to the floor joists, the steel frame and floor system form a rigid diaphragm that helps to distribute lateral loads equally to the support columns and then uniformly to the underlying grade beam and foundation piling.

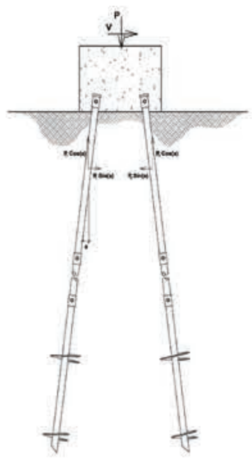
An estimate of the total lateral force on the foundation can be obtained by determining the projected area of each side of the home and multiplying by the wind pressure. Each row of columns with a set of battered piles can resist a portion of this wind loading. To determine the number of column rows required, divide the total wind load by the resistance afforded by each row.

Hint: A simple method for estimating the total wind load on a foundation can be obtained by calculating the projected area of the home and multiplying by the wind pressure. A reasonable estimate of wind pressure in hurricane prone areas per ASCE7-05 is 20 psf.

4.10.2. Lateral Resistance of Piling

Square-shaft helical piles do not have lateral resistance and should not be used in coastal construction unless they are cased and/or grouted. Round-shaft helical piles have lateral capacity and are appropriate for new foundation construction in scour prone coastal areas. Tables contained in the helical pile section of Magnum Piering Inc.'s product catalog provide an estimate of the allowable lateral capacity of various Magnum round-shaft helical piles in different soil conditions. The lateral capacity of a pile is defined in the IBC as half the load required to cause 1-inch of lateral deflection.

Head Fixity	Helical Pile	Shaft Diam., d	Non-Cohesive Soils				Cohesive Soils			
			V.Loose	Loose	Medium	Dense	V. Soft	Soft	Medium	Stiff
	MH220	2.88	1,300	1,800	2,000	2,400	800	1,800	2,300	3,100
	MH313	3.00	1,100	1,800	2,100	2,400	800	1,600	2,400	3,200
	MH325	3.00	1,500	2,500	3,400	4,000	900	2,000	3,500	4,900
	MH3521	3.50	1,700	3,000	4,100	4,800	1,100	2,300	4,000	5,800
	MH425	4.50	2,700	4,800	6,600	7,500	1,600	3,300	5,800	8,500
	MH431	4.50	2,900	5,200	7,100	8,500	1,700	3,500	6,200	9,900
	MH530	5.50	3,800	7,000	9,600	13,000	2,100	4,400	8,000	13,500
	MH536	5.50	4,100	7,500	10,400	14,000	2,200	4,700	8,400	14,000
	MH625	5.72	3,800	7,000	9,500	11,000	2,200	4,400	7,400	12,400
	MH637	5.72	4,400	8,000	11,000	14,300	2,400	4,900	8,800	14,800
	MH646	5.72	4,700	8,900	12,000	16,200	2,400	5,200	9,400	16,000
	Minimum Pile Depth, h =		40d	40d	40d	40d	40d	40d	40d	40d



When scour, unbraced length, flood water, and wind loading concerns are taken into account, often the lateral capacity of a vertical helical pile is insufficient. Fortunately, helical piles can be battered in order to provide more stability and wind shear resistance. Battered piles for bi-directional wind loads should always be laid out in pairs.

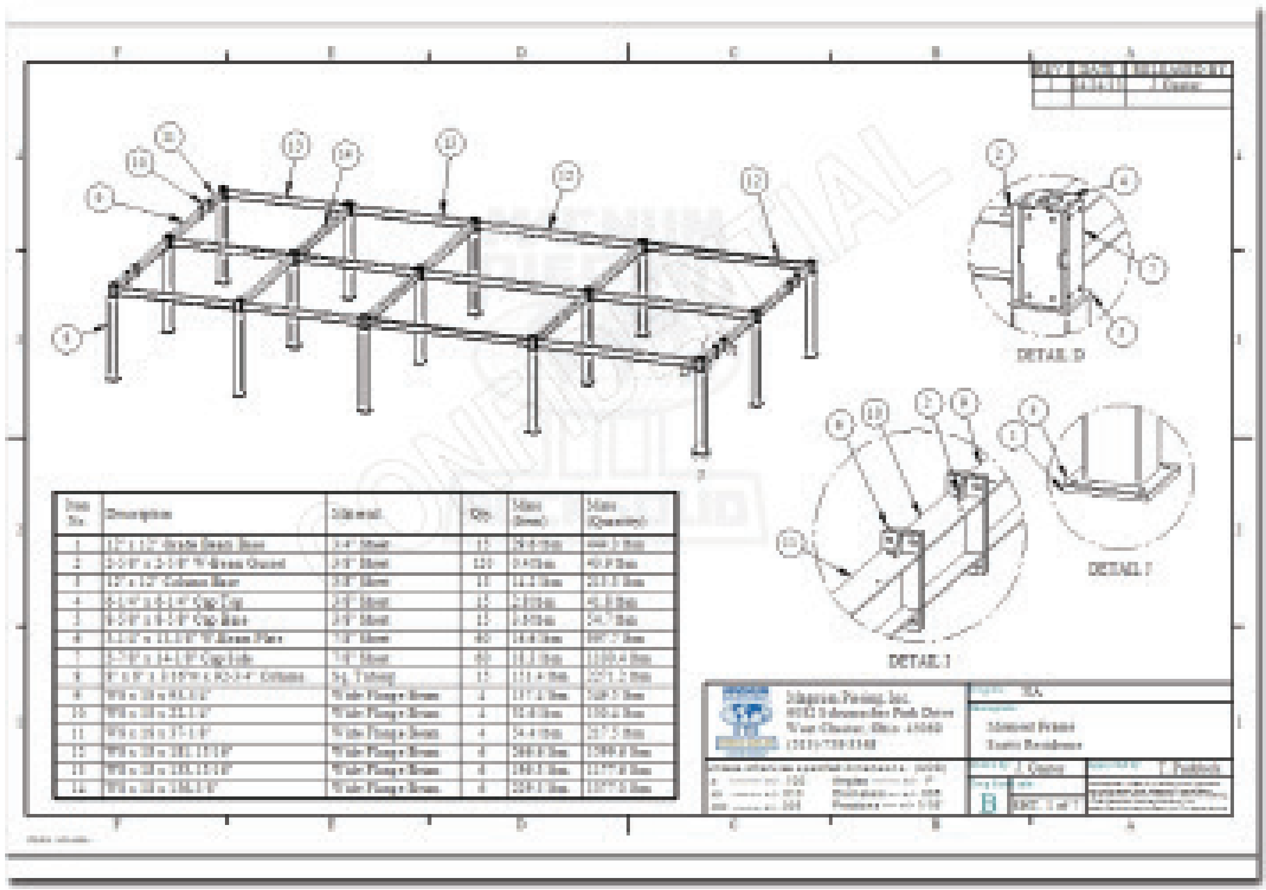
Battering a pair of helical piles to resist wind and flood loading will change the axial load on the piles. The pile located on the windward side of the home will carry less compressive load and possibly even go into tension. Whereas, the leeward pile will carry more compressive load. The maximum compressive load that the piles need to be designed for as a result of combined vertical and lateral loads for a battered pile pair may be computed from the following formula (Perko, 2009),

$$p' = 1/2\ [(P/\text{Cos}\ \alpha) + (V/\text{Sin}\ \alpha)]$$

where p' is the new working load to be resisted by each pile, P is the total axial load on the pile group, Q is the total lateral load on the pile group, and α is the batter angle from vertical.

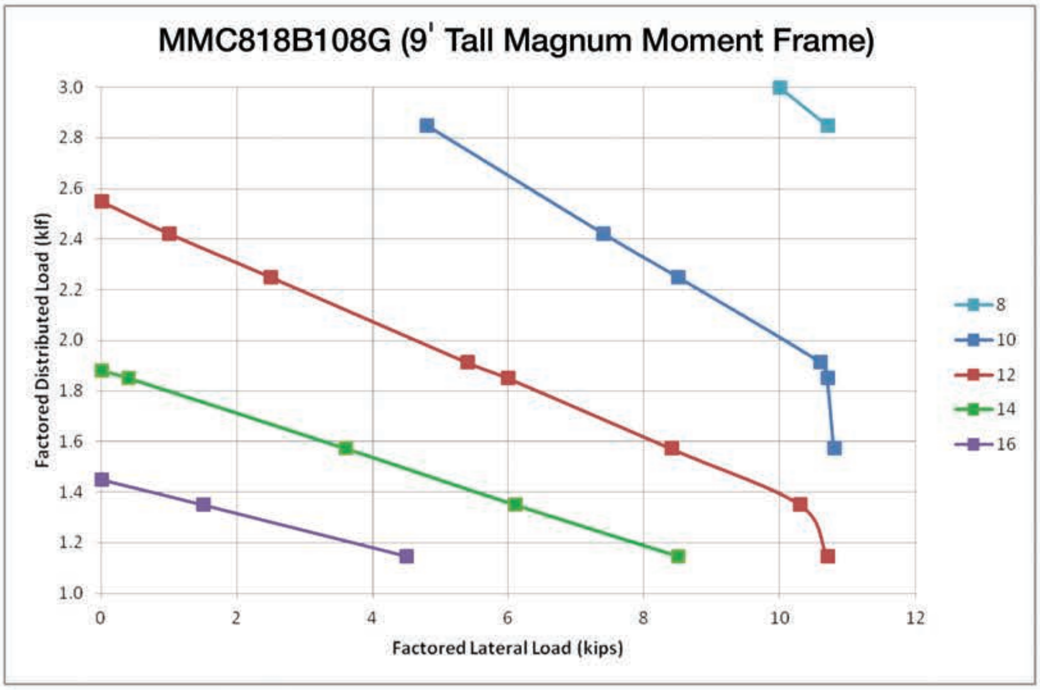
Section 4.11. Moment Frame Design

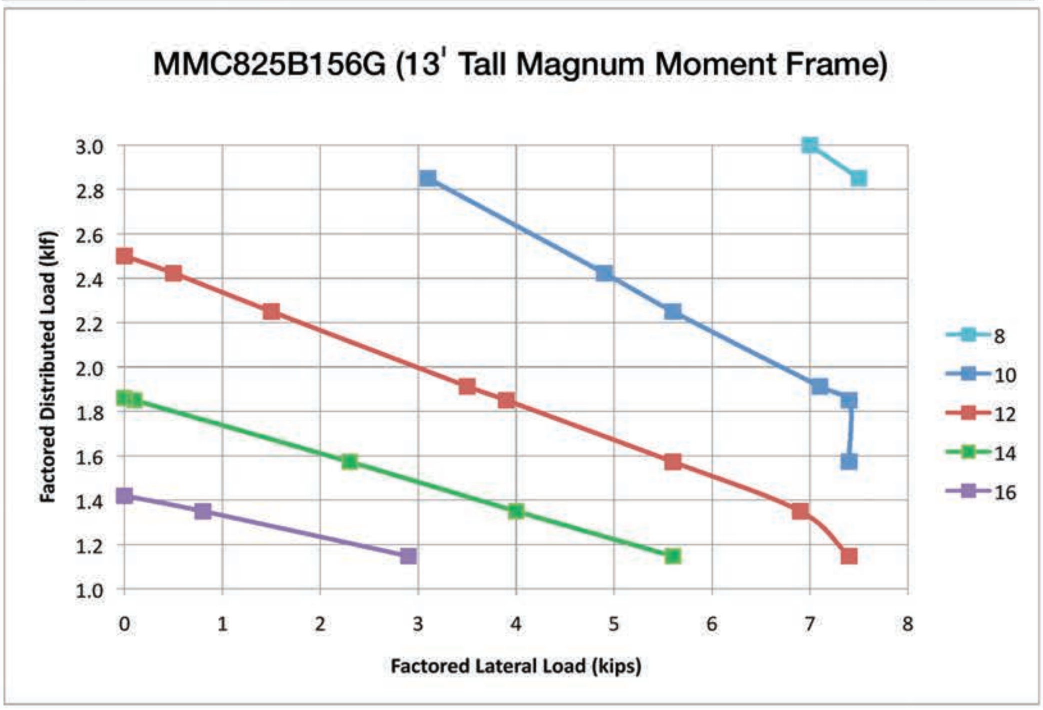
An economical and efficient method for support of elevated homes on grade beam and pile foundations in V-zones and Coastal A-zones is a steel moment frame. Magnum Moment Frames™ are pre-engineered in that the capacity of all columns, beams, and connections have been sized for various combinations of lateral loading and weight bearing capacity. Maximum span and lateral capacity of these frames are contained in the next section.



4.11.1. Allowable Distributed and Wind Loads

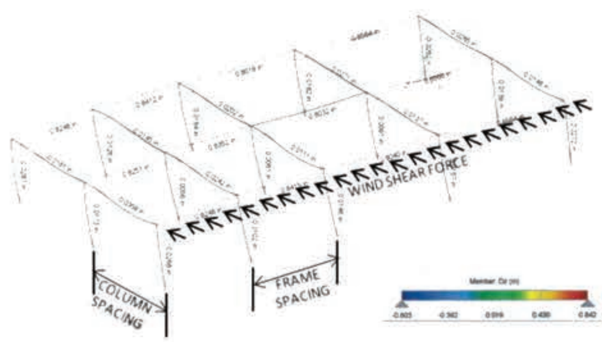
Moment frames are sized and spaced for live and dead loads distributed along the beams and also lateral wind load to be resisted by the frames. Frames with higher distributed load resist lower lateral loads. The relationship between maximum factored allowable distributed load and maximum allowable factored wind load for Magnum Moment Frames™ are given in the charts. For example, the 9' tall moment frame with 12' column spacing can resist a factored wind load of 8 kips and a factored distributed load of 1.6 klf. These charts were derived by applying various combinations of load to a model of the moment frame and checking allowable flexural strength of the beams and combined flexure and buckling of the columns. The charts can be used to size moment frames for support of homes. Frames need to be checked for wind loads in both directions.



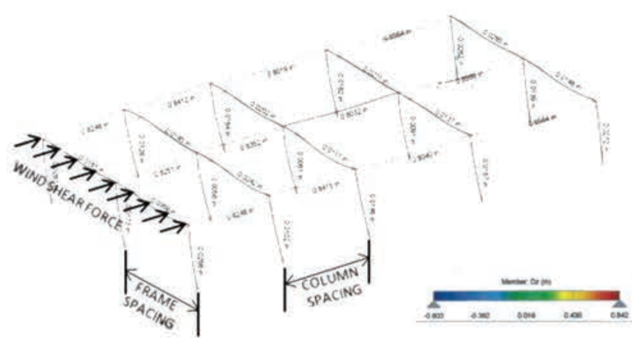


A number of example home sizes have been worked out for reference. These examples are contained in the tables. The examples are for 1-story, 2-story, 3-story, and 3.5-story homes. Exposure height used in these examples are given in the second column of the tables. Typical total distributed loads and wind loads are given in the next two columns. Per the allowable stress load combinations contained in ASCE7, the load case combining dead (D), live (L), and wind (W) loads on structures is given by D+0.75L+0.75W. Factored distributed loads for this combination (D+0.75L) are given in the 5th column and factored wind loads (0.75W) are given in the 6th column. The remaining columns contain maximum frame spacing for different column spacings.

Primary Wind Direction



Secondary Wind Direction



MMC818B108G (9' Tall) MAGNUM Moment Frame™ Column and Frame Spacing Guide

Load Case	Exposure Height, H	Typcal Total Loads: Distributed Load w/ Grade Beam	Typcal Total Loads: Lateral Load[1] [W] (klf)	Factored Loads: Distributed Load[2] [D+0.75L] (klf)	Factored Loads: Lateral Load [0.75W] (klf)	Column Spacing (ft): 10	12	14	16
						Maximum Frame Spacing (ft)			
1-story	12	1.8	0.24	1.15	0.18	16	16	16	16
2-story	20	2.3	0.40	1.57	0.30	14	14	12	n/a
3-story	28	2.7	0.56	1.91	0.42	12	12	n/a	n/a
3.5-story	32	3.3	0.64	2.42	0.48	10	n/a	n/a	n/a

[1]wind pressure times expore height [20psf x H]

[2]factored weight of home without grade beam

MMC825B108G (13' Tall) MAGNUM Moment Frame™ Column and Frame Spacing Guide

Load Case	Exposure Height, H	Typcal Total Loads: Distributed Load w/ Grade Beam	Typcal Total Loads: Lateral Load[1] [W] (klf)	Factored Loads: Distributed Load[2] [D+0.75L] (klf)	Factored Loads: Lateral Load [0.75W] (klf)	Column Spacing (ft): 10	12	14	16
						Maximum Frame Spacing (ft)			
1-story	12	1.8	0.24	1.15	0.18	16	16	16	16
2-story	20	2.3	0.40	1.57	0.30	12	12	n/a	n/a
3-story	28	2.7	0.56	1.91	0.42	10	8	n/a	n/a
3.5-story	32	3.3	0.64	2.42	0.48	10	n/a	n/a	n/a

[1]wind pressure times expore height [20psf x H]

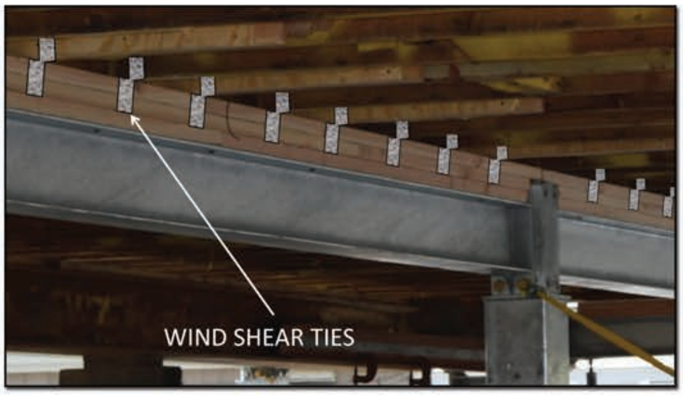
[2]factored weight of home without grade beam

The tables show that a 9' tall moment frame with column and frame spacing of 16 feet can be used for the example 1-story home with 12' exposure height. The 2-story example home can be supported with a 9' moment frame with frame spacing of 12 feet and a column spacing of 14 feet.

4.11.2. Connection to Structure

The connection between the moment frame and the home has to resist both shear and uplift forces caused by wind. The top flanges of Magnum Moment Frames™ are dropped 3" lower than the top of columns and pre-drilled with holes at 12" O.C. staggered. A double sill plate should be installed on the top of the frame beams between columns. Existing sill plates still attached to the home can be reused if they are in good conditions. Half-inch diameter lag bolts should be installed to secure the sill plates to the home. Lag bolts should extend to the top of the uppermost sill plate. After the home is lowered down onto the moment frame, the sheathing should be attached to the sill plate with 8d nails at 6" O.C. Interior sill plates should be attached to each intersection floor joist using a wind shear clips. When interior moment frame beams fall between joists, blocking should be installed between joists to provide a means of connection.

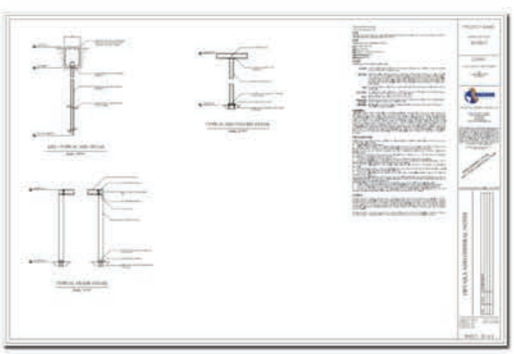
Most homes have some uplift at the ends of shear walls. At a minimum, one Magnum Hurricane Strap should be used at each corner of the home to hold-down the home to the corner columns. More information on Magnum Moment Frames™ and hurricane straps are contained in Chapter 5 of this manual.

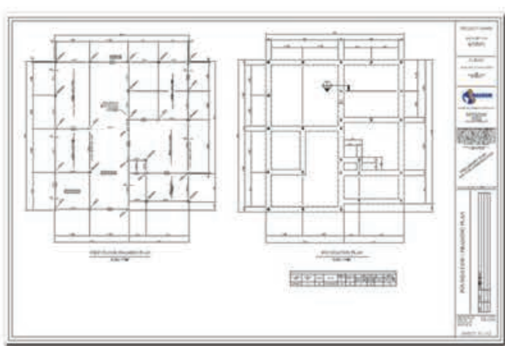


Section 4.12. Example Foundation Plans

Foundation plans should show pile locations, orientation, and inclination relative to vertical (batter angle). A pile schedule should be provided that lists the helical pile product designation, required compression, tension, and vertical capacity. The pile schedule also should list the required cap type, minimum depth, and minimum installation torque as appropriate.

Foundation plans should include the minimum cross-sectional dimensions of concrete elements such as footings, grade beams, and stem walls. Reinforcing bars and stir-ups should be depicted and labeled as well as minimum concrete coverage. Structural plans should list the Magnum Moment Frame™ product numbers and show the location of vertical columns and support beams.





Section 4.13. Inspection and Quality Assurance

The structural engineer, geotechnical engineer, and architect should inspect various aspects of construction in order to assure quality construction for the homeowner. Controlled inspection is recommended for installation of helical piles. Helical pile capacity is verified during installation by measuring the driving resistance, which is the torque required to further advance the pile. The ratio of capacity to torque depends on shaft diameter and proper shape of the helix.

Ultimate capacity to torque ratios for various Magnum helical piles is shown in the table at the front of the helical section of the 2012MPC. For example, the ultimate capacity to torque ratio of a Magnum 3" diameter shaft helical pile is 8.0 ft^{-1}. If geotechnical information is available for the site and the helical bearing plates have been sized for planned bearing stratum, then a factor of safety of 2.0 is commonly used to determine allowable capacity from ultimate capacity by torque. For example, a MH325BR helical pile installed to 10,000 ft-lbs would have a predicted ultimate capacity of 8 x 10,000 = 80,000 lbs. The working capacity of this pile would be 80,000/2.0 = 40,000 lbs or 20 tons.

The inspector should record installation depth and torque at 3-foot intervals and at the final depth. The inspector should note the diameter and number of helices and the type of shaft and coupling. A sketch should be prepared showing the pile locations. Each pile should be numbered. Pile installation logs should reference the pile number on the pile location plan. All helical plies should be approved by the Engineer prior to contractor completing work.

5. MATERIAL SELECTION

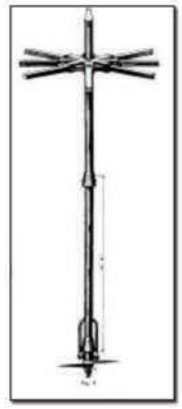
Section 5.1. Why use Magnum Helical Piles

Helical piles are defined as a central steel shaft with one or more helix shaped bearing elements that is rotated into the ground to support the loads of structures. Other names for helical piles are Helical Piers, Screw Piles, Torque Anchors, Auger Screw Piles, and Helix Piers.

Helical Piles were invented in 1836 and were primarily intended for coastal construction. Early applications included light-houses, marina piers, bridges, and other coastal structures. Their ease of installation in ground water and their resistance to scour makes them ideal for shoreline construction.

Why a Magnum Helical Pile?

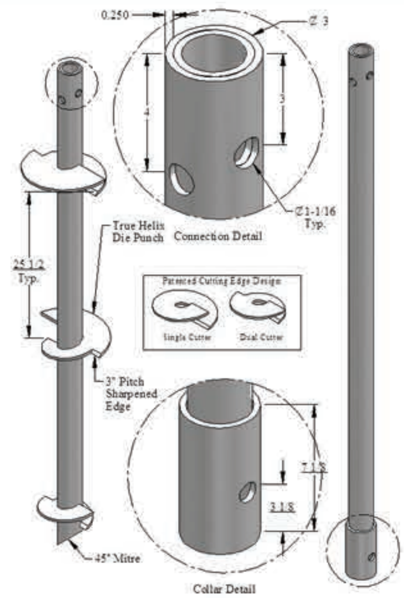
1. A Magnum helical pile can be installed in areas with a high water table
2. A Magnum helical pile can be installed under a home that has been lifted
3. A Magnum helical pile can be installed at a batter angle to resist lateral loads
4. Magnum helical piles are readily available at our distributer in central Jersey
5. Magnum helical piles and materials are MADE IN AMERICA



Helical piles are available in a variety of different sizes to accommodate residential, commercial, and industrial applications. An example of a residential application is shown in the top photo. An example of a commercial/industrial application is shown in the bottom photo.

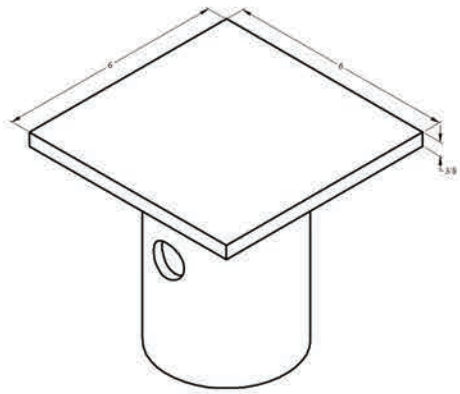
5.1.1. MAGNUM Helical Pile Spec Sheet

The following table provides information about helical pile sizes most frequently used on the Jersey Shore and coast of Long Island and are inventoried at Slabjack Foundations, LLC. More information about these piles and other helical piles offered by Magnum Piering, Inc. can be found in the 2012MPC.

Product Designation	Description	Image	Catalog Page
MH325BRG	Magnum Helical Pile with 3-inch diameter x 0.25" wall grade 65 ksi central steel shaft and dual-sleeve reinforced single 1" bolt couplings. Available galvanized with 8", 10", 12" and 14" single-cutting or dual cutting helices. [maximum working capacity = 25 tons compression/25 tons tension when installed to 12,500 ft-lbs torque]		31

5.1.2. MAGNUM Helical Pile Plate Caps

The following table provides information about helical pile cap sizes most frequently used on the Jersey Shore and coast of Long Island and are inventoried at Slabjack Foundations, LLC. More information about these caps and other helical pile caps offered by Magnum Piering, Inc. can be found in the 2012MPC.

Product Designation	Description	Image	Catalog Page
MHC1300-3K66BR1G	Magnum Plate Cap with collar for 3" shaft with 1" bolt and 6" x 6" x 3/8" top plate for embedment in concrete grade beam. [maximum working capacity = 25 tons compression/17 tons tension]		92

Section 5.2. Why Use Magnum Moment Frames

Magnum Moment Frames™ consist of a manufactured assemblage of steel columns and beams in rectilinear arrangement with rigid bolted moment connections. Resistance to lateral forces is provided by rigid frame action, which is the development of bending and shear forces in the frame members and joints. A moment frame cannot displace laterally without bending the beams and columns.

Magnum Moment Frames™ are fast to assemble beneath an elevated home, as such, they minimize labor cost and accelerate the project. Steel sections are galvanized for long lasting support. After installation, the columns and beams can be wrapped with a variety of architectural finishes including pressure treated wood, vinyl, stone, and brick.

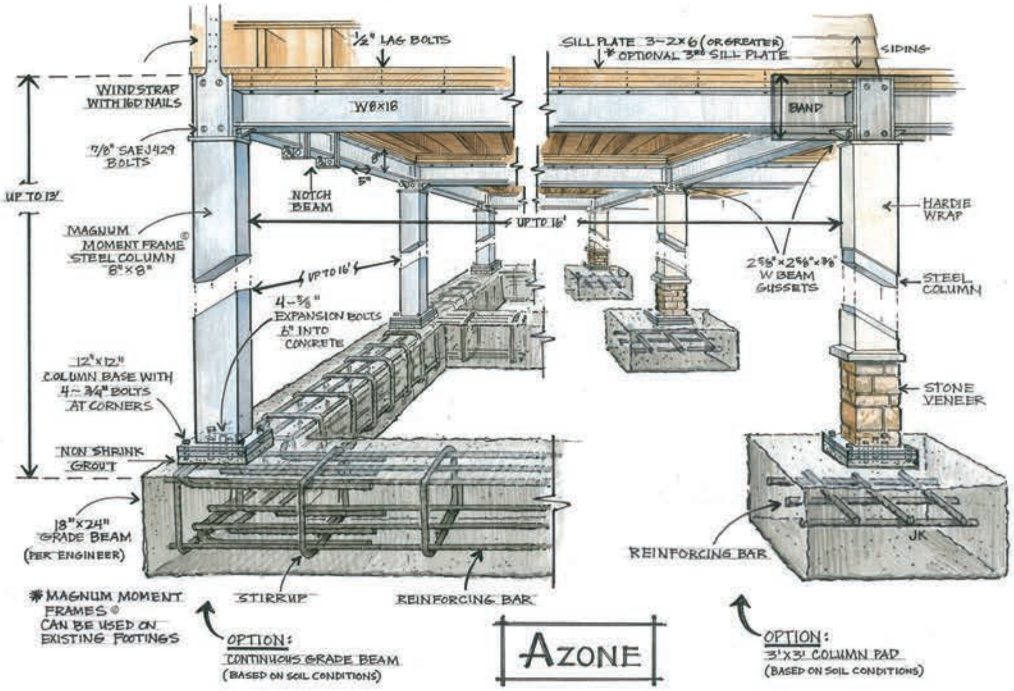
The Magnum Moment Frame™ has the advantage in that the columns can resist hurricane wind and flood forces without the need for cross bracing or diagonal ties that would interfere with flood waters and dissect the newly created space below the home. Magnum Moment Frames™ are FEMA P55 compliant, ASCE 24, and IBC compliant.

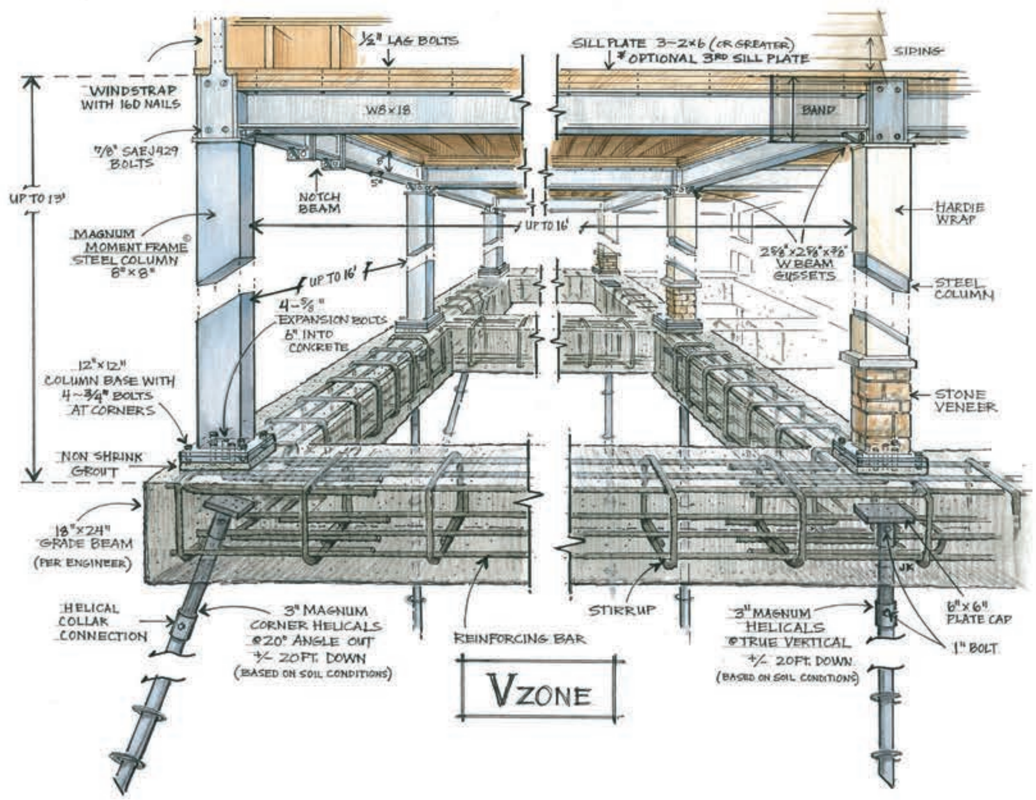
Steel moment frames have been in use for more than one hundred years, practically since structural steel starting being used in building construction. A steel moment frame was used in the first sky scraper ever built, the Home Insurance Building in Chicago, a 10 story structure with a height of 138 ft. Since then, steel moment frames have been used in buildings for generations. In the next hurricane, wouldn't you want a steel moment frame supporting your home?

The Best, Fastest, Pre-Engineered Foundation System
For A and V Zone House Lifting

Why a Magnum Moment Frame?

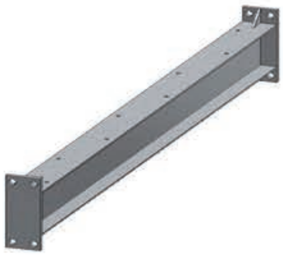
- Magnum Moment Frames™ are designed to offer the cleanest and safest look for your newly elevated home.
- Frames span longer distances than conventional wood beams *which means fewer columns and fewer piles resulting in larger garage areas and less construction cost.*
- Magnum Moment Frames™ do not require above ground bracing which trap flood debris and limit access to functional space.
- Architectural finishes are easy to attach and allow a variety of different options.
- Manufactured as per FEMA Coastal Construction Guidelines.
- ISO9001 DOC. M54-13


1/2" LAG BOLTS
SILL PLATE 3-2x6 (OR GREATER)
* OPTIONAL 3RD SILL PLATE
SIDING
WINDSTRAP WITH 16D NAILS
W8x18
BAND
7/8" SAEJ429 BOLTS
UP TO 13'
NOTCH BEAM
HARDIE WRAP
UP TO 16'
MAGNUM MOMENT FRAME© STEEL COLUMN 8"x8"
2 5/8"x2 5/8"x3/8" W BEAM GUSSETS
STEEL COLUMN
4-5/8" EXPANSION BOLTS 6" INTO CONCRETE
12"x12" COLUMN BASE WITH 4-3/4" BOLTS AT CORNERS
STONE VENEER
NON SHRINK GROUT
18"x24" GRADE BEAM (PER ENGINEER)
REINFORCING BAR
* MAGNUM MOMENT FRAMES© CAN BE USED ON EXISTING FOOTINGS
STIRRUP
OPTION: CONTINUOUS GRADE BEAM (BASED ON SOIL CONDITIONS)
AZONE
OPTION: 3'x3' COLUMN PAD (BASED ON SOIL CONDITIONS)


1/2" LAG BOLTS
SILL PLATE 3-2x6 (OR GREATER)
* OPTIONAL 3RD SILL PLATE
SIDING
WINDSTRAP WITH 16D NAILS
W8x18
BAND
7/8" SAEJ429 BOLTS
UP TO 13'
NOTCH BEAM
HARDIE WRAP
UP TO 16'
MAGNUM MOMENT FRAME© STEEL COLUMN 8"x8"
2 5/8"x2 5/8"x3/8" W BEAM GUSSETS
STEEL COLUMN
4-5/8" EXPANSION BOLTS 6" INTO CONCRETE
12"x12" COLUMN BASE WITH 4-3/4" BOLTS AT CORNERS
STONE VENEER
NON SHRINK GROUT
18"x24" GRADE BEAM (PER ENGINEER)
HELICAL COLLAR CONNECTION
3" MAGNUM CORNER HELICALS @20° ANGLE OUT +/- 20FT. DOWN (BASED ON SOIL CONDITIONS)
REINFORCING BAR
STIRRUP
3" MAGNUM HELICALS @TRUE VERTICAL +/- 20FT. DOWN (BASED ON SOIL CONDITIONS)
6"x6" PLATE CAP
1" BOLT
VZONE

5.2.1. Magnum Moment Frames

The following table provides information about Magnum Moment Frame™ sizes most frequently used on the Jersey Shore and coast of Long Island and are inventoried at Slabjack Foundations, LLC. More information about moment frames including load and span tables can be obtained by contacting Slabjack Foundations directly.

Product Designation	Description	Image	Catalog Page
MMC818B108G	8"x8"x3/16" Magnum Moment Frame column x108" tall with base plate and top bolts, galvanized.		N/A
MMC825B156G	8"x8"x1/4" Magnum Moment Frame column x156" tall with base plate and top bolts, galvanized.		N/A
MMB818BG	W8x18 Magnum Moment Frame beam with pre-drilled end plates and (8) 7/8" diam. SAE J429 bolts and washers. Standard lengths from 22" to 192". Custom lengths available.		N/A

Section 5.3. Why Use Hurricane Straps

Homes exposed to high winds can have significant uplift forces on the corners of each shear wall. For this reason, it is common to install hold down straps at the corners of homes. Magnum hurricane straps are designed to function with the Magnum Moment Frame. These straps are galvanized and are pre-drilled to accommodate 16d standard nails. Each strap can resist 6 kips of hold-down force when properly installed.

Magnum Hurricane Straps extend from the moment frame column past the rim board and up the wall corner. Nails from these straps penetrate the sheathing through to the framing. Magnum hurricane straps tie together corner studs, bottom plate, sill plate, and rim board for a secure hold down. Other manufacturer's systems attach only to the sheathing, sill plate, or rim board; this does not complete the load transfer path to the wall framing and typically is insufficient for hurricane uplift forces.

5.3.1. Magnum Hurricane Straps and Wind Shear Ties

The following table provides information about hurricane straps most frequently used on the Jersey Shore and coast of Long Island and are inventoried at Slabjack Foundations, LLC.

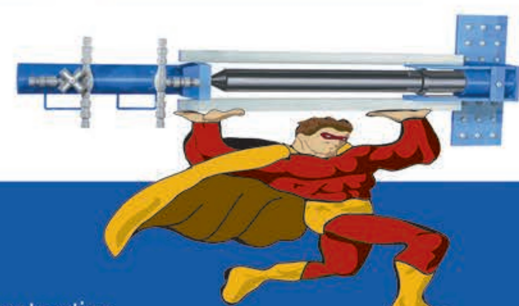
Product Designation	Description	Image	Catalog Page
MHS4-30	Hurricane strap with holes for 30 ct. 16d nails, comes with 7/8" bolts and washers.		N/A

Section 5.4. Why Use Magnum Steel Push Piers

5.4.1. Magnum Steel Push Piers

The following table provides information about steel push pier sizes most frequently used on the Jersey Shore and coast of Long Island. More information about push piers including installation ram calibrations and other equipment is contained in 2012MPC.

Product Designation	Description	Image	Catalog Page
MP313NG	Magnum 3" diameter x 0.13" wall push pier, 3' sections, internal sleeve coupling, non-galvanized [11 ton Working Capacity]		153

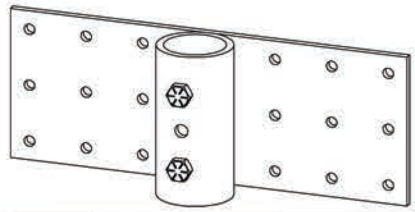
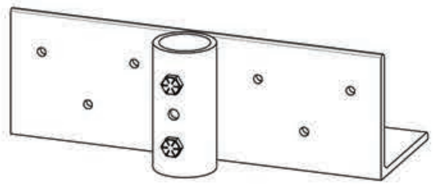


Why Magnum Push Piers?

1. Magnum push piers quickly boost strength to existing footings, construction can proceed without pouring new footings saving time and money.
2. Magnum push piers are used to realign and level existing walls.
3. Magnum push piers are used in many projects rather than conventional crib and beam systems.
4. Magnum push piers are all AMERCIAN MADE.

5.4.2. Magnum Foundation Brackets

The following table provides information about Magnum foundation brackets most frequently used on the Jersey Shore and coast of Long Island. More information about these and other foundation brackets is contained in 2012MPC.

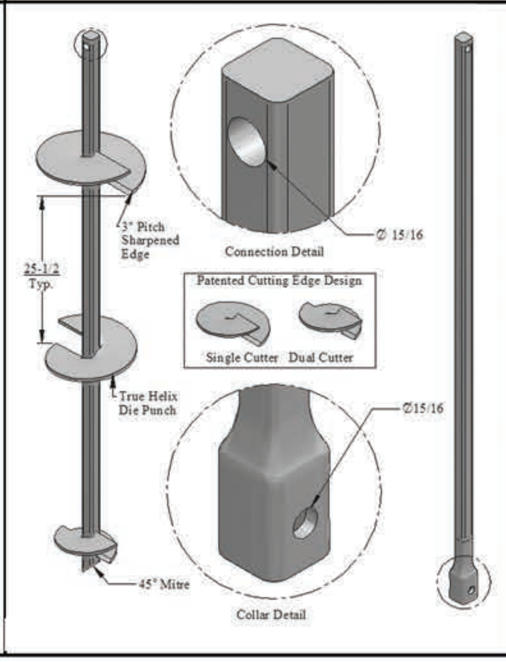
Product Designation	Description	Image	Catalog Page
MP1001-3P	Magnum 21"x8"x3/8" Plate Bracket with Collar tube for 3" helical pile or push pier shaft. Comes with 2 ct. 3/4" bolts, painted. [Max. Working Capacity with MP313 pier = 14 tons]		130
MP1002-3P	Magnum 24"x8"x8"x1/2" Angle Bracket with Collar tube for 3" helical pile or push pier shaft. Comes with 2 ct. 3/4" bolts, painted. [Max. Working Capacity with MP313 pier = 14 tons.]		133

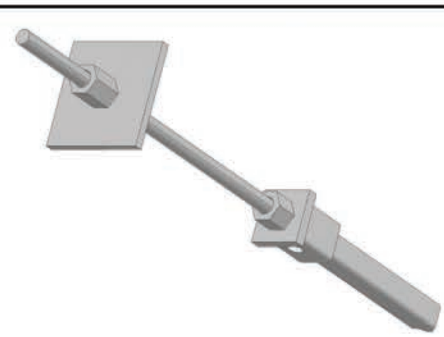
Section 5.5. Why Use Magnum Marine Construction Products

Magnum MS150B Helical Piles have 35 tons ultimate capacity and 17.5 tons working capacity in tension and compression (fully-braced conditions only). Square shaft helical piles are ideally suited for anchoring/tension applications. Lead sections and extensions couple together to extend helical bearing plates to the desired bearing stratum. Structural capacity calculations are based on average life expectancy of over 75 years for most soil conditions. Patented Magnum Dual-Cutting Edge helical bearing plates (DCE) enhance penetration through dense soils with occasional cobbles and debris. Custom lengths and helix configurations are available upon request. See Magnum Technical Reference Manual for additional information including design tools, prescriptive specifications and example plans.

5.5.1. Magnum Helical Anchors

The following table provides information about Magnum foundation brackets most frequently used on the Jersey Shore and coast of Long Island. More information about these and other foundation brackets is contained in 2012MPC.

Product Designation	Description	Image	Catalog Page
MS150B	Magnum 1.5"x1.5" square-shaft helical piles, grade 90 ksi central steel shaft and forged single 1" bolt couplings. Available galvanized with 8", 10", 12", and 14" single-cutting or dual-cutting helices. [maximum working capacity = 17.5 tons compression/17.5 tons tension]		25

Product Designation	Description	Image	Catalog Page
MSC1080-150824B	Magnum thread bar transition caps with 24" long #8 all-thread bar and nut. Bearing plate not included. [maximum working capacity = 17.5 tons tension]		66

6. CONCLUSION

Thank you for taking the time to read this Design Manual for Coastal Construction. Whether you are a homeowner, engineer, architect, or contractor, we hope that this manual provides some insight into the important decisions to be made, design considerations, and the variety of foundation products available for reconstruction of our coastal areas. From A-zone to V-zone, this book contains economical and effective construction solutions explained from the perspective of the trusted people at Magnum that have been serving the specialty foundation industry for over 30 years.

All Magnum foundation products are covered by our 30-year "Assured Quality" warrantee. A copy of the warrantee certificate is available at the Slabjack office in Point Pleasant, NJ or from your local Magnum installer. Magnum acknowledges that there are many ways to elevate and support house foundations. The systems described herein represent methods that are highly recommended by our team of engineers and experts. Magnum attests that its products have been designed in accordance with IBC2009 and ICC-ES AC358. Magnum Piering, Inc. is an ISO9001 Accredited Quality Manufacturer. Magnum products and systems were designed by our engineers according to the standard of care practiced by other members of the profession in this area at this time under similar circumstances. Unknowns could exist below ground. Magnum and Slabjack do not have control over product installations. No warrantee is made, express or implied, regarding performance in ground or quality of installation workmanship.

Good luck with your home elevation project!

MAGNUM

MAGNUM PIERING, INC.
30-YEAR "ASSURED QUALITY" WARRANTEE

"A warrantee is only as good as the company that stands behind it."

Synopsis:

We know our customers stand behind their work, and anyone who has worked with Magnum knows that we stand behind our products. With this new 30-year warrantee program, Magnum Piering, Inc. reasserts its commitment to its customers and to quality.

Magnum Piering, Inc. warrants that, in the event a manufacturing defect is determined within 30 years of the date of sale, it will provide replacement parts at no charge. Some of our competitors offer similar warrantees, yet many are not an accredited quality manufacturer and few have been in business for as long. A warrantee from Magnum Piering, Inc., with its 30-year history in business, exceptional engineering support, commitment to industry, and ISO 9001 accreditation should give you a better assurance of quality.

53320v2
WARRANTY PROVISIONS
LIMITATION ON DAMAGES

Magnum Piering, Inc. warrants its products and their parts and components to be free from manufacturing defects in materials and workmanship for a period of thirty (30) years from the date of sale. Purchaser's exclusive remedy under this warranty shall be the correction of any verified defect in workmanship and materials or the replacement of any nonconforming goods, components, or part. This warranty shall expire thirty (30) years after the date of sale. This warranty is only valid for products sold after January 1, 2012. EXCEPT AS SPECIFICALLY SET FORTH HEREIN, MAGNUM PIERING, INC., MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, WITH RESPECT TO ITS PRODUCTS AND THEIR PARTS AND COMPONENTS, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE. NOTWITHSTANDING THE FOREGOING WARRANTY, MAGNUM PIERING, INC., SHALL NOT IN ANY EVENT BE LIABLE TO PURCHASER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES OR LOST PROFITS ARISING OUT OF OR RELATED IN ANY WAY TO THE PURCHASE, INSTALLATION, OR USE OF THE PRODUCTS OF MAGUM PIERING, INC., AND THE PARTS AND COMPONENTS OF THOSE PRODUCTS. THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF.

This warranty shall be interpreted and enforced in accordance with the laws of the State of Ohio without regard to the conflicts of law rules of such state, and, further, the laws of the State of Ohio shall exclusively govern any claims, demands, or controversies arising from the sale of the products of Magnum Piering, Inc.

Quality Control Form 533201v2


V ZONE CONSTRUCTION


MOMENT FRAME


MAGNUM HELICAL FOUNDATION SYSTEMS
MAGNUM
HELICAL PILES
2150


MAGNUM MOMENT FRAME


MAGNUM PUSH PIER SYSTEM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HELICAL PILES
2150


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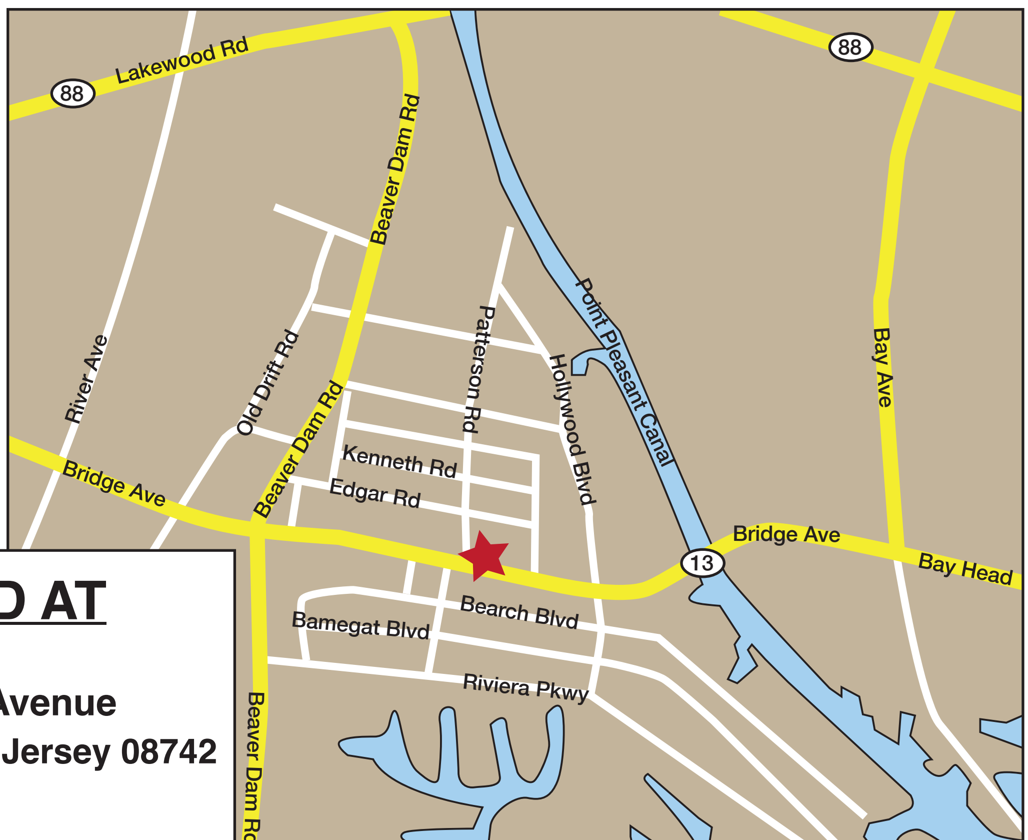
LET SLABJACK HELP YOU TAKE THE FIRST STEP IN RAISING YOUR HOME.

BRING THE FOLLOWING ITEMS TO OUR NEW SHOWROOM.

1. Plot Plan of lot.
2. Latest elevation certificate.
3. Any Plans you may have for existing.
4. Pictures of front, side, and rear of house.
5. Names of preferred Architects or Engineers you would like us to contact.



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