Chapter 2: General Construction Procedures

Preparing Site

To allow proper drainage plan to keep building grade higher than surrounding site. On an ideal site, water drains naturally away from building. Since few sites are ideal, in most cases, grade work will be required to keep surface water away from building. Keeping finished building floor higher than surrounding site reduces flooding chances during heavy rainfall or rapid snowmelt.

In flood plains, consult first with building department to determine their requirements. Typical recommendation is to establish grade level at finished floor top higher than flood level. This may require importing fill to raise grade. A surveyor can be hired to expertly determine these heights. In some cases, vents may be installed, below flood level, to equalize interior and exterior pressures.

Many sites can be graded with a skid steer (a.k.a. Bobcat) or backhoe. Some cases will require heavy equipment to properly grade site to allow water to drain away from building. If engaging a professional for site grading, make certain finished grade was adequately prepared before making final payment. In far too many cases supposedly “flat” sites being out of level have been experienced by disappointed owners.

At a minimum, site preparation includes:

- Remove all sod and vegetation.
- For ideal site preparation, remove topsoil and stockpile for later use in finish grading. In frost prone areas, remove any clays or silty soil from within future building “footprint”.
- Replace subsoil removed from around building with granulated fill to help drain subsurface water from building.
- Distribute all fill, large debris free (no pit run), uniformly around site in layers no deeper than six inches.
- Compact each layer to a minimum 90% of a Modified Proctor Density before adding next layer. It is recommended to invest in a Geotechnical (soils) Engineer to test to confirm correct compaction. Usually, adequate compaction takes more than driving over fill with a dump truck, or earth moving equipment.

When any building portion sits on fill, rest columns, as well as any concrete encasement, on or in undisturbed soil. In many cases, building inspectors will require a Geotechnical Engineer to confirm compaction adequacy on filled sites. Geotechnical Engineers can be expensive, but are even more costly when called in to do analysis “after the fact”. The E.O.R. for your building is, as a practicality matter, unable to visit sites; therefore they are unable to perform or provide any soils or other similar reports, design retaining walls or any other work beyond building shell.
Soil compaction is defined as a method of mechanically increasing soil density. In construction, this is a significant part of your building process. If performed improperly, soil settlement could occur and result in unnecessary maintenance costs or structure failure. Almost all types of building sites and construction projects utilize mechanical compaction techniques.

So what actually is soil? Soil is formed in place or deposited by various forces of nature – such as glaciers, wind, lakes and rivers – residually or organically. Important elements in soil compaction are soil type, soil moisture content and compaction effort required.

There are five principle reasons to compact soil: to increase load-bearing capacity, prevent soil settlement and frost damage, provide stability, reduce water seepage, swelling and contraction and reduce settling of soil.

Soil can be compacted by vibration, impact, kneading or pressure. These different compaction efforts can be accomplished by main types of compaction force, static or vibratory.

*Static force* is simply machine deadweight, applying downward force on soil surface, compressing soil particles. Only way to change effective compaction force is by adding or subtracting machine weight. Static compaction is confined to upper soil layers and is limited to any appreciable depth. Kneading and pressure are two examples of static compaction.

*Vibratory force* uses a mechanism, usually engine-driven, to create a downward force in addition to machine’s static weight. This vibrating mechanism is usually a rotating eccentric weight or piston/spring combination (in rammers). These compactors deliver a rapid sequence of blows (impacts) to soil surface, thereby affecting top layers as well as deeper layers. Vibration moves through material, setting particles in motion and moving them closer together for highest density possible. Based on materials being compacted, a certain amount of force must be used to overcome cohesive nature of particular particles.

Poor, improper or no compaction can result in concrete slab cracks or frost heaves, foundation erosion and/or building settling. Proper compaction can ensure a longer structural life.

Every soil type behaves differently with respect to maximum density and optimum moisture. Therefore, each soil type has its own unique requirements and controls both in field and for testing purposes. Soil types are commonly classified by grain size, determined by passing soil through a series of sieves to screen or separate different grain sizes. Soils found in nature are almost always a combination of soil types. A *well-graded* soil consists of a wide range of particle sizes with smaller particles filling voids between larger particles. Result is a dense structure lending itself well to compaction. A soil’s makeup determines best compaction method to use. There are three basic soil groups: cohesive, granular and organic. Organic soils are not suitable for compaction.

Cohesive soils, such as clays or silts have smallest particles. Cohesive soils are dense and tightly bound together by molecular attraction. They are plastic when wet and can be molded, but become very hard when dry. Cohesive soils feel smooth and greasy when rubbed between fingers. Clay soils are less than ideal to construct your new post frame building upon and should be removed and replaced.
Granular soils range in particle size from .003" to .08" (sand) and .08" to 1.0" (fine to medium gravel). Granular soils are known for their water-draining properties. Sand and gravel obtain maximum density in either a fully dry or saturated state. Granular soils feel gritty when rubbed between fingers. When water and granular soils are shaken in palm of your hand, they will mix, when shaking stops, they will separate. When dry, a soil sample will crumble.

Gravel and sand can be compacted either by vibration (using a vibrating plate compactor, vibrating roller or vibrating sheepsfoot) or kneading with pressure (using a scraper, rubber tired roller, loader or grid roller). Both are good to excellent in terms of foundation support and as a subgrade. They are easy to compact and are not expansive (expansive soils tend to be prone to frost heave issues).

Response of soil to moisture is very important, as soil must carry loads year-round. Rain, for example, may transform soil into a plastic state or even into a liquid. In this state, soil has very little or no load-bearing ability.

Soil moisture content is vital to proper compaction. Moisture acts as a lubricant within soil, sliding particles together. Too little moisture means inadequate compaction – particles cannot move past each other to achieve density. Too much moisture leaves water-filled voids and subsequently weakens load-bearing ability. Highest density for most soils is at a certain water content for a given compaction effort. Drier soil is more resistant to compaction. In a water-saturated state voids between particles are partially filled with water, creating an apparent cohesion binding them together. This cohesion increases as particle size decreases (as in clay-type soils).

To determine if proper soil compaction is achieved for any specific construction application, several methods were developed. Most prominent by far is soil density.

Soil testing accomplishes the following: measures density of soil for comparing degree of compaction vs. specifications for structure to be built; measures effect of moisture on soil density vs. specifications; and provides a moisture density curve identifying optimum moisture content.

Tests to determine optimum soil moisture content are done in a laboratory. Most common is a Proctor Test, or Modified Proctor Test. A particular soil needs to have an ideal (or optimum) amount of moisture to achieve maximum density. This is important not only for durability, but will save money because less compaction effort is needed to achieve desired results.

A quick method of determining moisture is known as a “Hand Test”.

Pick up a handful of soil. Squeeze it in your hand. Open your hand. If soil is powdery and will not retain shape made by your hand, it is too dry. If it shatters when dropped, it is too dry. If soil is moldable and breaks into only a couple of pieces when dropped, it has right amount of moisture for proper compaction. If soil is plastic in your hand, leaves traces of moisture on your fingers and stays in one piece when dropped, it has too much moisture for compaction.

Proctor, or Modified Proctor Test, determines maximum density of a soil needed for a specific job site. This test first determines maximum density achievable for materials and uses this figure as a reference. Secondly, it tests effects of moisture on soil density. This soil reference value is expressed as a percentage of density. These values are determined
before any compaction takes place to develop compaction specifications. Modified Proctor values are higher because they take into account higher densities needed for certain types of construction projects. Test methods are similar for both tests.

When hired, a soils engineer will probably perform either a sand cone or a nuclear density test. In sand cone, a small hole (6” x 6” deep) is dug in compacted material to be tested. Soil is removed and weighed, then dried and weighed again to determine its moisture content. A soil’s moisture is figured as a percentage. Hole’s specific volume is determined by filling it with calibrated dry sand from a jar and cone device. Dry weight of soil removed is divided by volume of sand needed to fill hole. This gives us density of compacted soil in pounds per cubic foot. This density is compared to maximum Proctor density obtained earlier, giving us relative density of just compacted soil.

Nuclear Density meters are a quick and fairly accurate way of determining density and moisture content. Meter uses a radioactive isotope source (Cesium 137) at soil surface (backscatter) or from a probe placed into soil (direct transmission). Isotope source gives off photons (usually Gamma rays) radiating back to meter’s detectors on unit bottom. Dense soil absorbs more radiation than loose soil and readings reflect overall density. Water content can also be read, all within a few minutes. A relative Proctor density with compaction results from this test.

Soil modulus or soil stiffness test is a field-test method is a very recent development replacing soil density testing. Soil stiffness is a ratio of force-to-displacement. Testing is done by a machine sending vibrations into soil and then measuring deflection of soil from vibrations. This is a very fast, safe method of testing soil stiffness. Soil stiffness is desired engineering property, not just dry density and water content.

**Be certain to know local Building Department requirements before starting to move dirt.**

In many jurisdictions, a separate grading permit may be required. In some cases a building permit must be issued prior to moving soil. Get started on right foot with permit authorities – ask first before digging!

Also, **prior to doing any excavation call 811.** This is a free service to mark underground utilities. Property owners and contractors can be held financially liable if they fail to locate underground utilities (like gas, electric, telephone, cable, water) and damage them in any way (besides a potential for causing severe injury or death).
Grade actual building “footprint” area as level as reasonably possible. A grade change beyond eight inches will often result in having to acquire longer building columns.

Ideally grade change was checked before placing building order. However this is sometimes unfeasible as a practical matter. If site grade was unchecked before order placement, do so within 24 hours. Longer columns are far more economical when provided with original lumber delivery. In some instances, building columns have been specially ordered (due to dimension, length, treating specifications or a combination thereof) and are impossible to return to original producer for credit, even if yet to be delivered to jobsite.

Create an adequate work area. At a minimum clear at least five feet beyond each building side. Building Codes generally require impervious areas beyond building perimeter be graded away from building with a minimum 5% slope to drain surface water away in all directions. **A 5% slope is a 6 inch drop in 10 feet.**

**Building Plans**

Before printing building plans, Hansen Buildings will make them available, online, for your review. Everything from invoice/order confirmation and signed door location sheet appears on plans. Please compare invoice items to plans thoroughly. In event unclear as to how to open and review plans, request help. Review building plans promptly and either approve or advise as to any requested corrections.
We repeatedly emphasize -- thoroughly and carefully review all building plans, instructions and material takeoff lists prior to beginning construction.

Any deviation from building plans places responsibility for building’s structural integrity squarely upon you.

A professional has designed your new Hansen Building. Rely upon their experience.

Cost to purchase “additional” materials and/or engineering if building is built other than according to building plans is your responsibility (or between you and your building contractor in event one has been hired).

Rules For Reading Building Plans

Never, we repeat, never “scale” a blueprint, as lines may be stretched or shrunk during printing process. Written dimensions on plans take precedence over any drawings.

Never count boards depicted on a drawing and automatically assume building will have same. Draftspersons will at times draw more or fewer pieces than will be required on actual building. Sometimes lumber grade or size determines girt or purlin number and spacing. If there is more than one lumber grade listed on building plans, match lumber received to appropriate wording on plans. Trusses are drawn as depictions on plans, actual drawings are done by truss manufacturer and provided with truss delivery.

E.O.R.’s structural review will establish actual required size, grade and spacing for members and connections. These all will be spelled out in writing on building plans.

Pay careful attention to girt and purlin grade and spacing. In many cases they will be at some spacing other than 24” on center.

There may be isolated instances when wainscot, eavestlights, an entry door or window height or location may, due to installation practicality, require a slight spacing deviation from indications on building plans. For this reason, as construction progresses, compare with actual materials provided, to avoid having to redo work performed, or purchase extra materials.

Symbol BL on building plans denotes “Building Line”. Used in cases where measures are made from building column “outside” edges.
Symbol **CL** denotes “center line” measure. Can be applied to building columns, or other sub-components.

**STOP** If anyone, including any building department plan checker, field inspector, other official, or a contractor, makes *any* changes or deviations from provided building plans we advise to obtain a signed statement reflecting they have now become “designer of record”. In effect, they have assumed all liability for building’s structural design. Again, *any deviation from building plans* relieves Hansen Buildings, building designer or E.O.R. from all structural responsibility.

While building plans have been reviewed by many eyes (including yours), prior to printing, a potential for inadvertent error exists, however small. If finding an apparent conflict between Emailed plans, printed building plans and/or this construction manual, contact Hansen Buildings **BEFORE** proceeding further with construction.

**Choosing Fasteners**

Hansen Buildings provides all required fasteners for post frame building kit structural assembly, **other than those normally driven by a nail gun**. For best results, and least time spent doing installation, we’ve found power-driven fasteners to be a superior choice. Power-driving equipment comes in many brand and style varieties. Due to this, providing these fasteners with building kits becomes an impossible task.

**Nail Note:** Either conventional or power-driven nails are acceptable. Be certain to use galvanized or other corrosion-resistant nails. (Vinyl or otherwise coated “sinkers” are inadequate.) Deficiently protected nail use will result in unsightly rust streaks on framing lumber, if rain or other moisture gets on nails prior to “closing in” building.

- We recommend, at a minimum, hot-dipped galvanized (hdg) fastener use, as opposed to electroplated galvanized (eg).
- Some building departments require stainless steel fasteners into pressure treated wood. As well, some new generation pressure treating techniques require stainless steel fastener use. Fasteners rated for use with new generation pressure treated lumber will be specified as such on nail carton exteriors.
- Most building plans and prefabricated truss drawings will specify 10d galvanized common nails for framing installation. These are 3” long with a 0.148” diameter. Hansen Pole Buildings does offer 10d galvanized common “strip nails” fitting many popular nail guns, at a discounted price, if shipped with building hardware.

Lesser diameter 3” nails (typically referred to as “box” nails), are not an equal substitution.

Nails greater in length than three inches and used for general framing, can cause lumber splitting with catastrophic results.

Researchers have found a nail driven into a board further than lumber face width, board will likely cause splits (example: driving nail 2” into 1-1/2” board face).

- Joist hanger attachments into a single 2x member will typically require a galvanized 10d common diameter (0.148”) by 1-1/2” long “joist hanger” or “teco” nail.
• Endwall Braced Wall Panels, or other wood or composite sheeting products, generally require 8d galvanized commons (2-1/2" long 0.131" diameter).
• Several pounds 3" or 3-1/2" duplex nails or 3" Torx head wood screws may prove convenient for easy temporary bracing installation and removal.
• Some 1" roofing nails (with big plastic washers) can be handy to have to temporarily hold reflective radiant barrier in place until steel application.

**Staples**: Some installers prefer to use staples to hold trims in place, or to install soffit materials. In general, same guidelines apply to staples as to nails.

• Either conventional or power-driven staples are acceptable if they are appropriately corrosion-resistant.
• In addition, staples are to be at least 16 gauge semi-flattened to an elliptical cross-section.
• Staple crown at least 7/16" wide with legs long enough to penetrate into framing at least 3/4".
• NOTE: Florida State has specific requirements for using staples, ask your Building Official.

**Screws**: As an ALTERNATIVE TO NAILS:

0.148" x 1-1/2" nails may be replaced by Simpson SD9112R100 or SD10112R100.
0.148" x 3" into hangers may be replaced by Simpson SD9212R100-R or SD10212R100-R.
0.148" x 3" lumber-to-lumber nails can be replaced by Simpson SDWS16300QR75. Fastener quantities remain equal in all cases.

Although many methods are acceptable, we have found ½” drywall screws to be handy for installing soffit panels.

**Estimating for Fasteners**

• For 10d common framing nails, a general rule is five pounds for each 20 dimensional 2” lumber pieces.
• Nailing T1-11, wood or composite sheeting with 8d commons? Usually a pound will do about two 4’x8’ sheets.
• For 1-1/2” joist hanger nails, conventional 2x6 hangers take roughly a pound for each eight hangers.

Keep in mind these are merely approximations. Actual usage may vary due to specific building design requirements or individual installation techniques.
Tools Needed

Required tools:

Most work will require some or all of these standard carpentry tools:

(2) 15/16” wrenches (if 5/8” truss bolts are specified)
Adjustable wrench
Carpenter’s level (4’ or 6’ long)
Carpenter’s pencil
Caulking gun and caulk**
Chalk line
Clam Shell digger
Come-Along w/cables
Ear protection
Framing Hammer
Framing square
Gloves
Hack saw
Hand saw
Nail apron
Nail puller
Plumb bob
Protective rubber sole boots
Safety glasses or goggles
Saw horses
Screwdrivers
Shims
Shovel
String line
Tape measures, 25’ & 100’
Tin snips
Transit (or building level)
Utility knife
Wooden stakes

**A suggested caulking for steel trims is TITEBOND Metal Roof Translucent Sealant available at The Home Depot®
Screw gun

No steel roofing and siding job is complete without this tool! Use equipment providing drive screw force control. Under or over driven screws will create adverse situations and cause leaks. While battery powered screw guns can be convenient, limited battery life usually makes a corded tool far more practical. Screws have 1/4" hex-heads. Hansen Buildings recommends purchasing several Master Surface Magnetic Drive bits (available through Hansen Buildings). Alternate bit brands may damage screws powder coating. For sliding door assembly, a Phillips head bit sufficient to drive a #8 pan head screw will be required.

**HELPFUL HINT:** Buy extra Master Surface Magnetic Drive bits as they do wear out. Usually a bit will do 750-1000 screws. If you have extras and have unopened packages, they can be returned for full credit. This is much cheaper than having to make an extra trip (or trips!) to hardware store.

**CAUTION** Under no circumstance use drive bits from Ryobi, Black and Decker or Ridgid, as they WILL damage screw heads.

Drill motor and bits
¼" Drill Motor. For pre-boring nail holes, 7/64” and 1/8” bits are required. Same size bit can be used for pre-drilling steel roofing and siding. Strong-Drive® SDWS TIMBER Screw truss fasteners require a 9/64” bit with 5” net penetration as well as a 7/32” bit. For pre-drilling eave light panels a 3/8” bit is required. A 5/8” diameter wood bit is required for drill holes for re-bar hairpins, if installing a concrete slab. For Strong-Drive® SDWS TIMBER Screw column/truss fasteners, a ½” Drill Motor and 5/16” hex head drive bit. For sliding doors a 17/32” metal bit is required. For bi-parting (split) sliding doors, a 9/32” metal bit.

In an event pre-drilling into wood for a nail or screw pilot hole is done, maximum bit diameter should be ¾ of fastener diameter.

If rafter or truss to column bolts are used, an 11/16” wood bit.

** Helpful, but unrequired, (time saving) tools:**

Save time by adding these **power tools** and their accessories to list:

**Auger**

Normally best if mounted on a skid steer or other similar equipment. Refer to building plans for required hole diameter. Hole diameters less than 18” are inadequate, in any case.

** Circular saw**

With sharp blades for both rough cutting and a fine-tooth plywood blade. Carbide tipped blades often give best results and greatest longevity. A power saw saves time and assures straight cuts. An abrasive saw blade may be handy as well. When using a power circular saw, work on a stable surface with ample clear area for cutting materials.
12” Miter saw

Handy for repetitive cutting for both speed and accuracy.

Palm Nailer

Palm nailers are small, air-powered tools designed to fit into one palm and strap on to keep stable. Unlike conventional nailers, a palm nailer simply uses standard nails. Fit nail into tip and press unit down on head, and nailer takes charge. An internal "hammer" begins a pounding action, and bam! - nail driven.

First time trying out a palm nailer can be a little disconcerting: there’s a rapid vibration in palm and nail disappears into a board - and fast. Nailer runs at 2300 blows per minute on 100 pound pressure (almost 40 blows a second). A 10d common nail takes but an instant to be driven to head in treated pine. And what’s more, when nail has been driven flush, nailer stops pounding to keep from marring surface.
Using a palm nailer takes a little practice, mainly getting used to pressing down with palm, getting nail to stand upright (with much practice, this can sometimes be done without using other hand), and getting accustomed to noise.

**Pneumatic or power driven stapler or nailer**

Nice to have for maximum productivity, but to assure installation quality, use power fasteners correctly. Nailing tips and requirements will be given throughout this manual.

**Metal nibbler or shear**

**Chain saw**
Hammer tacker

Optional tools:

Finally, to make work go easier, here are recommendations for other equipment:

Genie Superlift Contractor

Designed specifically for construction industry, these heavy-duty units can be operated by one person and can lift, lower and move loads up to 650 pounds to heights up to 24 feet. Glide rails allow one person to easily load or unload unit, as well as lift it in or out from a pickup truck. Ideal for lifting trusses.
**Truss jacks**

Also known as “winch boxes” to raise roof trusses. In simple terms, these normally are a steel box (or cap) designed to fit building’s sidewall column tops (or attached to column face, with a pulley wheel on column top). Welded to cap is a reduced drive boat trailer winch. While truss jacks are currently commercially unavailable, most experienced installers own at least two pair. This allows roofs to be framed on ground in “bays” and lifted with all framing in place.
**Extension ladder** (Only use OSHA-approved.)

Verify ladder sturdiness and upper side rails are padded to prevent damage to installed siding.

**SAFETY TIP:** When working with a ladder(s), set on dry, level ground, avoiding snow, mud, or wet grass. Wear work boots or shoes with non-slip soles and keep hips within ladder vertical rails. Leaning too far to side will cause ladder to topple over.

**Winding Bars**

For overhead door installations. Takes two ½” x 18” long steel rods.


**Scaffold**

If working on a tall building, a stable scaffold can save time and provide added safety. (Again, use OSHA-approved equipment.) Different types are available, from pump jacks to bracket scaffolding. Mount scaffold correctly and use sturdy, properly sized planks to stand on.

![Scaffold Image](image)

**4-1/2” Angle Grinder**

Can be used with a metal cutting disk for cutting steel panels.

![Angle Grinder Image](image)