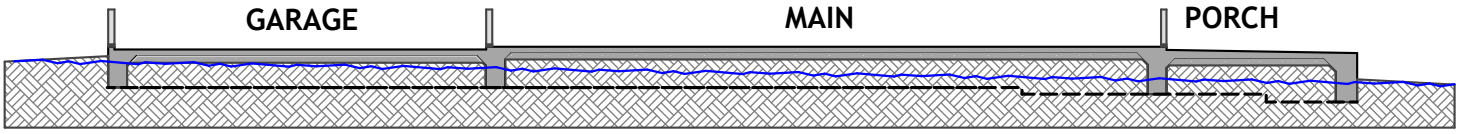
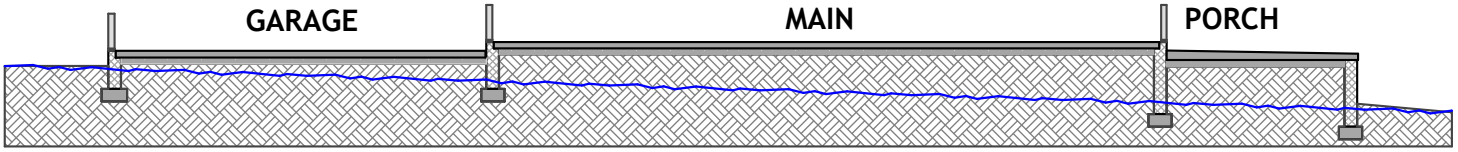
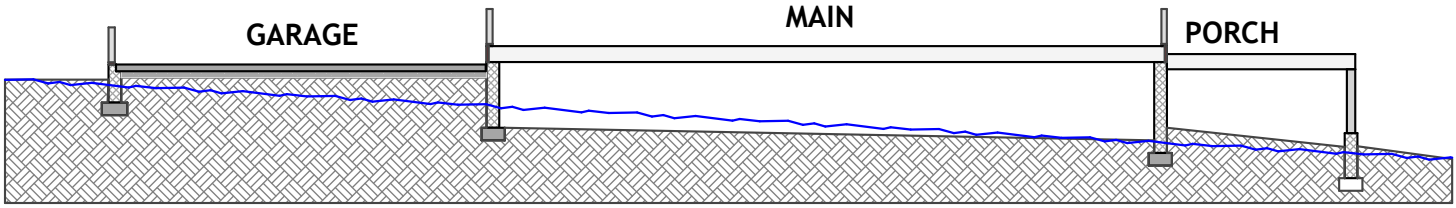


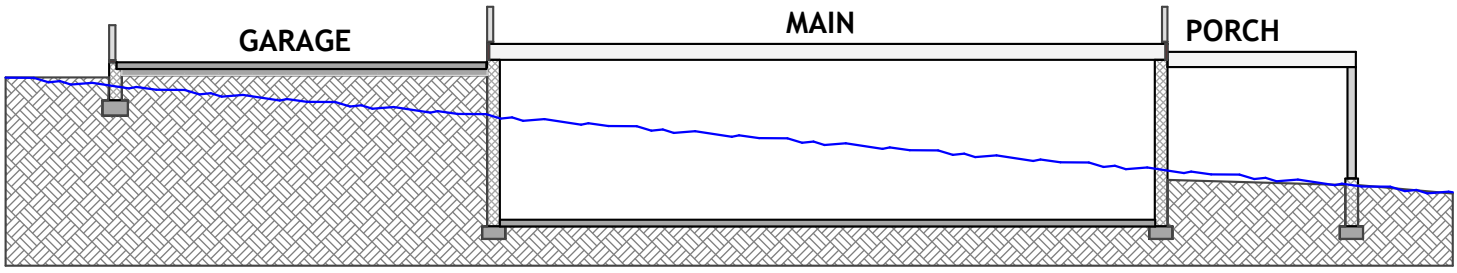
SLAB ON GRADE WITH INTEGRAL FOUNDATION c1,2, c1.3, c1.4



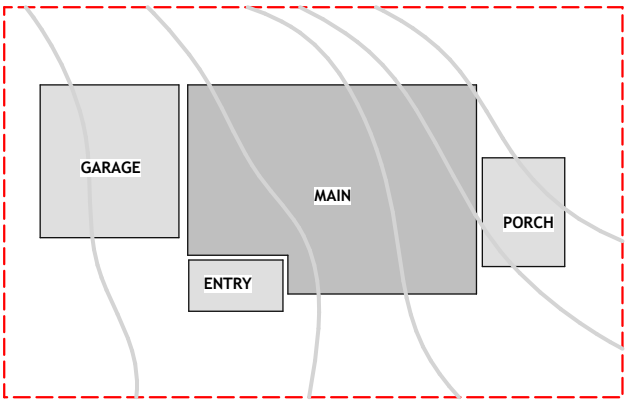
SLAB OB GRADE WITH STEM WALL c1.5, c1.6



CRAWL SPACE c1.7, c1.8

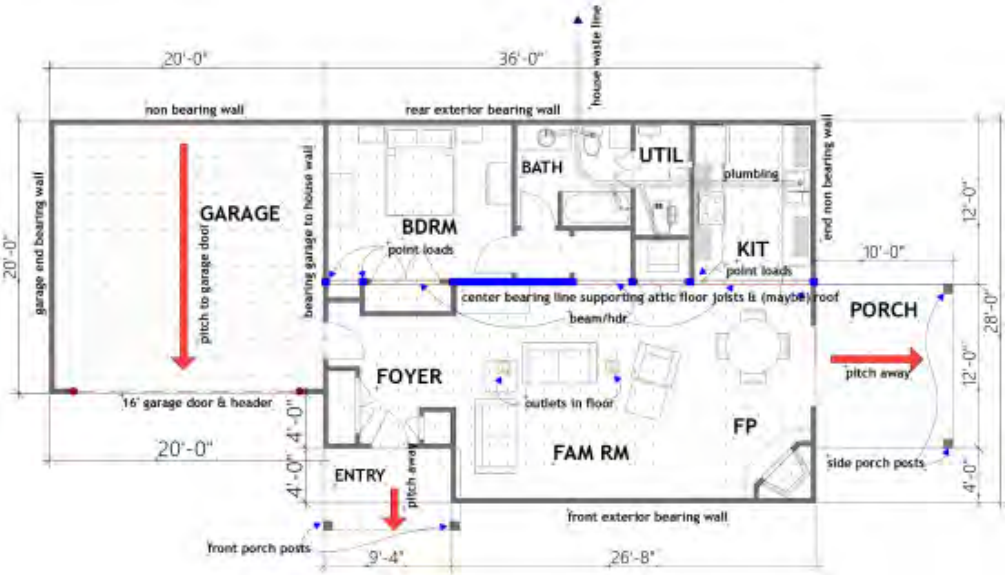


BASEMENT FOUNDATION c1.9, c1.10

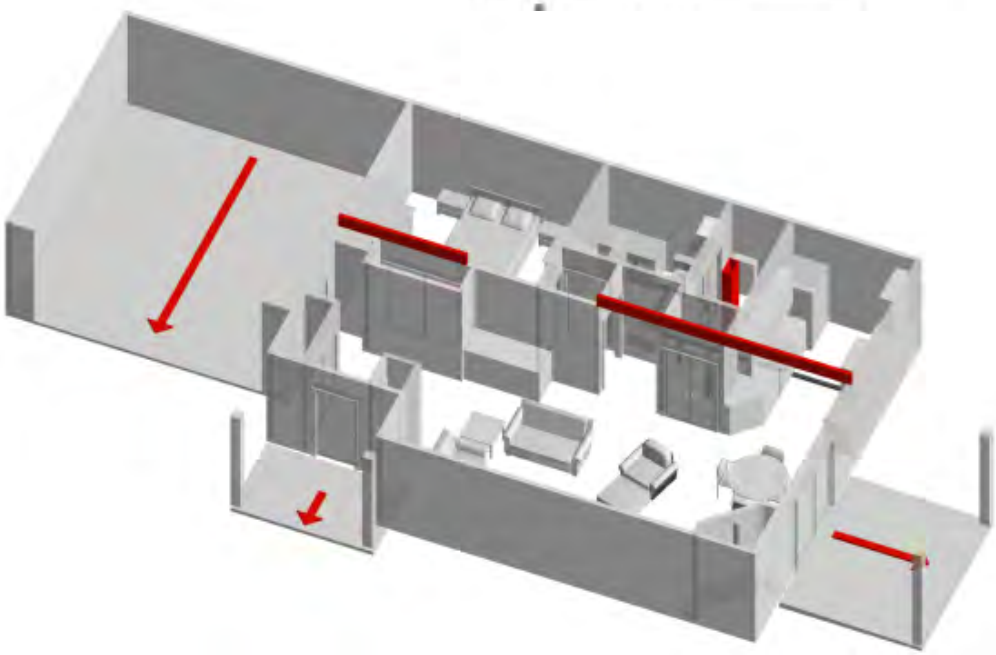


COMPOSITE FOUNDATION

***THESE EXERCISES**_THE FOLLOWING EXERCISES USE THE SAME PLAN ARRANGEMENT WITH THE SAME BASIC SITE TOPOGRAPHY TO BENEFIT A COMPARATIVE CONSTRUCTION OVERVIEW.
***THE FOUNDATION SYSTEMS**_THE 4 MORE COMMON FOUNDATION SYSTEMS ARE INCORPORATED IN THIS COMPARATIVE OVERVIEW. EACH EXERCISE ILLUSTRATES ONE (FAIRLY COMMON) CONSTRUCTION APPROACH.
***THE COMPONENTS**_ THE COMPONENT HERE IS REFERRING TO THE PRIMARY CONSTRUCTION ELEMENTS OF HOUSE, GARAGE, ENTRY AND PORCH. THESE WILL ILLUSTRATE THAT THE HOUSE COMPONENT MAY SHARE OR MAY NOT SHARE THE SAME FOUNDATION THINKING AS THE GARAGE, ENTRY AND PORCH COMPONENTS. THE ONLY CONSISTENTLY TREATED COMPONENT IS THE GARAGE WHICH IS INEVITABLY A SLAB ON GRADE CONSTRUCTION ALBEIT WITH DIFFERENT 'DETAILING' DEPENDING ON THE HOUSE FOUNDATION AND ITS ACTUAL SITE ELEVATION (c1.11-c1.14).



BASEMENT STAIR



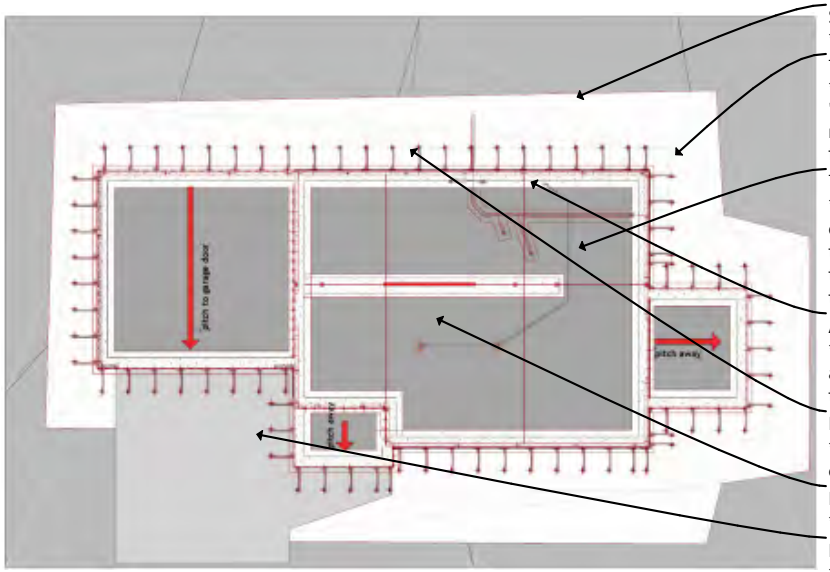
THE DESIGN PLAN

***PLAN NOTES**_THIS PLAN LAYOUT AND PLAN NOTES ARE CONSISTENT FOR ALL THE FOUNDATION EXERCISES EXCEPT FOR THE BASEMENT STAIR IN THE BASEMENT FOUNDATION SYSTEM EXERCISE.
***LOAD TRACKING**_THIS INTRODUCES LOAD TRACKING. ANY FOUNDATION SYSTEM NEEDS TO ACCEPT BUILDING LOADS AND DISTRIBUTE THAT LOAD TO THE SOIL. THEREFORE UNDERSTANDING THE LOADS THAT ARE CARRIED TO THE FOUNDATION IS ESSENTIAL. FRAMING MEMBERS ARE THE DASH DOT LINES AND SHOW THE FRAMING ABOVE WHICH IS A STANDARD DRAWING CONVENTION. THESE SHOWN FRAMING MEMBERS THEN REPRESENT THE ATTIC FLOOR FRAMING ABOVE THE MAIN CEILING. THIS ASSUMES A ONE STORY ABOVE GRADE CONSTRUCTION.
***FRAMING CONVENTIONS**_IT IS A KIND OF DEFAULT TO FRAME FLOOR AND CEILING JOISTS AND ROOF RAFTERS IN THE SAME DIRECTION- BUT THERE ARE MANY CIRCUMSTANCES WHERIN CHANGING FRAMING DIRECTION IS MORE EFFECTIVE OR ECONOMICAL. IN THE INSTANCE OF THE SLAB ON GRADE CONSTRUCTIONS THERE IS NO MAIN FLOOR FRAMING SO THE BUILDING LOADS ARE ABSORBED AT THAT SLAB LEVEL. THE CRAWL SPACE AND BASEMENT CONSTRUCTIONS DO HAVE 2 LEVELS OF FRAMING THAT REQUIRE COORDINATION (LOAD TRACKING). THIS DESIGN PLAN PURPOSEFULLY FRAMES THE ATTIC AND ROOF ABOVE FRONT TO BACK, AND THE MAIN FLOOR LEFT TO RIGHT. THIS PERMITS ILLUSTRATION OF A COUPLE OF STRUCTURAL CONDITIONS.
***THE MECHANICALS** _PLUMBING AND HVAC AND ELECTRICAL REQUIREMENTS ARE AN INTEGRAL PART OF ANY HOME DESIGN. INTEGRATING SAME CAN CERTAINLY BE PESKY, BUT IT MUST BE DONE. WASTE LINE PLUMBING IS PRESENT IN THESE ILLUSTRATIONS MOSTLY TO CREATE AN AWARENESS.

BELOW THE MAIN LEVEL[4.1]

***THESE EXERCISES**_ARE ALSO REASSERTING THAT THE SAME DESIGN PLAN CAN SIT ON ON SEVERAL DIFFERENT FOUNDATION TYPES.
***THE BASEMENT EXCEPTION**_BECAUSE OF THE STAIR REQUIREMENT FROM MAIN FLOOR TO BASEMENT, SINGLE STORY BASEMENT HOMES NECESSARILY REQUIRE A DIFFERENT MAIN FLOOR PLAN. IN MULTI STORY DESIGNS A STAIR IS ALREADY REQUIRED TO GO UP TO THE ABOVE GRADE STORIES, SO SPACE FOR THAT STAIR THAT CAN ALSO DECEND TO A BASEMENT IS IN PLACE.
***PLANS THIS PROJECT** _WILL NOTE OPTIONAL/ALTERNATE FOUNDATIONS. PER TH NOTE ABOVE THE EXISTENCE OF A STAIR IS A BIG FACTOR.

SLAB ON GRADE WITH INTEGRAL FOOTING 1



PLAN NOTES

SITE PREP
*Compacted fill is required to level out the building pad.

THE FOOTING/FOUNDATION
*The footing/foundation in this construction is poured together with the slab. The 'footing' requires a structurally adequate width (w). That required width (and any reinforcement) is a function of building load and soil bearing capacity as with any footing. That footing also must be at or below local frost depth.

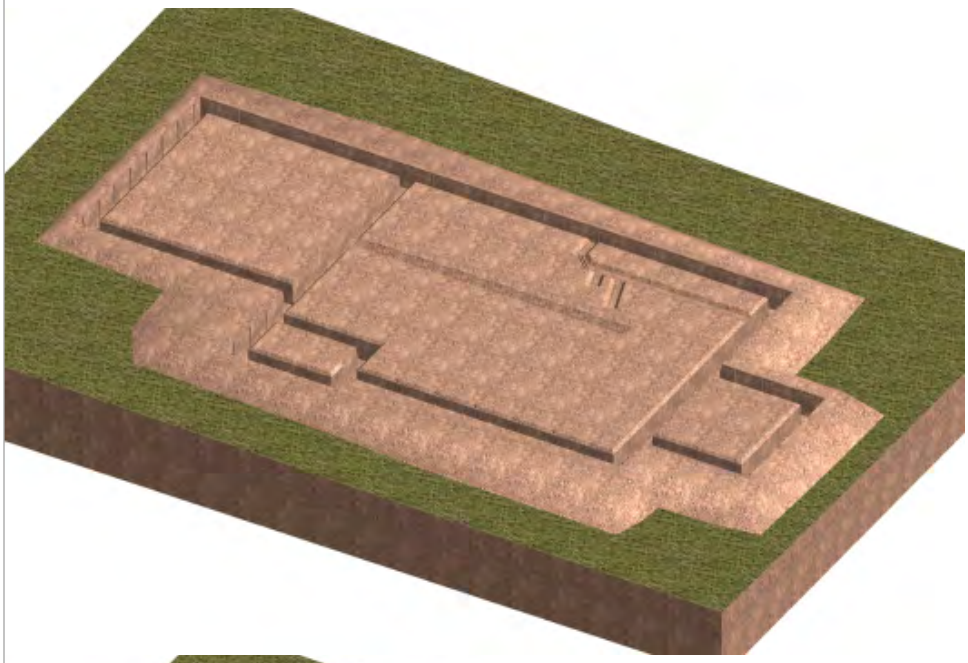
THICKENED OR HAUNCH SLAB
*This design has a center bearing wall and point loads that (for this exercise) exceed the slab only structural capacity, so a thicker slab is required under that load. This may be called a thickened slab, a haunch, or an internal footing. This fill pad should be compacted and (if so) this thickened slab does not need to go down to virgin soil. the stem wall exercise shows this loading going down to virgin soil with piers.

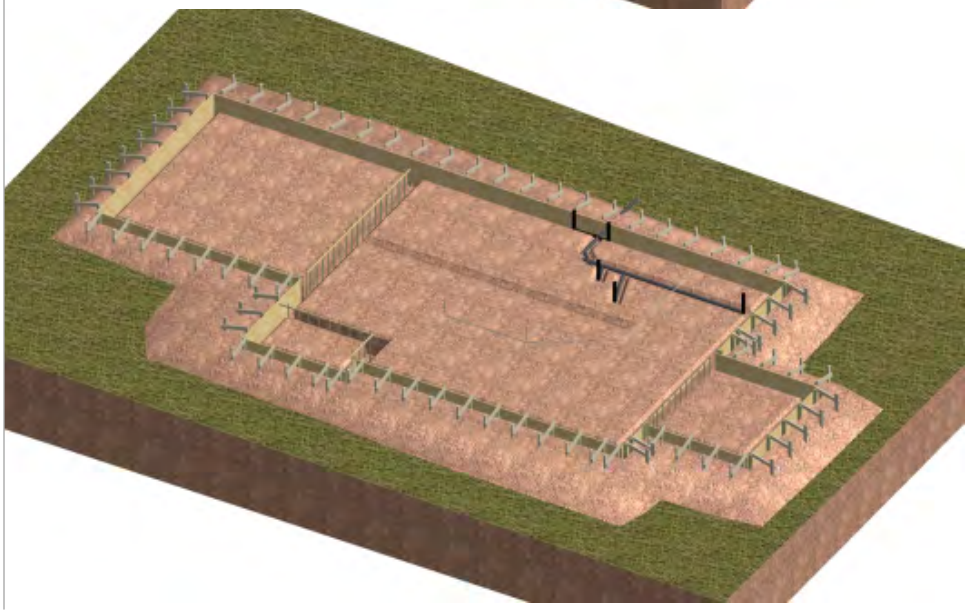
ANCHORS
*Steel anchor bolts need to be let into the slab perimeter while the slab is setting up. These anchor bolts set permanently in the concrete and tie down the framing plate (2x4 or 2x6) to the slab.

PLUMBING
*Reference the design plan. Exact locations need to be predetermined as all drain lines need code compliant installation before the slab is poured.

ELECTRIC IN SLAB
*This design needs floor outlets to serve living area furniture.

PITCH SLABS FOR DRAINAGE
*Garage, entry, and porch slabs need to be pitched away from the house for water drainage.





PREP & EXCAVATION

***BUILDING PAD**_A FLAT BUILDING PAD NEEDS TO EXIST FOR THIS CONSTRUCTION SYSTEM TO MAKE SENSE. THE SITE IS PREPPED BEFORE FOOTING EXCAVATION. (c1.4) TRIES TO ILLUSTRATE THE ISSUE WITH ROOM FOR A BACKHOE TO BACKUP & DIG, BACKUP & DIG TO CREATE THE SIMPLE CLEAN FOOTING/FOUNDATION TRENCH

***THIS EXERCISE**_IS SHOWING A GRADE CHANGE AND CONSEQUENT 'FILL' REQUIREMENT THAT IS APPROACHING THE LIMITS OF THIS SYSTEMS COST PRACTICALITY. TRUELY FLAT (AND SANDY) SITES TYPICAL IN FLORIDA, TEXAS, AND FARTHER SOUTHWESTERN STATES ARE GREAT CANDIDATES FOR THIS CONSTRUCTION FOR THE ABOVE REASONS AND- THE LIMITED INSULATION REQUIREMENTS.

***TRENCHING**_NOTE THE FOUNDATION "DIG' AND THE TRENCHING FOR THE SUPPORTING HAUNCH, AND ANY TRENCHING REQUIRED FOR PLUMBING.

FORMING FOR FOOTING/FOUNDATION

***REQUIRED**_THE FOOTING/FOUNDATION AND SLAB ARE POURED SIMULTANEOUSLY. DIMENSION CONTROL AND SQUARE CORNERS AND A LEVEL SLAB ARE REQUIRED. THE WAY TO ACHIEVE THAT IS WITH CAREFULLY INSTALLED FORMS THAT SET THE DIMENSIONS, SQUARE THE CORNERS, AND A LEVEL 'TOP OF FORM' PERIMETER.

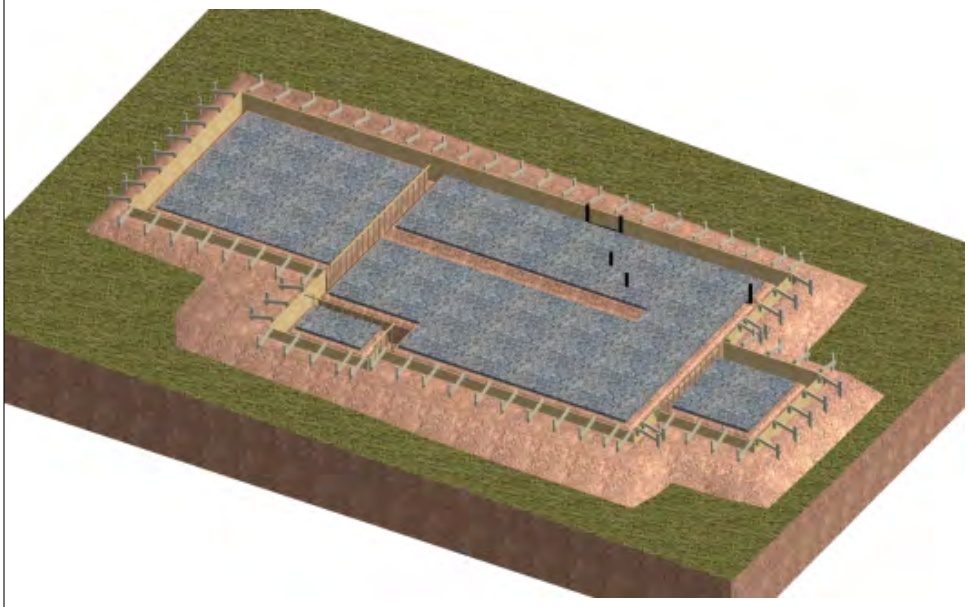
***FORMING CONDITIONS**_THE 4 SLABS IN THIS EXERCISE, 3 OF WHICH ARE AT A SLIGHTLY LOWER ELEVATION, AND ARE PITCHED, DO MAKE THIS FORMING AND POURING A CHALLENGE. THE FORMING BETWEEN THE PRIME CENTRAL HOUSE SLAB AND 3 ADJUNCT SLABS REQUIRE SOME PLANNING. VENDORS WILL HAVE DIFFERENT TECHNIQUES TO ACCOMPLISH THIS. AND SOME LOCALES, TRADITIONS MAY NOT ACTUALLY DROP THE 3 ADJUNCT SLABS BELOW THE MAIN HOUSE SLAB. HANDICAP CONSIDERATION WANT THOSE JUNCTURES CLOSE TO LEVEL, AND WIND DRIVEN RAIN PENETRATION WANT THEM SEPARATED.

***FORMING CONSTRUCTION**_SIMPLE SIDEWALKS MAY BE FORMED WITH SOME WOOD STAKES AND 2X4'S. A SIDEWALK POUR IS 3 1/2"TO 4" DEEP WITH LIMITED LATERAL PRESSURE ON THOSE FORMS. AS THE DEPTH OF THE POUR INCREASES THE PRESSURE AGAINST THE FORMS INCREASE AND THEREFORE THE QUALITY OF THE CONSTRUCTION OF THE FORMS NEED TO BE UPGRADED. (DEPTH=VOLUME OF CONCRETE=PRESSURE)

FOOTING REINFORCEMENT

***OPTIONAL**_ANY SPECIFIED FOOTING REINFORCEMENT WOULD BE SET AFTER THE FORMS ARE IN PLACE AND ANY LOOSE SOIL HAS BEEN REMOVED FROM THE BOTTOM OF THE TRENCH.

SLAB ON GRADE WITH INTEGRAL FOOTING 2



SUB SLAB

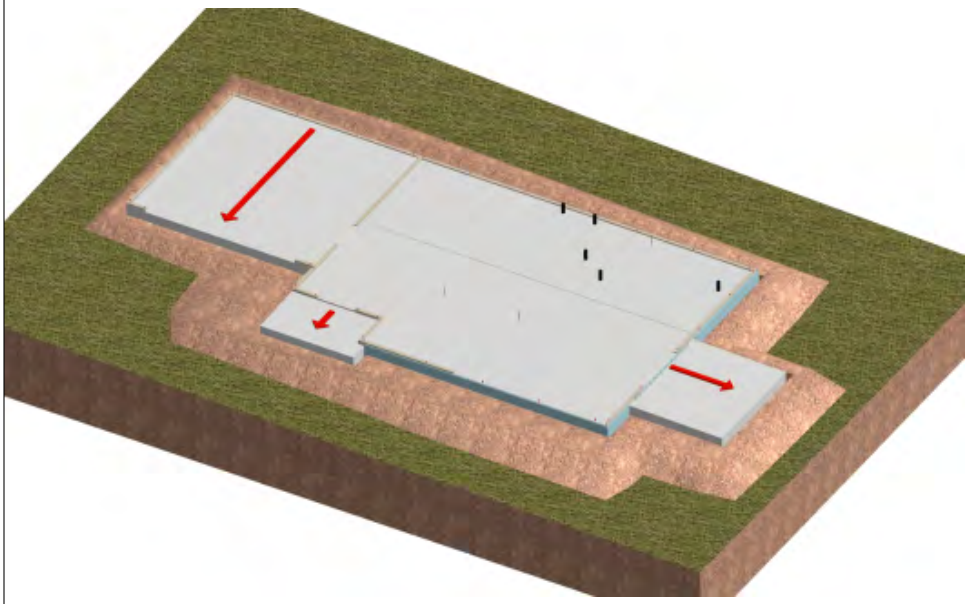
***BUILDING PAD**_IT IS BECAUSE OF THE BUILDING PAD PREP THAT THE EXCAVATION CUT CAN BE CLEAN. THE INSIDE OF THE TRENCH IS NOT FORMED. THE GRAVEL SUB BASE CAN BE SPREAD AND RAKED OUT TO THAT INSIDE EDGE. THE SUB BASE AT A 4" DEPTH DOES NOT REQUIRE ANY COMPACTION. THAT UNFORMED INSIDE TRENCH WALL WANTS TO STAY FIRM AND NOT COLLAPSE.

***THE MOISTURE BARRIER IS THE SUB BASE**_THE SUB BASE, (OR A HIGHLY DRAINABLE SOIL-LIKE SAND) IS POROUS AND WILL PREVENT SUB SURFACE WATER FROM RISING (MIGRATING).

***UNDER SLAB INSULATION**_(CONDITIONAL-DOES NOT SHOW). INSULATION MAY OR MAY NOT BE REQUIRED OR DESIRED. IN WARM WEATHER CLIMATES IT IS NOT REQUIRED. IN COLD WEATHER CLIMATES, AND IF A HEATED SLAB IS DESIRED, THE ENTIRE UNDERSIDE OF THE SLAB AND FOOTING/FOUNDATION WILL WANT TO BE SURFACED WITH RIGID INSULATION.

***THE VAPOR BARRIER**_THE SUB BASE (OR DRAINABLE SOIL) CONTROLS MIGRATING WATER BUT NOT VAPOR. CONCRETE WILL TRANSFER MOISTURE AND VAPOR, WHICH ONE WANTS TO KEEP OUT OF CONDITIONED LIVING SPACE ABOVE. A 6 MIL POLYETHYLENE VAPOR BARRIER IS (TYPICALLY) REQUIRED BY CODE. THE VAPOR BARRIER MATERIAL ITSELF IS IMPERMEABLE. POOR INSTALLATION AND OR PUNCTURES EASILY HAD DURING THE CONSTRUCTION PROCESS ARE THE ENEMY. IF PROPERLY INSTALLED, AND NOT COMPROMISED, THE VAPOR BARRIER DOES ITS JOB.

***SLAB REINFORCEMENT**_(CONDITIONAL-DOES NOT SHOW) REINFORCEMENT IN A SLAB MAY SERVE A STRUCTURAL AND OR SHRINKAGE CONTROL PURPOSE, BUT ALSO MAY NOT BE NEEDED. (c4)



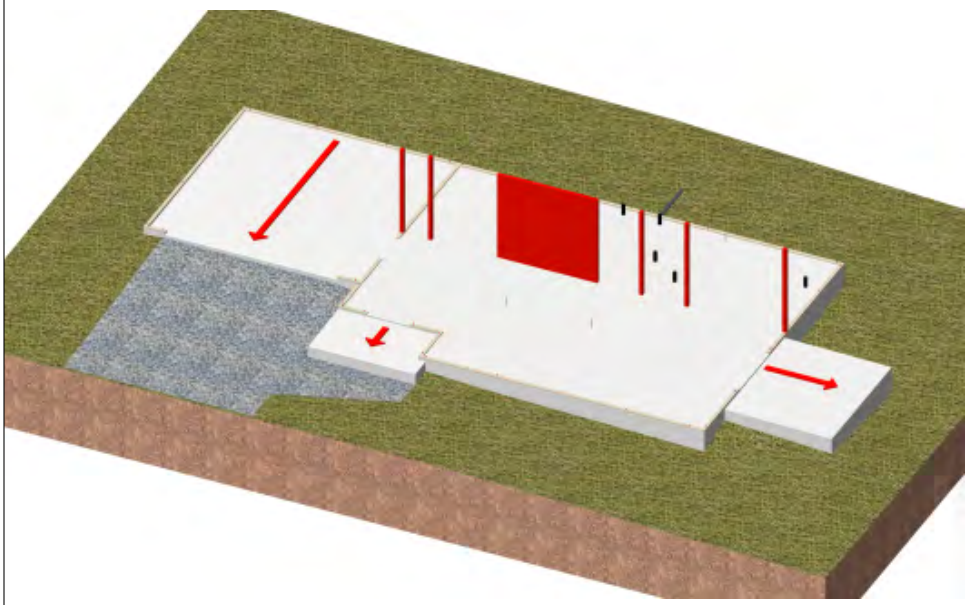
THE CONCRETE POUR

***THE CONCRETE**_A 2500 OR 3000 PSI CONCRETE IS A COMMON MIX FOR THIS INSTALLATION. BECUSE OF THE SINGLE POUR THE MIX HAS TO BE SELECTED TO MEET THE MOST STRINGENT REQUIREMENT (E.G. THE GARAGE SLAB)

***ANCHORS**_ANY REQUIRED PERIMETER ANCHORS THAT WILL BE POSITIVELY ATTACHING THE FRAME WALL TO THE SLAB WILL BE EMBEDDED IN THE CONCRETE AS IT IS SETING UP.

***PITCH**_THE INSTALLERS WILL SCREED THE POUR TO ESTABLISH THE SPECIFIED PITCHES FOR THE 3 ADJUNCT SLABS

***FINISH & SHRINKAGE CRACKING CONTROL**_SEE THE FLOORING SECTION. (c4.5)



EXTERIOR INSULATION-THE SLAB EDGE

***THE DEVIL**_THE SLAB EDGE-IN THIS CONSTRUCTION-IS REALLY ANY CONCRETE THAT IS ABOVE GRADE UP TO THE TOP OF SLAB. IT WILL CONDUCT HEAT IN OR HEAT OUT QUICKLY. SO 'SLAB EDGE' INSULATION IS REQUIRED OR DESIRED IN SUPER HOT CLIMATES, AND ALL MODERATE TO COLD CLIMATES.

***THE INSULATION**_RIGID BOARD INSULATION IS THE TYPICAL PRODUCT AND ADHERED TO THE OUTSIDE FACE OF CONCRETE AFTER THE FORMS ARE REMOVED. PROTECTING THE INSULATION FROM DAMAGE, AND IN SOME REGIONS A REQUIRED TERMITE INSPECTION GAP, MAKE THIS INSTALLATION A LITTLE TRICKY AND A LITTLE COMPROMISED.

FINAL GRADE

***BUILDING PAD**_GRADE CAN BE PUSHED AROUND A BIT AFTER ALL CONCRETE IS IN PLACE . SITE DRAINAGE AND MAINTAINING THE FROST DEPTH REQUIREMENT ARE THE 2 ESSENTIALS.

STRUCTURAL GRAPHIC

***RED WALLS**_BEARING WALL AND POINT LOADS SHOW THIS 3D GRAPHIC. THESE LOADS ARE HANDLED WITH THE FOOTING/FOUNDATION PERIMETER AND THE HAUNCH SLAB

SLAB ON GRADE WITH INTEGRAL FOOTING 3

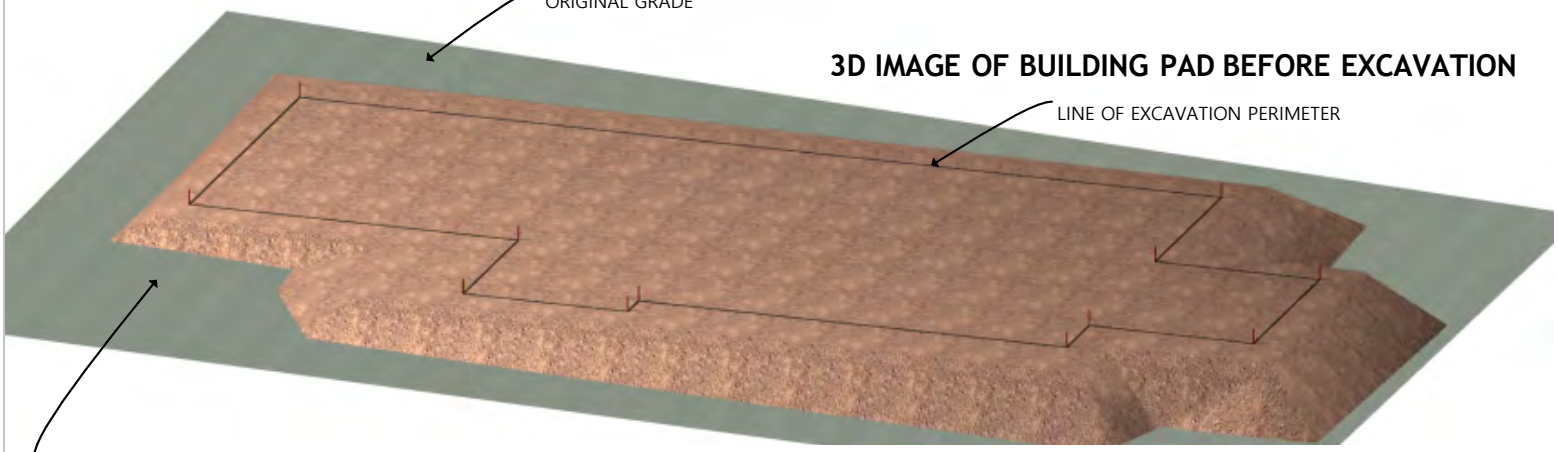
HIGH END
*This slab on grade construction must be all above grade.
*This high side needs enough fill to get the projected finish slab above final grade.

PROFILE OF BUILDING PAD BEFORE EXCAVATION

ORIGINAL GRADE

3D IMAGE OF BUILDING PAD BEFORE EXCAVATION

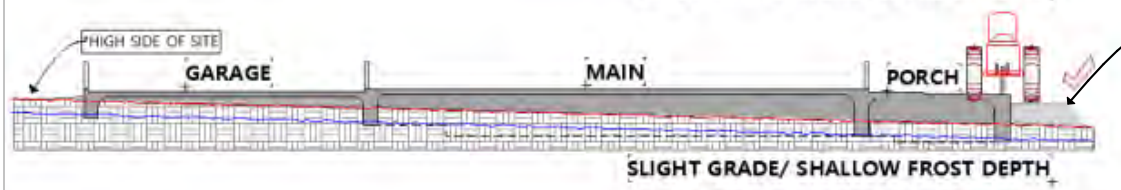
LINE OF EXCAVATION PERIMETER



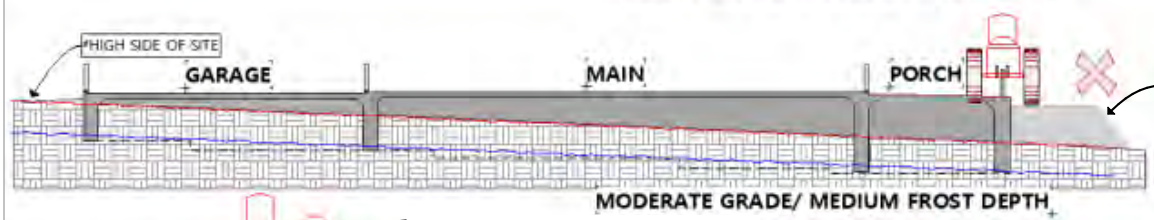
BUILDING PAD PREP
*This construction is very common in low rise commercial projects. There may be many building and parking 'pads'. Large equipment pushes (and compacts) fill into place. A new building site is created. Then the required excavation begins.
*For single small residential projects this site prep work has a cost break point wherein a stem wall construction may be more cost effective. Grade differential over the building area translates directly into fill volume and cost to truck and install. This sample illustration would require about 200 cubic yards of fill, or 20 truck loads. And it needs to be compacted.

THE IDEA OF DIFFERENTIAL SETTLEMENT
*Any building produces different loads needing to be resisted by the footing construction and soil beneath. There are heavier uniform perimeter loads, lighter uniform perimeter loads, point loads that are more concentrated, and even light loads across a slab. These different loading conditions are represented in these exercises, and are very typical.
*Structures do 'settle', or sink into the ground--even properly constructed ones. The science of that settlement is discussed a bit along with the footing stuff (c2). The concept here is to ensure the settlement is uniform. When settlement is not uniform then shear problems and consequent cracks in the construction can occur.
*Building design that understands the soil that supports everything certainly has a much better chance of staying out of trouble. Uniform soil bearing is the best defense. Hence these exercises continually refer to compacted or engineered soil, which is (should be) uniform. Loose non compacted soil, if built on, will allow differential settlement and subsequent problems.

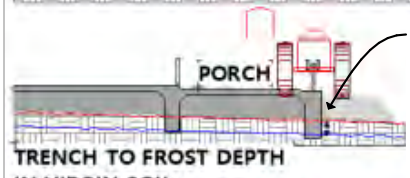
VERY COST EFFECTIVE
*A level site allow the backhoe to get right to work with simple perimeter trenches, and interior trenches as needed.
*A gravel sub base can be installed after that excavation.



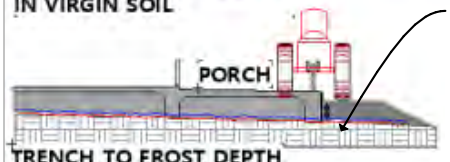
STILL COST EFFECTIVE
*A filled and compacted level site allows the backhoe to get to work with simple perimeter trenches, and interior trenches as needed.
*Good compacted fill with limited stone (chunks) allows that clean dig which assists everything going forward.
*The backhoe needs to function off reasonably level ground, hence the required overfill beyond edge of slab.



NOT COST EFFECTIVE
*Extensive site fill starts to break the cost efficiency rules of the this integral system. Structural fill is costed by volume and the number of lifts that each require compaction.



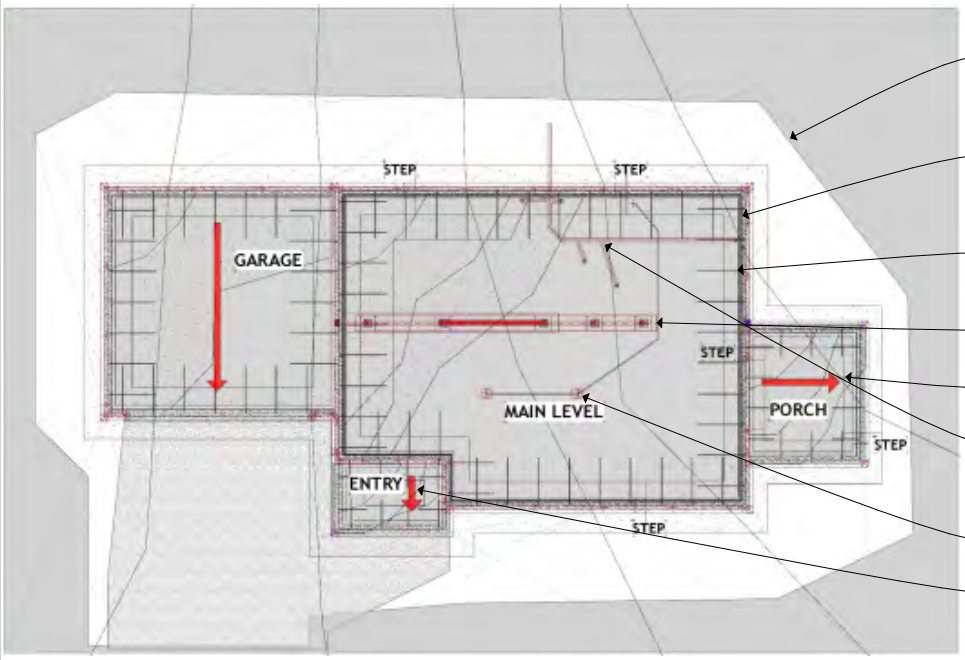
VIRGIN FROST DEPTH
*Conventional frost depth needs to be honored if either the engineered pad is structurally questionable or the pad outside the perimeter will be lowered/altered/removed after the pour.



ENGINEERED FROST DEPTH
*Measured from the surface at grade to the bottom of the dig.
*If the pad is prepped properly, and the pad outside the perimeter is left in place, then the dig depth can be measured from that pad.

WHY THE ELEVATED LEVEL BUILDING PAD
*The backhoe can dig the foundation trenches before the required fill for a site is installed but the following challenges exist-
*Compacting fill close to a vertical plane will either collapse the trench, or need to be angled back further and further with each lift resulting in an excessive amount of concrete to fill the trench space.
*More concrete required to fill the 'angle void' from the fill will increase lateral pressure on the perimeter forms and require a more robust form construction.

SLAB WITH STEM WALL FOUNDATION 1



PLAN NOTES

SITE CLEARING
*Ground cover, top soil is cleared around the excavation target. Perimter access, good drainage-mud management is important.
*Local requirements likely exist.

THE FOOTING
*Footings will show as a line (only) each side of the foundation walls. The 'projection' of the footing is the distance outside each face of foundation wall to the edges of footing.

THE FOUNDATION OR STEM WALL
*Surrounding all components this exercise with a 'pocket' for the slab floor to sit on.

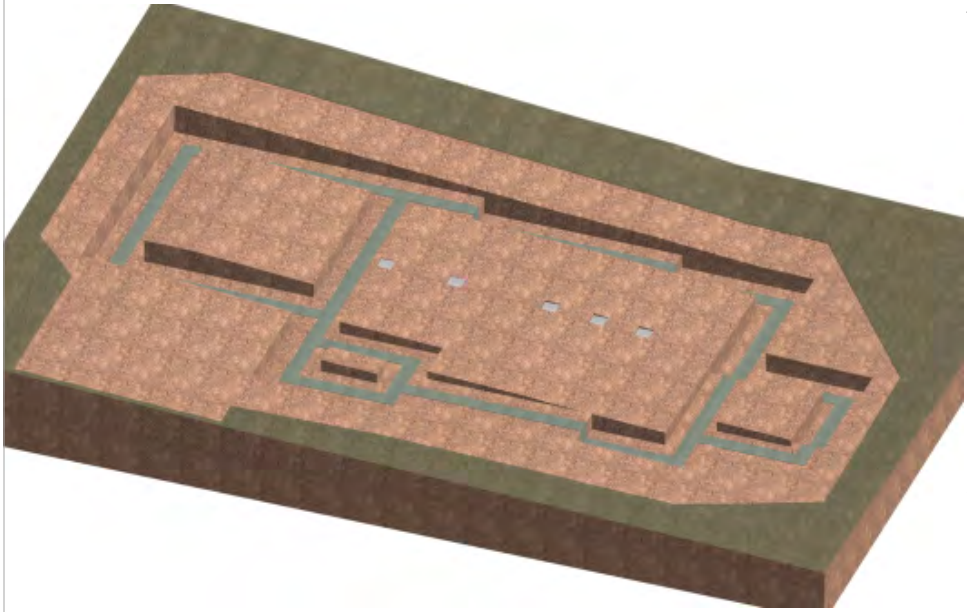
CENTER SUPPORT PIERS
*Located under the bearing line & haunch slab above.

FOUNDATION INTO SLAB REINFORCEMENT
*Bent rebar from foundation wall into slab at perimeter.

PLUMBING
*Reference the design plan. Exact locations need to be predetermined as all drain lines need code compliant installation before the slab is poured.

ELECTRIC IN SLAB
*This design needs floor outlets to serve living area furniture

PITCH SLABS FOR DRAINAGE
*Garage, entry, and porch slabs need to be pitched away from the house for water drainage.



EXCAVATION

***SURFACE PREP**_CONSTRUCTION AREA IS SCRAPED BELOW SOFT/TOP SPOIL

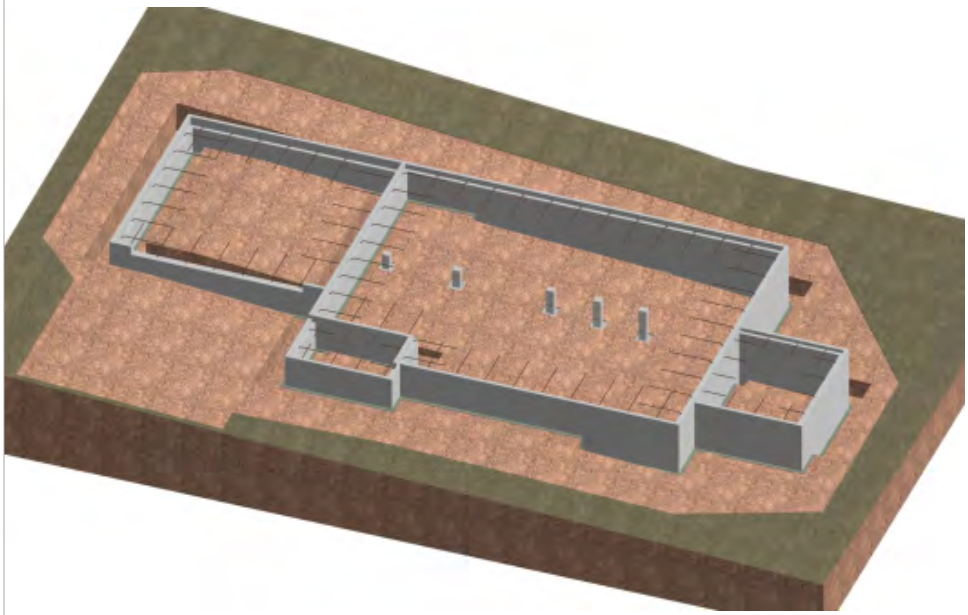
***PREP DIG**_FOLLOWS FOOTING LAYOUT AND FROST DEPTH ELEVATION REQUIREMENTS AND STEPPED FOOTINGS. THIS DIG CREATES ENOUGH SPACE ON ONE OR BOTH SIDES OF FOOTING FOR WORK SPACE AS REQUIRED DEPENDING ON THE FOUNDATION WALL TYPE, DEPTH OF DIG, AND ANY FOUNDATION DRAINAGE.

***TRENCH POUR FOOTING DIG**_THIS ACCURATE CUT USES A BACKHOE BUCKET SIZE APPROPRIATE TO THE PROPOSED FOOTING WIDTH AND IS CUT AS CLEANLY AND CAREFULLY AS POSSIBLE AT THE SPECIFIED FOOTING DEPTH.

***REINFORCEMENT SET**_ANY REINFORCEMENT IS SET IN THE FOOTING TRENCH

***FOOTING POUR**_TRENCH IS POURED WITH FOOTING CONCRETE USUALLY TO ELEVATION CONTROL STAKES. THE TOP OF THE POUR NEEDS TO BE PRETTY LEVEL OR FOUNDATION WALLS WILL HAVE TO WORK HARD TO GET LEVEL.

***TRENCH POUR NOTE**_A TRENCH POUR AVOIDS THE EXPENSE OF LAYING OUT FORMS. IT REQUIRES SOIL THAT CAN BE CUT CLEAN AND HOLD THE SIDE WALLS, AND A GOOD EXCAVATOR.



FOUNDATION WALL

***POINTS**_A SURVEYOR WILL VERY EXACTLY LOCATE THE FOUNDATION CORNERS AND MARK THEM ON THE TOP OF THE FOOTING.

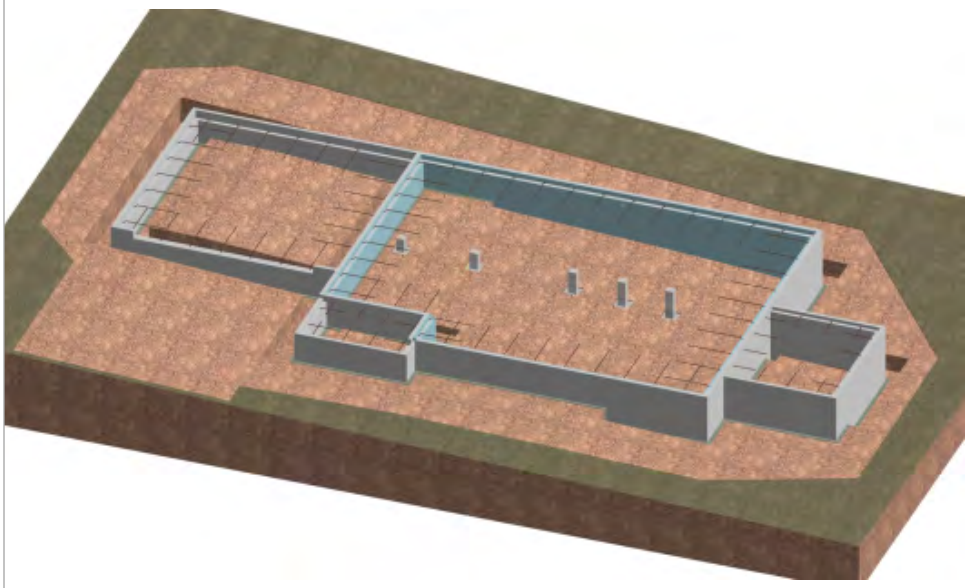
***MATERIAL STAGING**_THE PREP DIG WILL HAVE ALLOWED SPACE TO STAGE MATERIALS, FORMS, AND ROOM TO WORK.

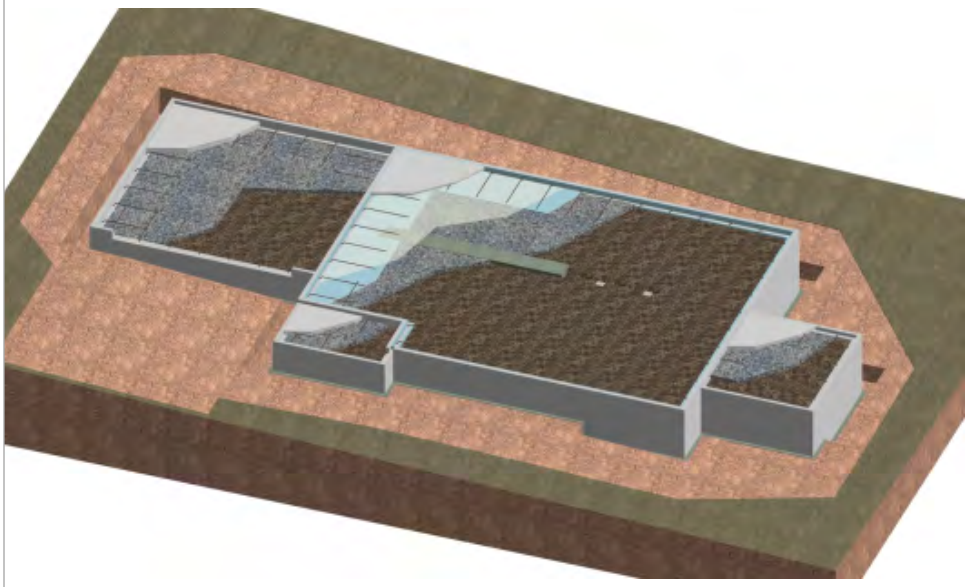
***FOUNDATION WALLS**_WALLS ARE CONSTRUCTED OR FORMED AND POURED. THIS DESIGN IS ELECTING TO BUILD THE ENTRY AND SIDE PORCH WITH THE SAME CONSTRUCTION AS THE HOUSE AND GARAGE. THE TOP OF WALL DETAIL IS ALSO THE SAME- CONSTRUCTING A POCKET TO SIT THE SLAB ON. THE HEIGHTS OF TOP OF WALL AND THE POCKET DEPTHS NEED TO BE ALL THOUGHT OUT.

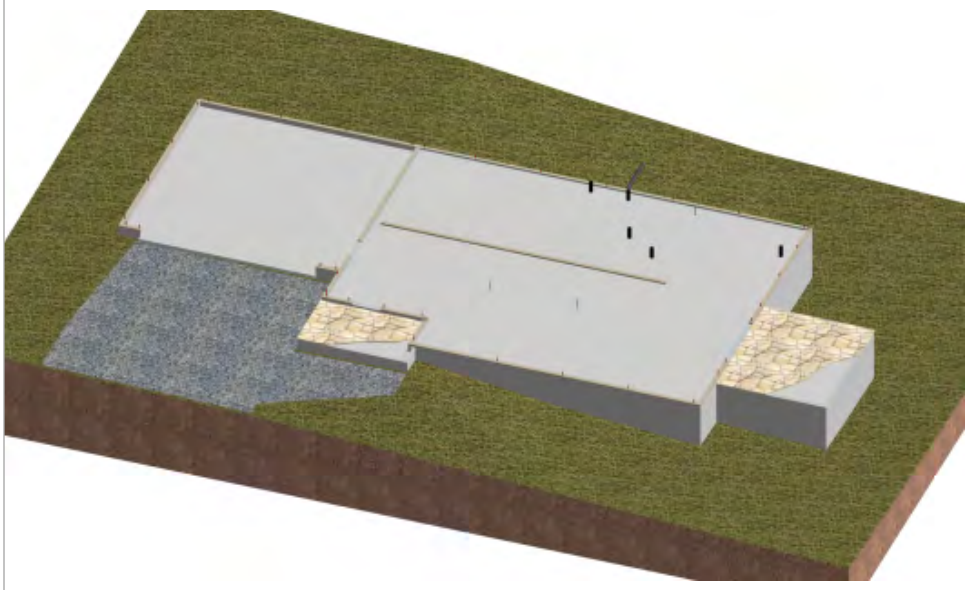
***REINFORCEMENT SET**_THIS IS SHOWING BENT REBAR (AT 2'-8" CENTERS) ALL THE WAY AROUND TO TIE INTO THE CONCRETE SLABS.

***CENTER PIERS**_(CONDITIONAL). THESE PIERS SIT UNDER THE CENTER BEARING REQUIREMENTS AND HAUNCH SLAB, AND WILL ENSURE THE SAME RESISTANCE TO LOAD AS THE PERIMETER WALS. **IF** THIS BIG HOLE GETS PROPERLY BACKFILLED THIS PIER PRECAUTION IS NOT NECESSARILY REQUIRED.

SLAB WITH STEM WALL FOUNDATION 2







INSULATION

***INSIDE THE FOUNDATION WALLS_**THIS IS ONE OPTION FOR INSULATING STEM FOUNDATION WALLS. RIGID INSULATION IS PLACED AGAINST THE INSIDE OF THE WALL DOWN TO THE FOUNDATION.

***FILL PLACEMENT_**CONTROLLED AND COMPACTABLE FILL CAN BE PLACED WITHOUT DAMAGING RIGID INSULATION AND THE INSULATION IS PERMANENTLY FIXED IN PLACE.

***OTHER OPTIONS_**(RIGID) INSULATION CAN ALTERNATIVLY BE PLACED ON THE OUTSIDE OF THE FOUNDATION WALLS OR UNDER THE SLAB (BELOW). CRITERION FOR BEST LOCATION IS PROJECT SPECIFIC.

***INSIDE THE SLAB POCKET_**THIS SLAB POCKET CONSTRUCTION ALSO ALLOWS RIGID INSULATION ON THE BOTTOM AND OUTSIDE FACE OF THE POCKET. THIS IS THE 'THERMAL BREAK'. THE CONCRETE SLAB IS PROTECTED FROM DIRECT CONTACT WITH EXTERIOR WEATHER. THIS DETAIL IS IMPORTANT AND EFFECTIVE, AND CANNOT BE DONE WITH THE INTEGRAL POUR.

STRUCTURAL FILL & BACKFILL

***FILL EM UP_**THE STEM FOUNDATION WALLS BECOME RETAINING WALLS AND CAN BE FILLED WITH EARTH AND OR GRAVEL UP TO THE PROPOSED SLAB ELEVATIONS. THERE ARE MANY CAUTIONS ABOUT THIS FILL PROCEDURE ASSUMING THE PRECAUTIONS ARE HEEDED, THE FOUNDATION STEM WALLS NEED TO BE STRUCTURED TO HANDLE THE SOIL PRESSURE PUSHING FROM THE INSIDE. THE PIVOTAL CRITERION IS THE 'DIFFERENTIAL FILL' WHICH IS THE HEIGHT DIFFERENCE FROM EARTH OR SOIL ON ONE SIDE OF THE WALL TO THE OTHER SIDE OF THE WALL. IN THIS STEM WALL CONSTRUCTION THE PRESSURE IS FROM THE INSIDE OUT. (c2.12)

***BENT REBAR_**THE BENT REBAR SHOWS THIS DESIGN EXAMPLE IS NOT NECESSARILY REQUIRED, HOWEVER IT DOES PERFORM 2 VALUABLE STRUCTURAL FUNCTIONS. WHEN THE SLAB IS POURED AND CAPTURES THE BAR THAT HAS BEEN BENT OVER HORIZONTALLY, THE WALLS AND SLAB ARE TIED TOGETHER. THE SLAB IS BEING USED TO 'PULL BACK' ON THE PRESSURE ON THE WALL. THE TOP OF THE WALL IS MOST SUSPECT AND THAT IS WHERE THIS RESISTANCE IS MOST EFFECTIVE. THE SECOND STRUCTURAL FUNCTION IS KEEPING THE SLAB 'STRUCTURED' AT THE INSIDE PERIMETER WHERE THE THERE IS ALWAYS FILL- THE DEEPEST FILL. (c2.19)

***HAUNCH PIERS_**THE HAUNCH SLAB PARTIALLY SHOWS HERE SITTING ON THE CENTER PIERS. THE HAUNCH ALONE WOULD BE FINE IF IT IS SITTING ON PROPERLY COMPACTED SOIL. BUT THE HAUNCH -WHICH IS AN INTEGRAL FOOTING- IS ONLY AS GOOD AS THE SOIL IT IS SITING ON. THE PIERS RUN DOWN TO VIRGIN SOIL SO ARE AS SOLID AS THE PERIMETER FOUNDATION.

SLAB POUR

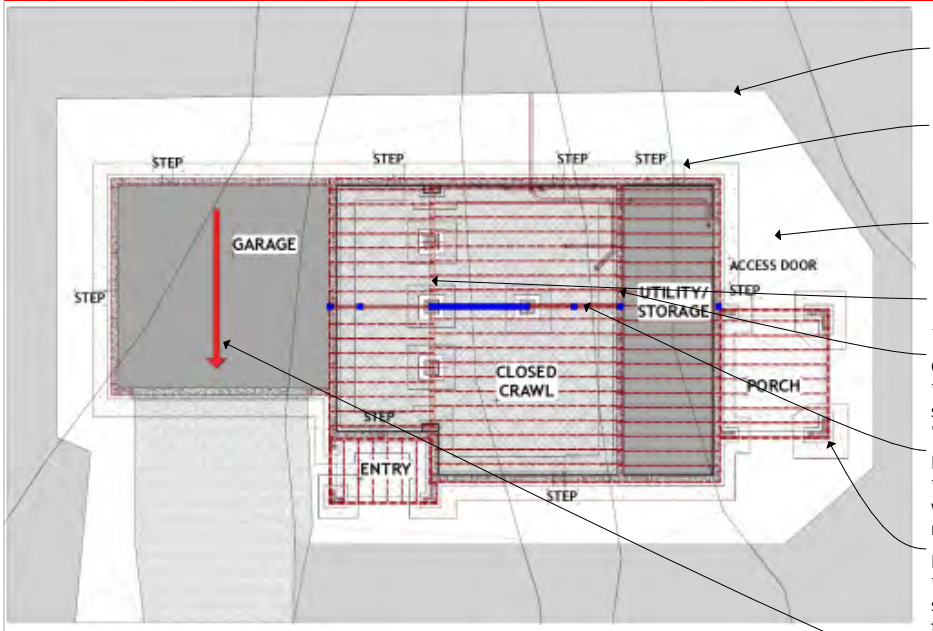
***SEE (c4)_**FOR SLAB THINKING AND OPTIONS.

***HOUSE SLAB_**IS FLAT.

***THE PORCH SURFACES_**IF THE SLABS ON THESE PORCHES SIT IN THE WALL POCKETS FLUSH WITH THE TOP OF THE FOUNDATION WALL THEN A CROWNED SLAB PITCHING TO 3 PERIMETER WALLS IS AN OPTION. IF THE SLABS SIT FULLY ON THE FOUNDATION WALL THEN THE SLAB CAN HAVE A 1 WAY PITCH.

***GARAGE_** USUALLY WILL SIT INSIDE THE FOUNDATION WALL AND BE PITCHED TO THE GARAGE DOOR.

CRAWL SPACE FOUNDATION 1



PLAN NOTES

SITE CLEARING
*Ground cover, top soil is cleared around the excavation target.
*Remember the construction area needs to drain-

THE CONTINUOUS (STEPPED) FOOTING
*Footings will show as a line (only) each side of the foundation walls. the 'projection' of the footing is the distance outside each face of foundation wall.

THE FOUNDATION WALL
*This concrete or concrete block foundation sets on the stepped footing and built up to predetermined elevations.

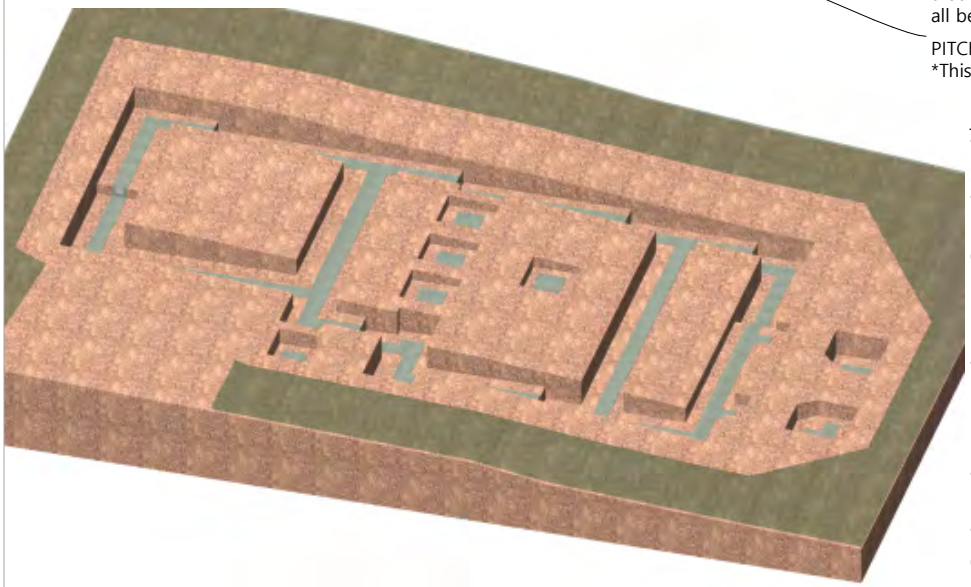
SUPPORT PIERS & GIRDER
*This is a conventional bearing line supporting the main floor floor joists.

CRAWL SPACE RETAINING WALL & GIRDER
*This design is showing a higher conventional crawl space, and a lower storage area that is leveled out with a gravel floor. An internal low 'retaining' wall is showing that manages the grade differential.

FLUSH LOAD BEARING LINE
*This center bearing line is handled with a double or triple floor joist flush with the floor and supported at 4 points. There is one (additional) pier required.

PORCH CORNER PIERS
*This design uses the same footing and foundation construction to support the porch beams and joists. A convenience to this approach is that all the foundation work and subsequent floor and porch framing can all be done at the same time.

PITCH GARAGE SLAB FOR DRAINAGE
*This garage slab is 'floating' below the top of foundation.



EXCAVATION & FOOTING

***SURFACE PREP**_CONSTRUCTION AREA IS SCRAPED BELOW SOFT/TOP SPOIL

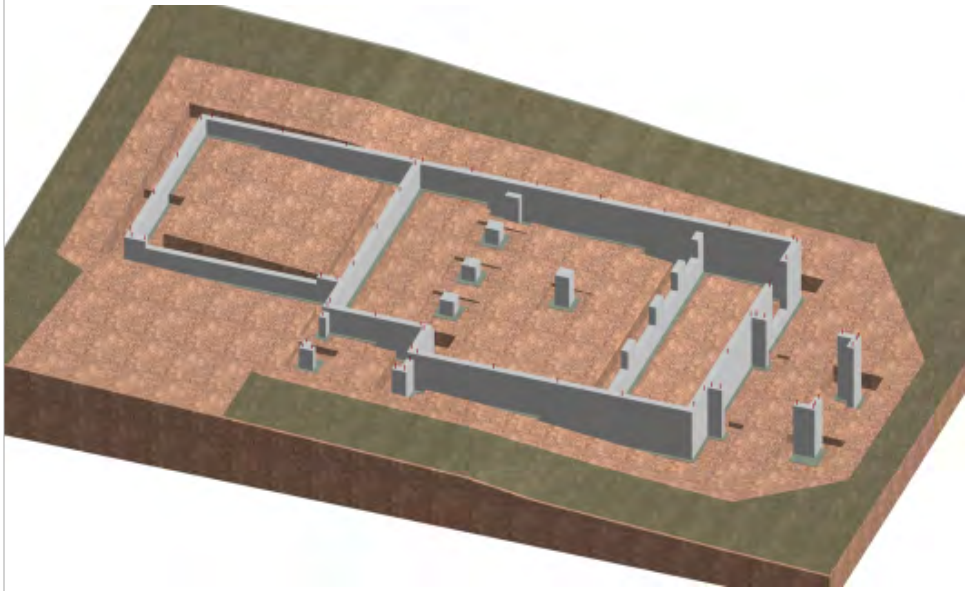
***PREP DIG**_FOLLOWS FOOTING LAYOUT AND FROST DEPTH ELEVATION REQUIREMENTS AND STEPPED FOOTINGS. THIS DIG CREATES ENOUGH SPACE ON ONE OR BOTH SIDES OF FOOTING FOR WORK SPACE AS REQUIRED DEPENDING ON THE FOUNDATION WALL TYPE, DEPTH OF DIG, AND ANY FOUNDATION DRAINAGE.

***TRENCH POUR FOOTING DIG**_THIS ACCURATE CUT USES A BACKHOE BUCKET SIZE APPROPRIATE TO THE PROPOSED FOOTING WIDTH AND IS CUT AS CLEANLY AND CAREFULLY AS POSSIBLE AT THE SPECIFIED FOOTING DEPTH.

***REINFORCEMENT SET**_ANY REINFORCEMENT IS SET IN THE FOOTING TRENCH

***FOOTING POUR**_TRENCH IS POURED WITH FOOTING CONCRETE USUALLY TO ELEVATION CONTROL STAKES. THE TOP OF THE POUR NEEDS TO BE PRETTY LEVEL OR FOUNDATION WALLS WILL HAVE TO WORK HARD TO GET LEVEL.

***TRENCH POUR NOTE**_A TRENCH POUR AVOIDS THE EXPENSE OF LAYING OUT FORMS. IT REQUIRES SOIL THAT CAN BE CUT CLEAN AND HOLD THE SIDE WALLS, AND A GOOD EXCAVATOR.



FOUNDATION WALL

***POINTS**_A SURVEYOR WILL VERY EXACTLY LOCATE THE FOUNDATION CORNERS AND MARK THEM ON THE TOP OF THE FOOTING.

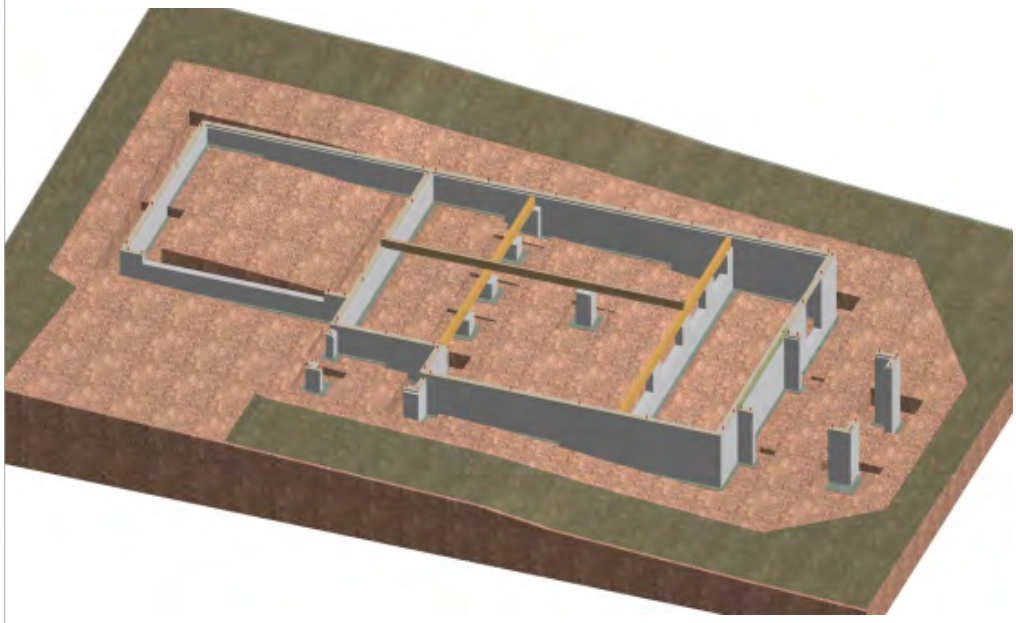
***MATERIAL STAGING**_THE PREP DIG WILL HAVE ALLOWED SPACE TO STAGE MATERIALS, FORMS, AND ROOM TO WORK.

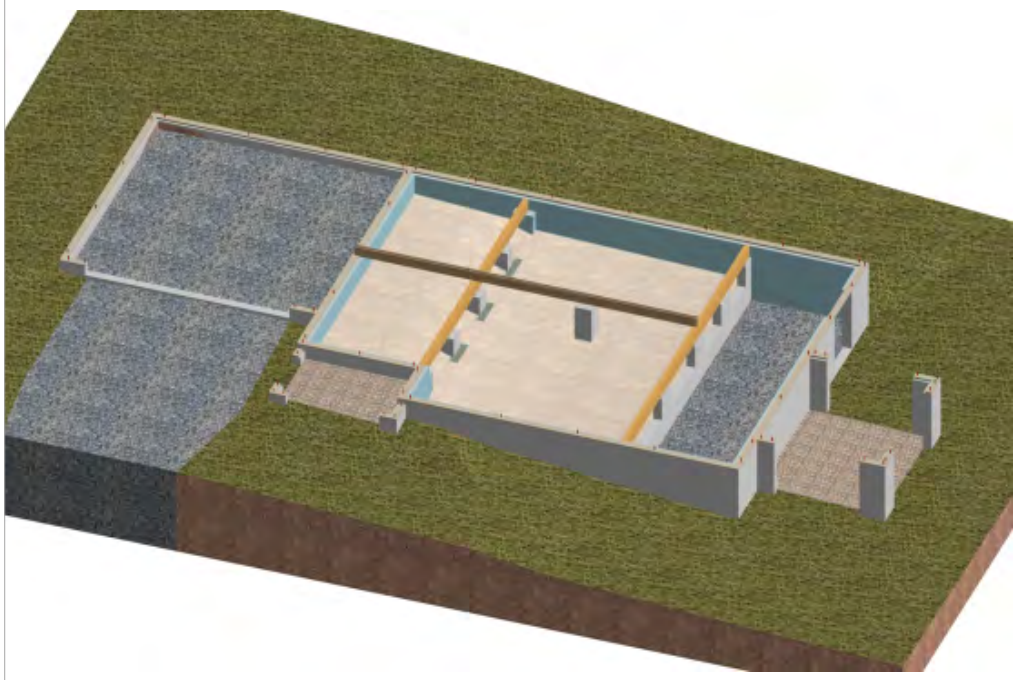
***FOUNDATION WALLS**_WALLS ARE CONSTRUCTED OR FORMED AND POURED. THIS DESIGN IS ELECTING TO BUILD THE ENTRY AND SIDE PORCH WITH THE SAME CONSTRUCTION AS THE HOUSE AND GARAGE. THE TOP OF WALLS ARE FLAT. EACH 'TOP OF WALL' HEIGHT IS SET ACCORDING TO THE PLANNED CONSTRUCTION FOR EACH OF THE 3 ADJUNCT FUNCTIONS. THEY MAY BE ALL THE SAME OR ALL DIFFERENT.

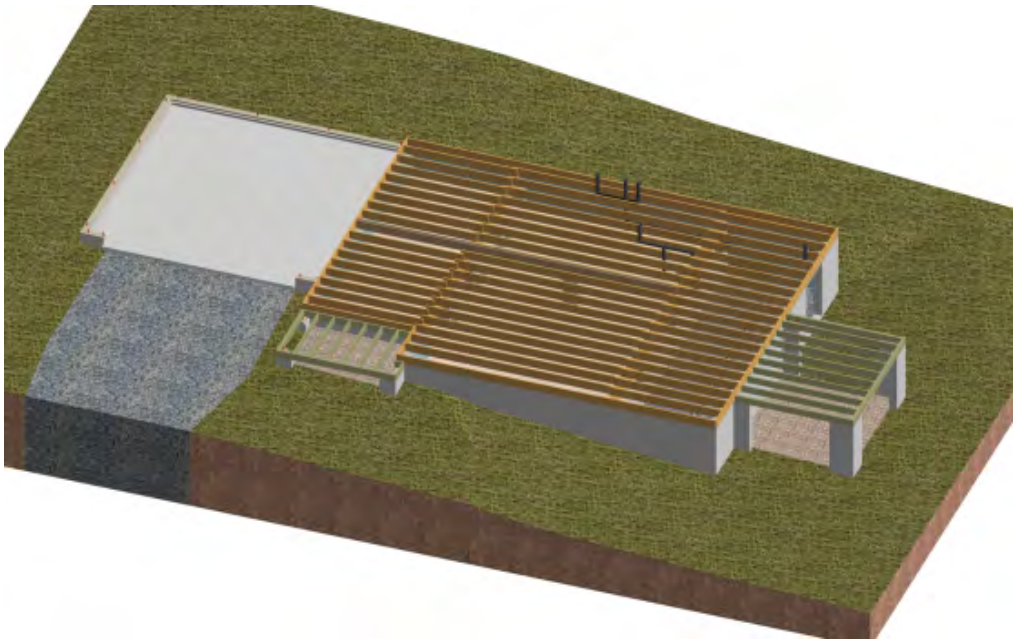
***ANCHORS SET**_THIS IS SHOWING STANDARD ANCHOR BOLTS SET IN THE TOP OF WALL FOR HOUSE, GARAGE, AND PORCHES.

***SUPPORT PIERS**_THERE ARE 3 VARIATIONS REQUIRED THIS DESIGN. THERE IS A STANDARD PIER LINE THAT WILL SUPPORT A (DROP) GIRDER. THERE IS ONE POINT LOAD PIER THAT SITS A LITTLE HIGHER TO DIRECTLY SUPPORT A BEEFED UP FLOOR JOIST. AND THERE IS A COMBO RETAINING WALL WITH INTEGRATED SUPPORTS FOR A SECOND GIRDER SUPPORT LINE.

CRAWL SPACE FOUNDATION 2







FRAMING PREP

***PLATES_**THE PERIMETER PLATES NEED TO BE FIRST INSTALLED. THE 2X6 (TYPICAL) IS MARKED AND DRILLED AT THE ALREADY SET BOLT LOCATIONS AND BOLTED DOWN TO THE TOP OF FOUNDATION.
***GIRDERS_**THIS EXERCISE IS SHOWING FRONT TO BACK (DROP) GIRDERS. DROP MEANING THEY ARE BELOW THE FLOOR JOISTS. THESE ARE SUPPORTING THE MAIN FLOOR JOISTS (ONLY). THIS SPACING AND LOADING MAY REQUIRE A TRIPLE 2X10 WHICH IS PRETTY STANDARD.
***'FLUSH' SUPPORT LINE_**THE LEFT TO RIGHT MEMBER SHOWING IS A MULTI-PLY JOIST FLUSH WITH THE FLOOR THAT WILL BE SUPPORTING THE MAIN FLOOR CENTER BEARING WALL. THIS IS A SUPPORT 'BEAM' FUNCTION THAT REQUIRES CALCULATION.

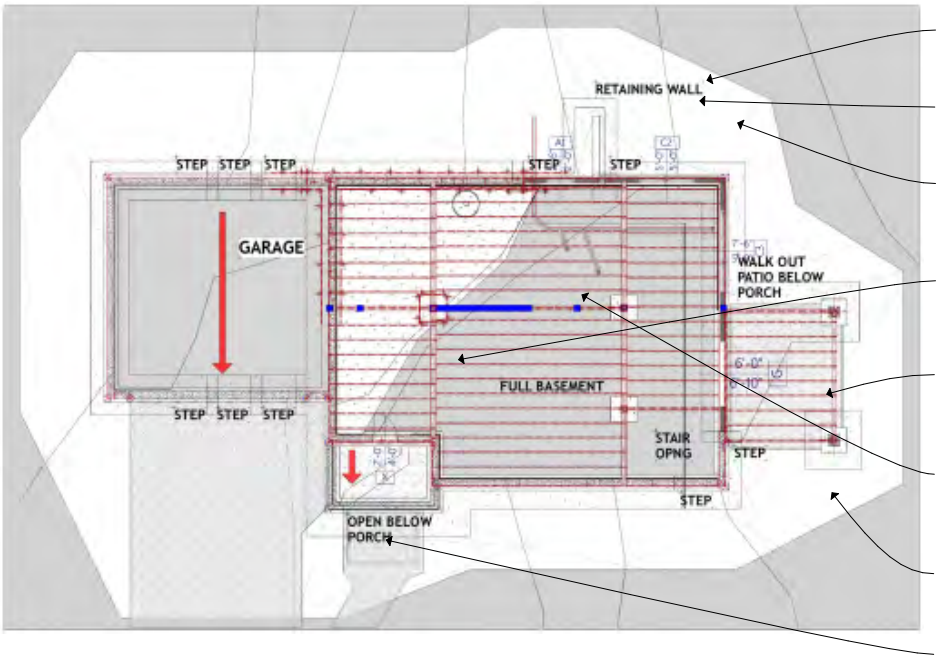
SURFACING PREPS

***CLOSED CRAWL PREP_** PERIMETER RIGID INSULATION IS INSTALLED INSIDE THE FOUNDATION WALL (DOWN TO THE TOP OF FOOTING IN MODERATE & COLD CLIMATES). THEN THE INTERIOR GROUND SURFACES ARE CLEANED UP, GRADED, SLOPED. THEN A (SERIOUS) VAPOR BARRIER IS INSTALLED. IN THE STORAGE/UTILITY AREA A PEA GRAVEL MAY BE INSTALLED OVER THE VAPOR BARRIER THAT WOULD NOT BE PRONE TO PUNCTURE IT- OR A "MUD' SLAB COULD BE POURED (WHEN THE GARAGE SLAB IS POURED).
***GARAGE PREP_**ALTHOUGH NOT ALWAYS REQUIRED A SUB BASE IS SHOWING HERE UNDER THE GARAGE SLAB TO SET ELEVATION, LEVEL, AND OFFER THE MOISTURE MIGRATION PROTECTION FOR THE GARAGE.
***OUTSIDE BACKFILL & FINAL SITE PREP_**THIS IMAGE IS SUGGESTING THE EXTERIOR BACKFILL IS BEING DONE BEFORE THE FLOOR IS FRAMED. THAT MAY OR MAY NOT BE THE CASE. ANY FOUNDATION WATERPROOFING/DAMPROOFING, AND OR MECHANICAL DRAINAGE NEEDS COMPLETION BEFORE BACKFILLING TO THE FOUNDATION WALL CAN BE DONE. IT IS ALSO A CONDITION OF (TALLER) FOUNDATION WALLS THAT THE FLOOR FRAMING SHOULD BE DONE FIRST (TYPICAL WITH BASEMENTS) TO HELP BRACE THE FOUNDATION WALLS AND RESIST THE EARTH PRESSURE OF THE BACKFILLING ITSELF. IN THIS CRAWL SPACE EXAMPLE THERE IS LITTLE DIFFERENCE IN BACKFILL HT INSIDE TO OUTSIDE (THE DIFFERENTIAL FILL) SO THIS IS NOT A STRUCTURAL ISSUE. HAVING THE EXTERIOR BACKFILLED EARLIER DOES MAKE WORKING AROUND THE SITE EASIER.

FLOORS

***MAIN FLOOR_**STANDARD FRAMING WITH 2X10 0R 2X12 FLOOR JOISTS SITTING ATOP THE DROP GIRDERS.
***PORCHES_**THIS EXERCISE IS SHOWING STANDARD FRAMING (2X8 OR 2X10) FOR THESE DECK/PORCHES. TREATED LUMBER IS THE TYPICAL CHOICE. THIS FRAMING MIGHT BE ONLY A FEW INCHES BELOW THE MAIN FLOOR FRAMING- OR IN SNOW ENVIRONMENTS A FULL STEP OR TWO.
***GARAGE SLAB_**THE GARAGE SLAB (PITCHED TO THE DOOR) IS 'FLOATING' MEANING IT IS SITTING ON GRADE WITHOUT BEING MECHANICALLY TIED TO THE FOUNDATION WALL. IF THE GRADE IS PREPPED/COMPACTED PROPERLY THIS IS NOT A PROBLEM.

BASEMENT FOUNDATION 2



PLAN NOTES

SITE CLEARING
*Ground cover, top soil is cleared around the excavation target.
*Remember the construction area needs to drain-

THE CONTINUOUS (STEPPED) FOOTING
*Footings steps between garage foundation and basement might face a big elevationchange. (c2.20)

THE FOUNDATION WALL
*This concrete or concrete block foundation sets on the stepped footing and built up to predetermined elevations. Above grade walls are 'hybrid' this design to facilitate the door and window install.

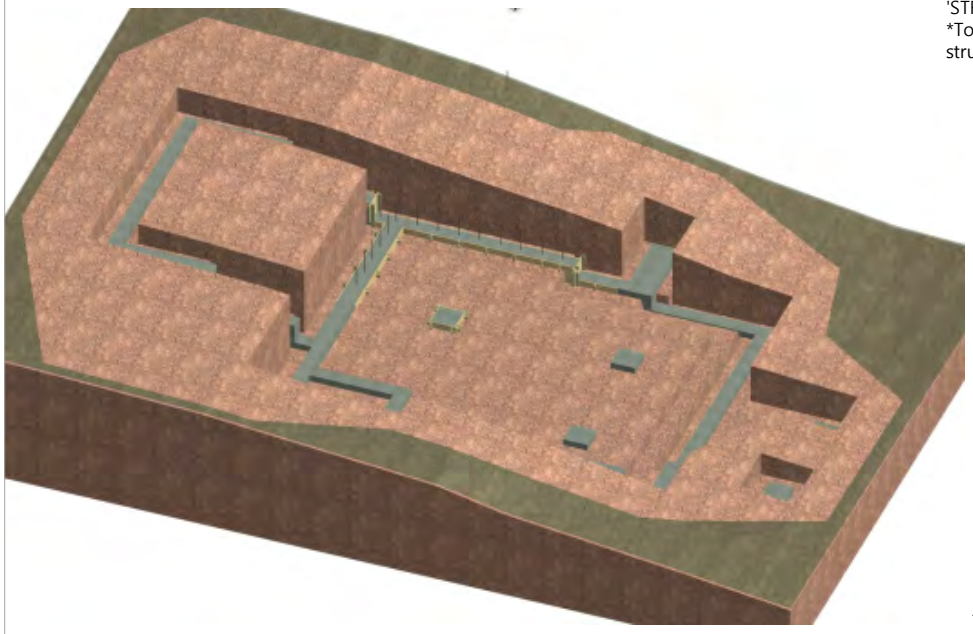
STEEL POST & BEAM
*2 bearing lines supporting the main floor floor joists. Showing are steel pipe columns and pretty small beams above carrying the floor joists. Steel is space efficient for sure.

THE BASEMENT SLAB
*This is a full slab for the entire basement area. This might be poured early with steel posts installed on the slab, or poured after steel and floor are in so weather protection for the slab pour is possible.

BASEMENT WALK OUT
*These 2 basement hybrid walls with concrete or concrete block construction to grade or above grade, and frame walls up to the main floor framing. (c2.16). Frame walls are sympathetic to window

PORCH CORNER PIERS & POSTS
*This design shows footing and masonty piers to,above grade and steel posts up to support the treated lumber floor framing. (c2.15)

'STRUCTURED' CONCRETE FRONT PORCH
*To avoid using a lot of fill inside the porch foundation perimeter a structured slab can span across. (c4.3)



EXCAVATION & FOOTING

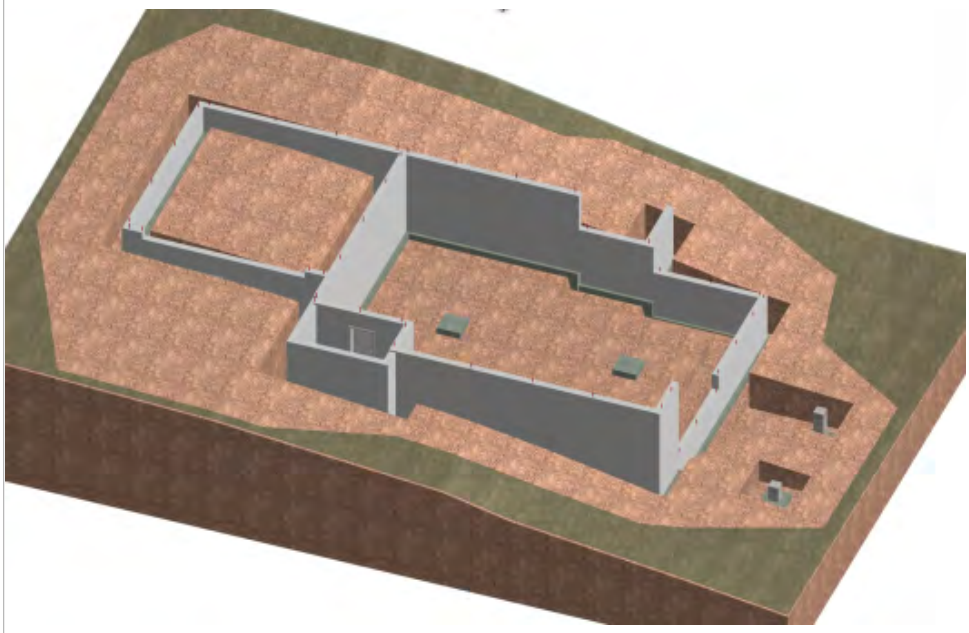
***SURFACE PREP**_CONSTRUCTION AREA IS SCRAPED BELOW SOFT/TOP SPOIL

***BIGGER DIG**_THIS ALSO FOLLOWS FOOTING LAYOUT AND FROST DEPTH ELEVATION REQUIREMENTS AND STEPPED FOOTINGS, AND THE BASEMENT SLAB. THIS DIG CREATES ENOUGH SPACE ON BOTH SIDES OF FOOTING FOR WORK SPACE. THE BASEMENT (INTERIOR) SIDE WILL HAVE PLENTY OF SPACE

***FORMED FOOTINGS**_GENERALLY SMART TO FORM BASEMENT FOOTINGS. WITH THE DEEPER DIG THE TRENCH POUR FOOTING PROCESS IS DIFFICULT.

***REINFORCEMENT SET**_ANY REINFORCEMENT IS SET IN THE FOOTING FORMS.

***FOOTING POUR**_MOST OF THIS WORK IS IN THE FORMING. IF PROPERLY LAYED OUT WITH SOLID STEP FORMS THEN FILL EM UP. CONCRETE NEEDS TO BE JIGGLED TO GET ANY AIR OUT & SCREEDED OFF TO TOP OF (LEVEL) FORMS.



FOUNDATION WALL

***POINTS**_A SURVEYOR WILL VERY EXACTLY LOCATE THE FOUNDATION CORNERS AND MARK THEM ON THE TOP OF THE FOOTING.

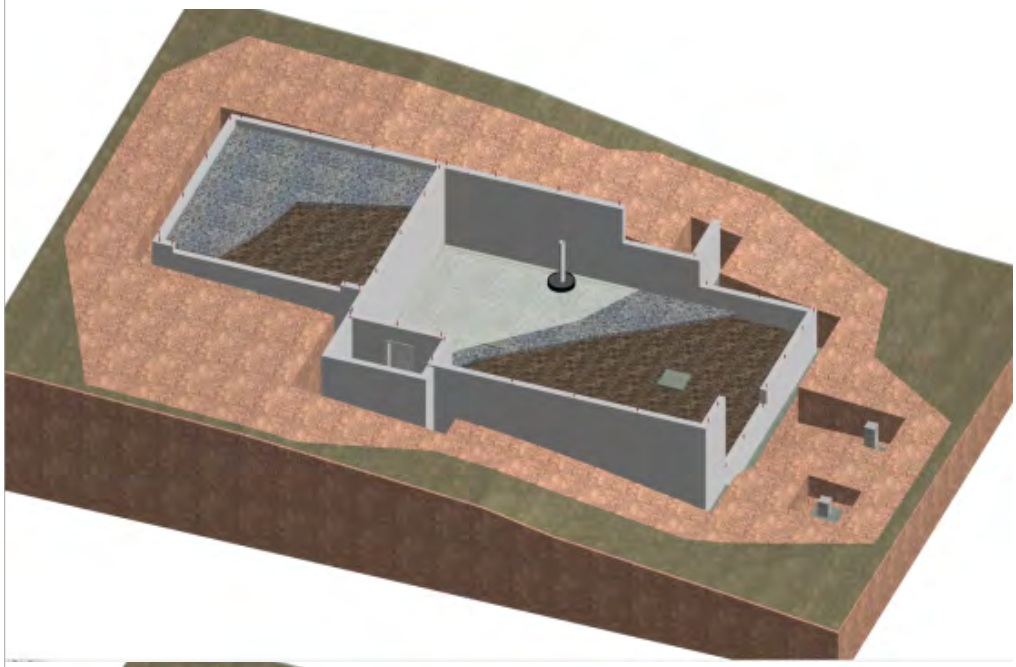
***MATERIAL STAGING**_THIS BASEMENT DIG HAS SPACE FOR STAGING

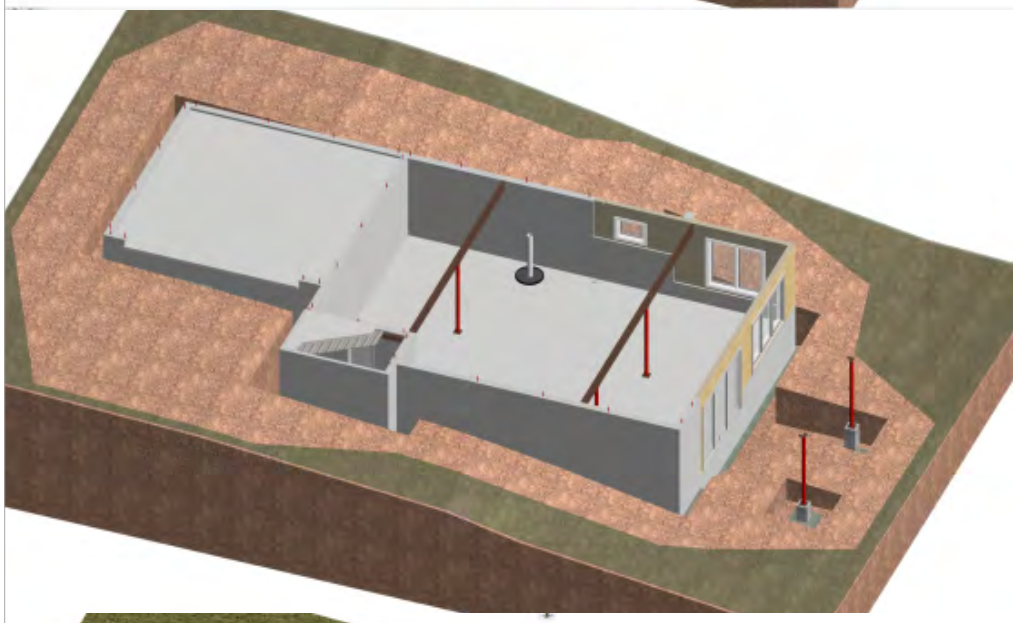
***FOUNDATION WALLS**_WALLS ARE CONSTRUCTED OR FORMED AND POURED. THE HEIGHT OF THE BASEMENT WALL AND THE DIFFERENTIAL FILL FREQUENTLY REQUIRES SOME WALL DESIGN. THE TOP OF WALL WILL STEP IN ACCORDANCE WITH FINISH GRADE AND ANY WINDOW OR WALK OUT FRAME WALLS.

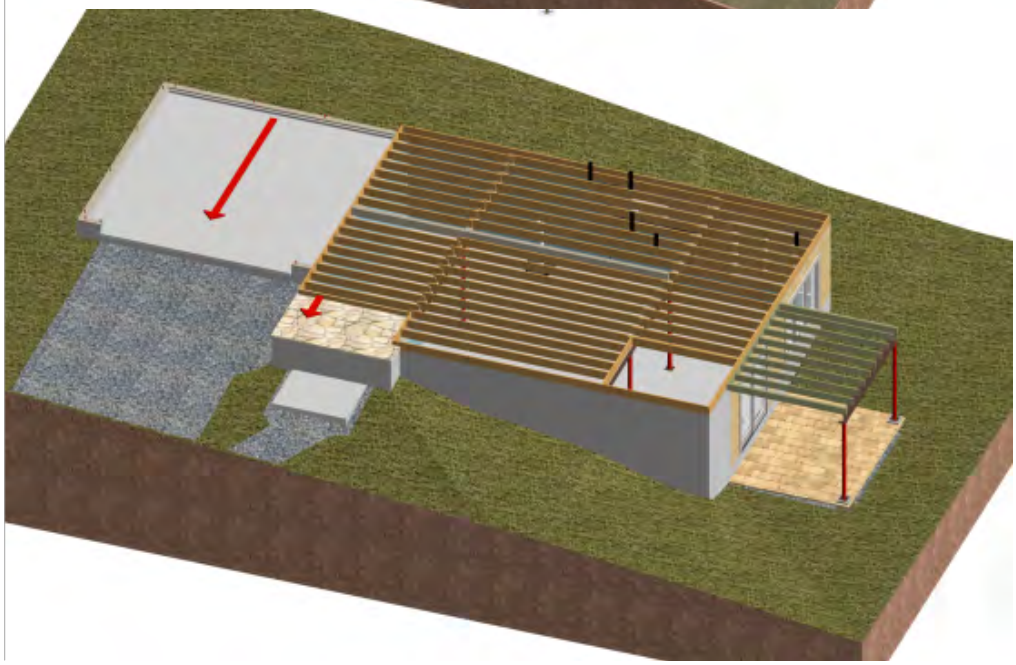
***FRONT PORCH FOUNDATION**_WITH THE DEEPER BASEMENT DIG IT MAY BE UNAVOIDABLE TO DO ANYTHING BUT DIG THE SMALL FRONT PORCH AS DEEP AS THE BASEMENT. IF SO IT MAY BE CHEAPER TO DO A STRUCTURED DECK (STEEL FORMING PAN AND POURED CONCRETE), THAN TO FILL UP THE PORCH HOLE WITH GRAVEL.

***ANCHORS SET**_THIS IS SHOWING STANDARD ANCHOR BOLTS SET IN THE TOP OF WALL FOR HOUSE AND GARAGE

***SIDE PORCH SUPPORT PIERS**_THIS DESIGN IS SHOWING 2 SUPPORT FOOTINGS WITH PIERS CONSTRUCTED THE SAME AS THE FOUNDATION WALLS AND BROUGHT TO ABOVE GRADE. THE FINAL SUPPORT POST-WHETHER STEEL OR WOOD-WANT TO SIT ABOVE GRADE.







PREP FOR SLABS

***PLUMBING**_IF A SUMP OR SEWAGE EJECTOR PUMP ARE PROJECT REQUIRED THEN ALL UNDERSLAB PLUMBING/DRAIN LINES NEED FIRST TO BE INSTALLED.
***FILL**_DEPENDING ON THE DIG, SOME AMOUNT OF INTERIOR PERIMETER FILL, AND POSSIBLY UNDERSLAB FILL MAY BE REQUIRED. THIS FILL SHOULD BE COMPACTED, WHETHER IT IS GRAVEL OR CLEAN DIRT.
***SUB BASE**_4" SUB BASE IS SPREAD FOR BOTH SLABS
***VAPOR BARRIER**_THE VAPOR BARRIER IS ESSENTIAL IN THE BASEMENT AND OPTIONAL IN THE GARAGE

A GENERAL NOTE ON SLAB PREP

* SHORTCUTS ARE FREQUENT IN FILL PREP/COMPACTION FOR SLABS. SEE (c2.5, c4.1, c4.2) .

SUPPORT STRUCTURE

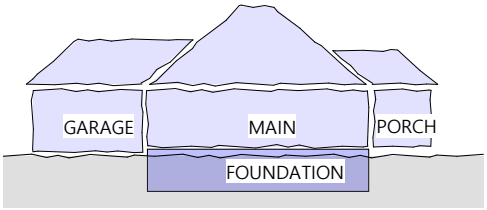
***THE FRAME WALLS**_FRAME WALLS ARE SHOWING HERE FROM THE STEPPED DOWN FOUNDATION WALLS UP TO THE FOUNDATION FRAMING PLATE. THESE 2X4 OR 2X6 WALLS ARE A GOOD CHOICE AS THEY ARE FLEXIBLE AND FORGIVING IN INSTALLING THE WINDOWS AND DOORS.
***SUPPORT POSTS**_STEEL POSTS ARE SHOWING HERE WITH FLAT STEEL BEARING PLATES ON THE SLAB. THESE BEARING PLATES CAN BE INSTALLED DIRECTLY ON THE FOOTINGS BELOW WITH THE SLAB BEING POURED AROUND THEM. THESE SUPPORTS CAN BE WOOD, WHETHER MULTIPLE STUDS, SOLID WOOD, OR ENGINEERED WOOD POSTS.
***THE BEAMS**_THIS DESIGN IS SHOWING STEEL BEAMS SITTING ON/IN THE FOUNDATION WALLS IN 'BEAM POCKETS', SITTING ON TOP OF THE STEEL POSTS ON FLAT STEEL PLATES, OR SITTING ON THE FRAME WALL (USUALLY ON 2 OR 3 OR 4 STUDS DEPENDING ON THE LOAD). STEEL CAN SPAN LONGER DISTANCES WITH LESS DEPTH REQUIRED. BUILT UP WOOD OR ENGINEERED WOOD CAN CERTAINLY DO THE JOB. A GREATER BEAM DEPTH OR MORE COLUMNS MAY BE REQUIRED.
***STRUCTURED PORCH DECK**_THIS CONSTRUCTION REQUIRES SUPPORT FOR THE STEEL 'RIBBED' DECK. A SMALL STEEL BEAM IS SHOWING HERE SUPPORTING THE DECK AT THE HOUSE WALL AND IT SITE ON THE OUTSIDE FOUNDATION WALL IN A POCKET. THE SLAB IS POURED FLUSH WITH THE TOP OF THE FOUNDATION WALL. THIS IS A PREFERABLE APPROACH WHEN A THICKER HARD SURFACE, LIKE FLAGSTONE, IS DESIRED. IT WON'T ROT. BUT THESE INSTALLATIONS HAVE THEIR OWN SMALL CHALLENGES.

FLOORS

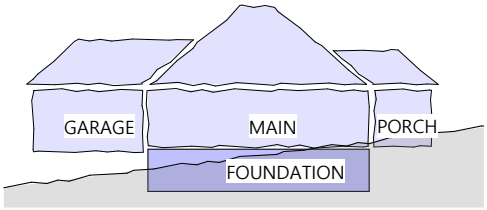
***MAIN FLOOR**_STANDARD FRAMING WITH 2X10 0R 2X12 FLOOR JOISTS SITTING THE THE DROP GIRDERS.
***PORCHES**_THIS EXERCISE IS SHOWING STANDARD FRAMING (2X8 OR 2X10) FOR THESE DECK/PORCES. TREATED LUMBER IS THE TYPICAL CHOICE. THIS FRAMING MIGHT BE ONLY A FEW INCHES BELOW THE MAIN FLOOR FRAMING- OR IN SNOW ENVIRONMENTS A FULL STEP OR TWO.
***GARAGE SLAB**_THE GARAGE SLAB (PITCHED TO THE DOOR) IS 'FLOATING' MEANING IT IS SITTING ON GRADE WITHOUT BEING MECHANICALLY TIED TO THE FOUNDATION WALL. IF THE GRADE IS PREPPED/COMPACTED PROPERLY THIS IS NOT A PROBLEM.

SIDE TO SIDE SLOPE

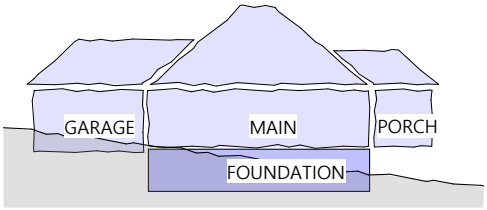
CONSIDERATIONS_USING THE SAME GARAGE/HOUSE/PORCH COMPONENT ARRANGEMENT USED THIS CHAPTER TO DEMONSTATE THE 4 FOUNDATION SYSTEMS-THESE NEXT 3 PAGES WILL ILLUSTRATE SOME DIFFERENT SLOPE CONDITIONS AND WAYS TO THINK ABOUT THEM.



LEVELc1.11

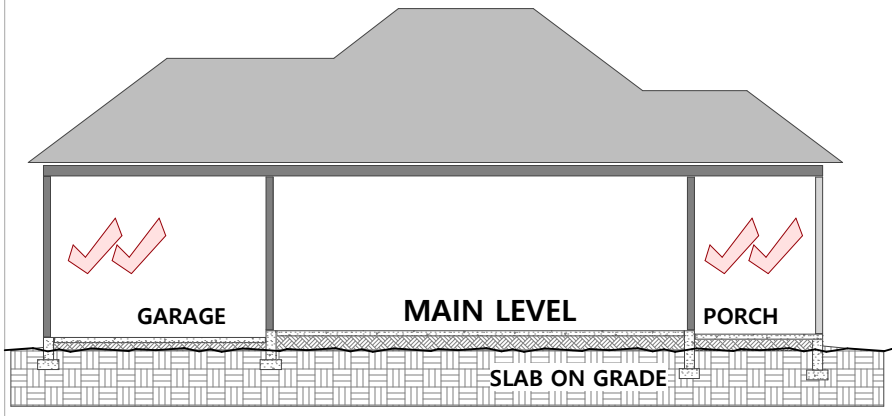


SLOPE c1.12



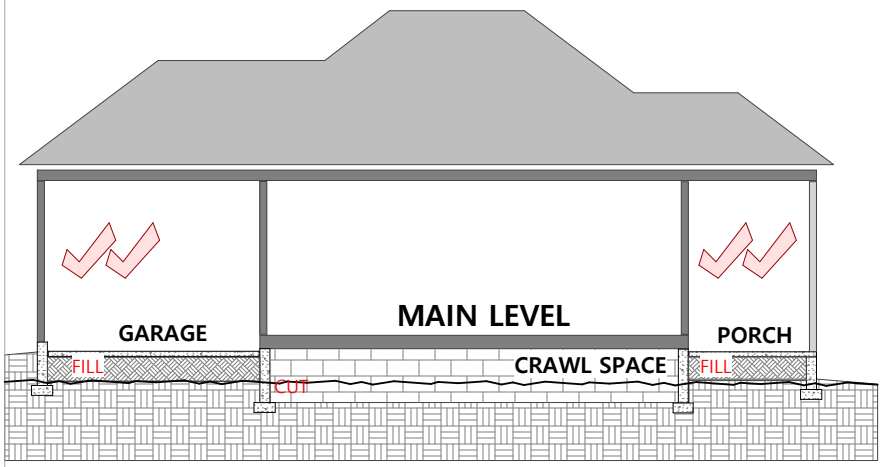
SLOPE c1.13

THE FLATTER SITE PERMITS THE BEST CONNECTIONS BETWEEN COMPONENTS



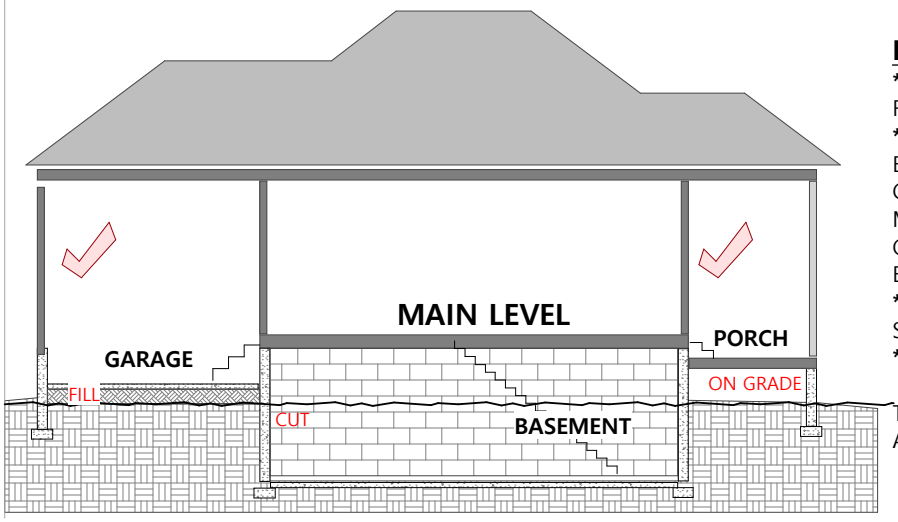
LEVEL SITE-SLAB ON GRADE

***GRADE**_TO BE MAINTAINED A NOMINAL 8" BELOW (ALL) SLAB FLOOR(S)- AND MUST PITCH AWAY 6" IN 10' OR MORE.
***GARAGE**_SEE THE RULES OF THE GARAGE. THE GARAGE COULD BE SET DEAD LEVEL WITH THE FINISHED FLOOR (CHECK LOCAL CODE), OR A MINIMAL AMOUNT BELOW WITH INTEGRAL SLAB CONSTRUCTION. WITH STEM WALL CONSTRUCTION THAT STEP DOWN MIGHT INCREASE TO A COMFORTABLE 6" OR 7" FULL STEP
***PORCH**_THE RULE HERE IS NOT CODE DRIVEN BUT WATER PENETRATION DRIVEN. A DEEP PORCH UNDER ROOF MAY NOT ~~HAVE~~ ANY RISK OF WIND DRIVEN WATER BEING A PROBLEM. A SHALLOW PORCH OR ONE NOT COVERED MAY BE MORE OF A CONCERN. THE PORCH SLAB- REGARDLESS- NEEDS TO BE PITCHED AWAY FROM THE HOUSE ENVELOPE.



LEVEL SITE-CRAWL SPACE

***GRADE**_TO BE MAINTAINED A NOMINAL 8" BELOW (ALL) SLAB FLOOR(S)- AND MUST PITCH AWAY 6" IN 10' OR MORE.
***GARAGE**_ELEVATION DIFFERENCE IS FLEXIBLE. THIS SHOWS SLAB BEING SET AGAINST CRAWL SPACE FOUNDATION WALL. BUT IT CAN BE SET HIGHER [(c1.14).
***PORCH**_DITTO
***PERIMETER GRADE**_THE GARAGE APPROACH GRADE AND OR HOLDING GRADE BELOW FOUNDATION MAY SET THE 2 SLAB ELEVATIONS.

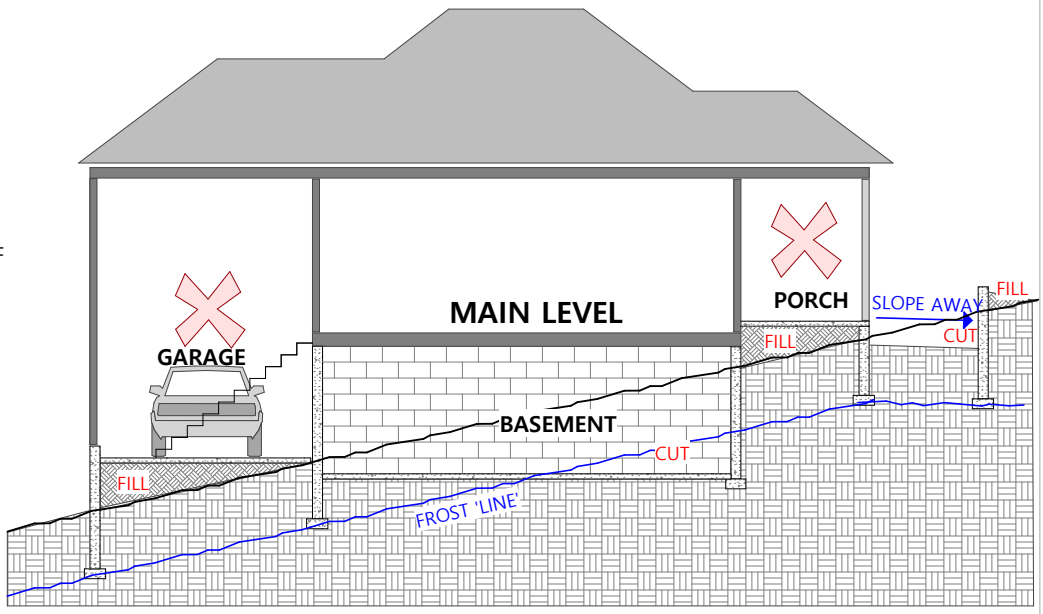


LEVEL SITE-BASEMENT

***GRADE**_TO BE MAINTAINED A NOMINAL 8" BELOW (ALL) SLAB FLOOR(S)- AND MUST PITCH AWAY 6" IN 10' OR MORE.
***BASEMENT**_BASEMENT WALLS ARE EFFECTED THE FARTHER BELOW NATURAL GRADE THEY ARE SET. DEEPER MEANS MORE CUT OR SOIL THAT IS REMOVED AND NEEDS A HOME, AND IT MEANS 'STRONGER' BASEMENT WALL CONSTUCTION DRIVEN BY GRADE ELEVATION DIFFEENTIAL. SEWAGE DISCHARGE MAY ALSO BE A FACTOR.
***GARAGE**_ELEVATION DIFFERENCE IS FLEXIBLE. THE NUMBER OF STEPS INTO THE HOUSE CERTAINLY ONE CONSIDERATION.
***PORCH**_FRAME (OR SLAB) CONSTRUCTION AVAILABLE
IF SET LOWER THE PORCH SPACE IS HIGHER, AND VIEWS THRU THE PORCH FROM THE MAIN FLOOR ARE ENHANCED. LOWER ALSO MEANS ADDITIONAL STEPS.

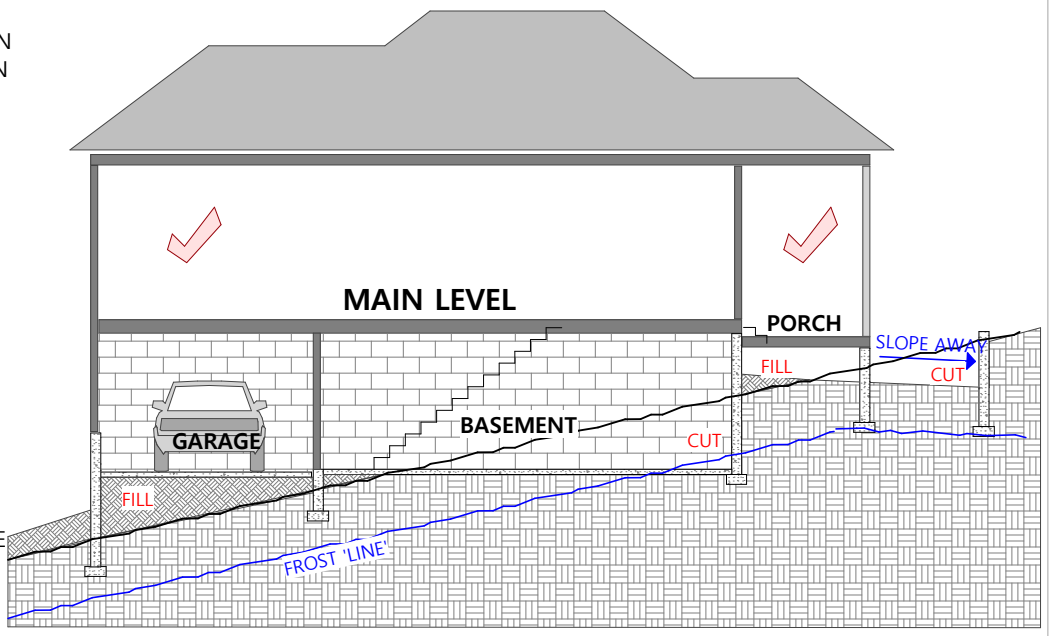
PROBLEMATIC GARAGE & PORCH

***GRADE**_SET AT 2' BELOW MAIN FLOOR ON THE HIGH SIDE. THIS TRANSLATES TO A 8' ELEVATION DIFFERENTIAL BETWEEN GARAGE SLAB AND MAIN FLOOR LEVEL ON THE LOW SIDE.
***BASEMENT**_A BASEMENT CAN ABSORB A LOT OF GRADE CHANGE, SO IT IS FINE IN THIS SITUATION.
***GARAGE**_THE GARAGE CAN MECHANICALLY WORK IN THIS LOCATION BUT REQUIRES A LOT OF SPACE FOR STAIRS ALONG WITH AN INCONVENIENCE_12 OR 13 RISERS REQUIRED.
***PORCH**_THE PORCH BEING HIGHER THAN THE MAIN FLOOR IS NOT SMART DUE TO BOTH POSSIBILITY OF WATER ENTRY AND AWKWARDNESS OF ACCESS AND ACCESS DOOR.



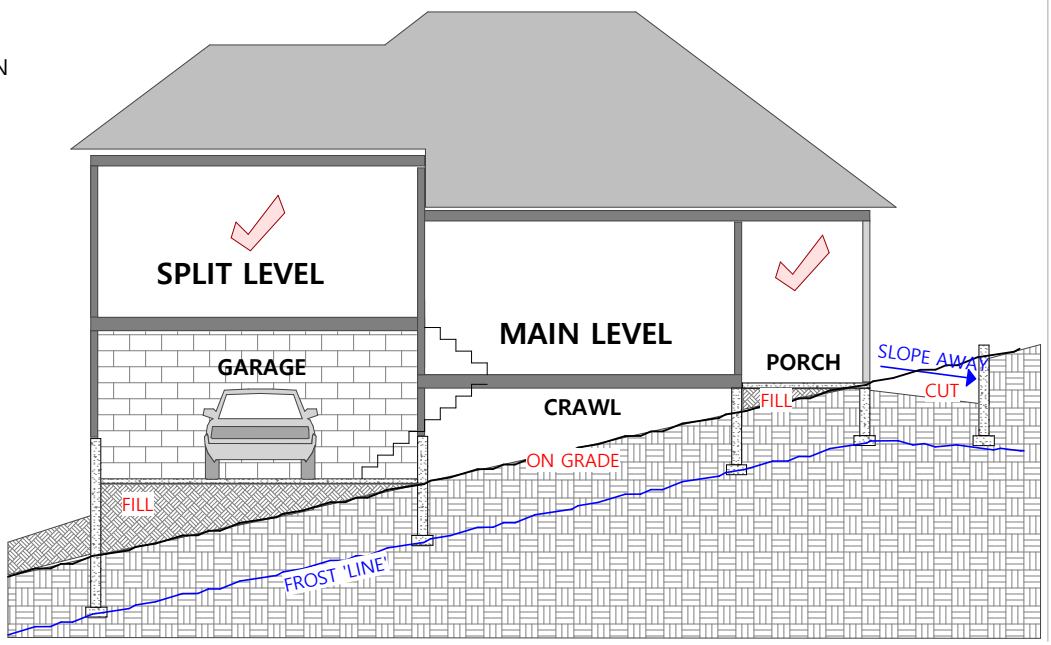
BASEMENT GARAGE

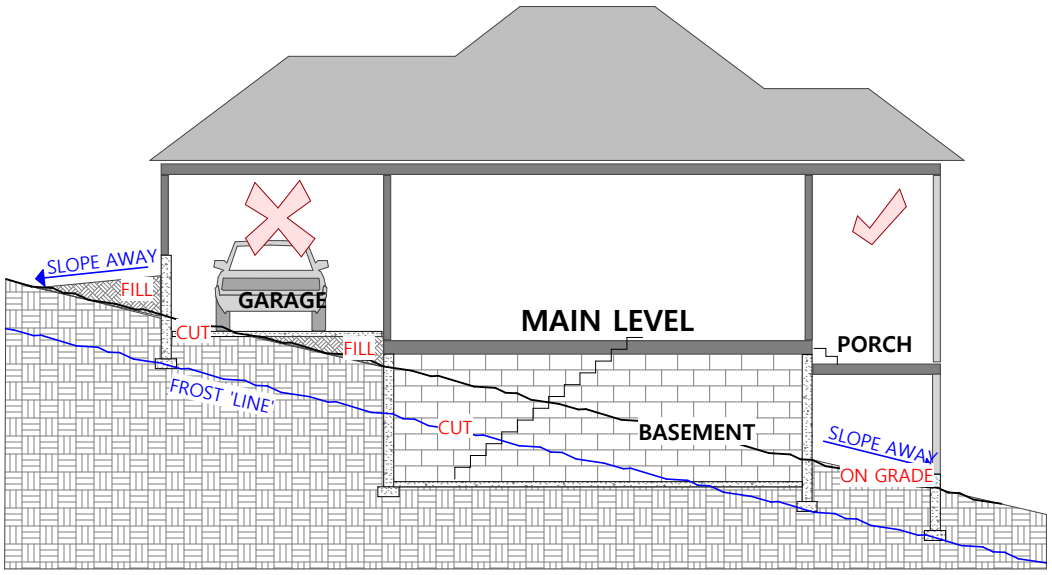
***GRADE**_SET AT 4' BELOW MAIN FLOOR ON THE HIGH SIDE. THIS TRANSLATES TO A 10' ELEVATION DIFFERENTIAL BETWEEN GARAGE SLAB AND MAIN FLOOR LEVEL ON THE LOW SIDE. THIS IS CLOSE TO A FULL LEVEL.
***BASEMENT**_A BASEMENT WORKS FINE. NOT SHOWN ARE THE POSSIBILITY OF GLASS AND FINISHED FOOTAGE. THIS BASEMENT IS MORE THAN 50% ABOVE GRADE.
***GARAGE**_THE GARAGE CAN BE ESSENTIALLY AN EXTENSION OF THE BASEMENT SLAB CONSTRUCTION. SEE THE GARAGE RULES. THE GARAGE ON THIS LEVEL WORKS AND IS FINANCIALLY COST EFFECTIVE. IT IS THE INCONVENIENCE OF UP & DOWN THE STAIR THAT NEEDS CONSIDERATION. A MUD RM AREA AND CONVENIENCE COUNTER FOR STUFF CAN MAKE THIS WORK BETTER.
***PORCH**_THIS LOWER GRADE ALLOWS THE PORCH TO BE FAR ENOUGH ABOVE GRADE TO BE FRAMED AS SHOWN. EVEN WITH SLAB CONSTRUCTION IN THIS CASE SOME RETAINING ON THE HIGH SIDE WOULD BE REQUIRED TO MAINTAIN REQUIRED 'SLOPE AWAY'.



SPLIT LEVEL THINKING

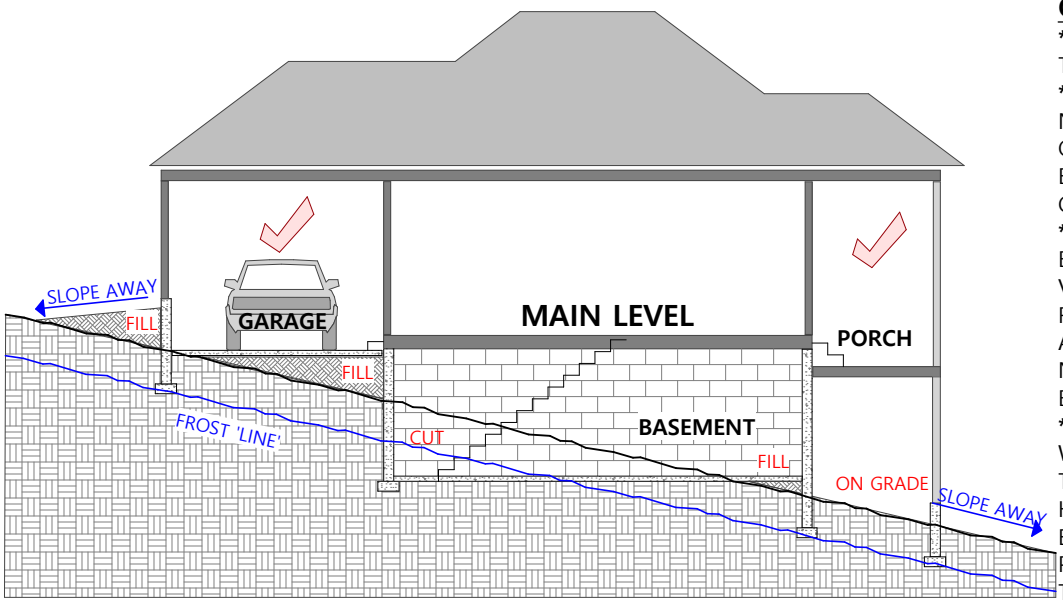
***THE HOUSE BOX**_BY DESIGN THE HOUSE BOX IN A SPLIT HAS 2 LEVELS (AS SHOWN) WITH LIVING SPACES ON THE MAIN LEVEL AND BEDROOMS ON THE SPLIT LEVEL. THE SPLIT DESIGN CAN CONTINUE UP MULTIPLE LEVELS BUT THE SITE CONDITION REMAINS THE SAME.
***THE GARAGE**_THE GARAGE IN A SPLIT AT HALF LEVEL (GIVE OR TAKE DEPENDING ON GRADE). THIS STEEPER GRADE HAS THE MAIN LEVEL UP PAST HALFWAY.
***THE PORCH**_SLAB PORCH AT GRADE POSSIBLE. SOME RETAINING STILL REQUIRED TO ACCOMPLISH 'SLOPE AWAY'.
***THE SLOPE**_NOTE THIS SLOPE IS A LITTLE STEEPER THAN TYPICALLY PERMITTED FOR ROAD CONSTRUCTION WHICH IS 8% TO A MAX 10%. THIS IS MENTIONED BECAUSE A SPLIT DESIGN ALLOWS THE HOME TO FACE A SLOPED STREET. IN FACT THE SPLIT LEVEL'S EXISTENCE IS ARGUABLY DUE TO UNAVOIDABLE SLOPED STREETS.





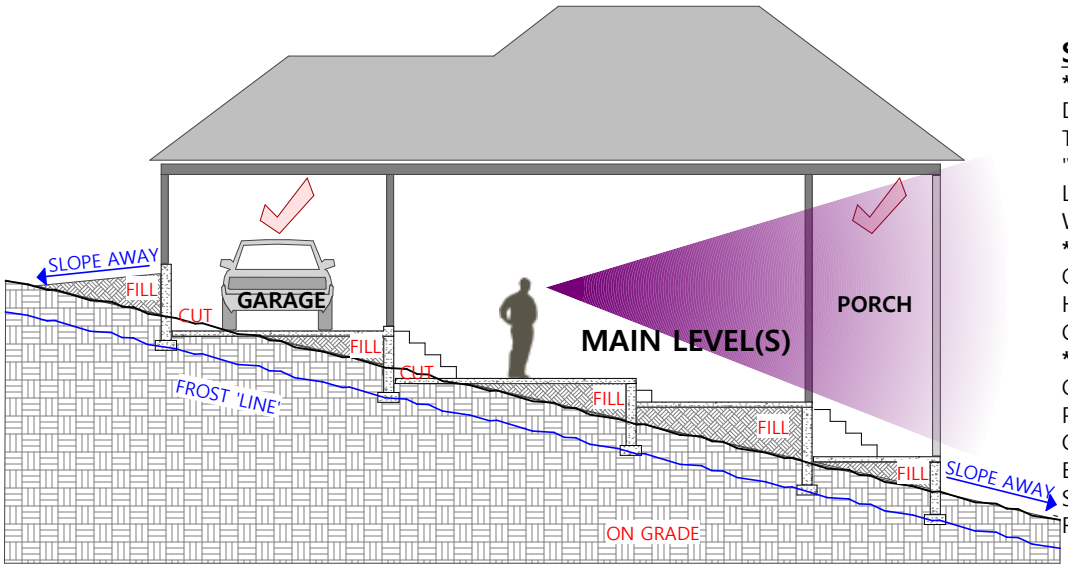
HIGH GARAGE

***GRADE**_SET AT 2' BELOW MAIN FLOOR ON THE HIGH SIDE.
***BASEMENT**_THE BASEMENT ITSELF WORKS BUT IS MORE THAN 50% BELOW GRADE SO IT CANNOT BE CONSIDERED A STORY, OR HAVE ITS FINISHED FOOTAGE BE FULLY VALUED.
***GARAGE**_THE GARAGE IS SHOWN HERE ABOVE THE MAIN FLOOR. SEE THE GARAGE RULES. THIS CAN BE DONE BUT NOT ADVISED PARTICULARLY WITH MAIN FLOOR FRAME CONSTRUCTION. SEE BELOW. RAISING THE WHOLE STRUCTURE SOLVES THIS.
***PORCH**_PORCHES ARE FLEXIBLE FROM A CONSTRUCTION STANDPOINT WHEN OFF GRADE. IF SUPPORTED ON POSTS OR PIERS THE ONLY DISTINCTION IS TALLER POSTS OR PIERS- SO VERY MANAGEABLE. FLOOR ELEVATION CAN BE SET 1 STEP OR A COUPLE STES DOWN.



GOOD SET UP

***GRADE**_SET AT 4' BELOW MAIN FLOOR ON THE HIGH SIDE.
***BASEMENT**_THE BASEMENT WORKS FINE. NOT SHOWN HERE ARE THE POTENTIAL FOR GLASS AND FINISHED FOOTAGE. THIS BASEMENT 'STORY' IS MORE THAN 50% BELOW GRADE.
***GARAGE**_THE GARAGE IS SHOWN HERE 1 STEP BELOW THE MAIN FLOOR WHICH IS GENERALLY VERY DESIREABLE. THE LEFT SIDE WALL REQUIRES FILL TO ACCOMPLISH THE 'SLOPE AWAY' REQUIRED, AND THEREFORE THAT WALL NEEDS TO RETAIN SOME EARTH. THIS IS NOT A BIG CONSTRUCTION DEAL IN A GARAGE SPACE.
***PORCH**_THIS PORCH IS SAME AS ABOVE BUT WITH THOSE SLIGHTLY TALLER SUPPORT POSTS. THE PORCH FLOOR HAS FLEXIBILITY. IF SET HIGHER A WALK OUT CONDITION IN THE BASEMENT IS BENEFITTED. IF SET LOWER THE PORCH SPACE IS HIGHER, AND VIEWS THRU THE PORCH FROM THE MAIN FLOOR ARE ENHANCED.



STEP DOWN SLAB CONSTRUCTION

***SITE RESPONSE DESIGN** _A STEP DOWN DESIGN FOLLOWS THE SLOPE. THE MORE STEPS THE CLOSER TO GRADE A DESIGN CAN HUG. 'WALK OUTS' BECOME POSSIBLE ON SEVERAL LEVELS AND SIDES. THIS STEP DOWN DESIGN WORKS BEST WITH SLAB CONSTRUCTION
***HIGH GARAGE**_THE HIGH GARAGE IS GENERALLY NOT RECOMMENDED. IT IS HOWEVER POSSIBLE AND IN THIS DESIGN CONCEPT THE BETTER APPROACH.
***THE DESIGN**_THE LEVELS IN THIS DESIGN CONCEPT DO NEED TO BE COORDINATED WITH PLAN REQUIREMENTS. OPEN PLANS/LIMITED CLOSED OFF ROOMS WILL GENERALLY WORK BETTER. THE VIEW POTENTIAL THROUGHOUT IS SUBSTANTIAL, IF THAT PLAN DESIGN CAN REMAIN OPEN.

HOUSE TO GARAGE

CONSIDERATIONS_A VERY HIGH PERCENTAGE OF HOMES HAVE THE GARAGE CONTAINED OR CONTIGUOUS WITH THE HOUSE. THIS MEANS A COMMON WALL EXITS BETWEEN THE TWO, AND THE 2 FLOOR ELEVATION MUST BE THOUGHT THRU. BELOW ARE THE 'RULES OF THE GARAGE' ADDRESSING THESE CONDITIONS. THEY ARE BEING INTRODUCED HERE BECAUSE THEY ARE A CONDITION OF EVERY FOUNDATION CONSTRUCTION DECISION THAT HAVE A CONTIGUOUS OR EMBEDDED GARAGE. NO GARAGE, OR LINKED, OR DETACHED GARAGES DO NOT SHARE ALL THESE EXACT REQUIREMENTS.

FIRE PROTECTION

***WALL(S) & CEILING**_THE HOUSE NEEDS TO BE FIRE PROTECTED FROM THE GARAGE (THE CAR). THE WALL (S) SHARED WITH THE HOUSE, AND THE CEILING SURFACE TO AN ATTIC SPACE ABOVE REQUIRE 1/2" GYPSUM WALL BOARD. IF THERE IS HABITABLE SPACE ABOVE 5/8" GYPSM WALL BOARD IS REQUIRED ON THE CEILING.

***DOOR TO HOUSE**_NEEDS TO BE SOLID WOOD OR 'FILLED' STEEL DOORS OR CARRY A 20 MINUTE RATING. THE INSULATION REQUIREMENT (TYPICAL R-5) SUGGESTS A PREFABRICATED EXTERIOR DOOR WITH PERIMETER WEATHER STRIPPING AND THRESHOLD, WHICH BECAUSE OF THE THRESHOLD DESIGN, MEANS THAT DOOR WILL SWING INTO THE HOUSE.

GARAGE FLOOR PITCH

***CODE**_CODE REQUIRES A GARAGE FLOOR BE PITCHED TO THE DOOR OR TO A DRAIN. IN REALLY BIG GARAGES DRAINS MAY BE NEEDED OR DESIRED. IN MOST GARAGES PITCHING THE CONCRETE FLOOR TO THE DOOR IS FINE. THESE DRAWING ALL ASSUME A PITCH TO THE DOOR.

***THE CORRECT SLOPE**_BECAUSE IT IS NOT CODE SPECIFIED IT IS OPEN FOR DISCUSSION. THE PREVAILING OPINION IS 1/8" IN 1' IS ADEQUATE, WHICH TRANSLATES INTO 2 1/2" TOTAL FALL IN A 22' DEEP GARAGE.

***WHY THE PITCH**_ANYTHING DRIPPING OFF OR LEAKING FROM (LIQUID GAS IS THE FEAR) THE CAR WILL THEN MOVE TOWARD THE DOOR AND OUT.

*OTHER PITCH CONSIDERATIONS_IN SOME DRY WARM CLIMATES WITH GOOD DRAINING SANDY SOIL, A VERY MINIMAL PITCH MAY BE FINE. IN HEAVY SNOW CLIMATES WHERE VEHICLES MAY SHED SNOW REGULARLY WHEN PARKED INSIDE THE GARAGE THRU THE WINTER A MORE AGRESSIVE PITCH MAY BE BENEFICIAL. OR IF A REVERSE SLOPE DRIVEWAY PITCH CAN'T BE AVOIDED A MORE AGREESSIVE PITCH MAY AT LEAST PSCYCHOLOGICALLY ---

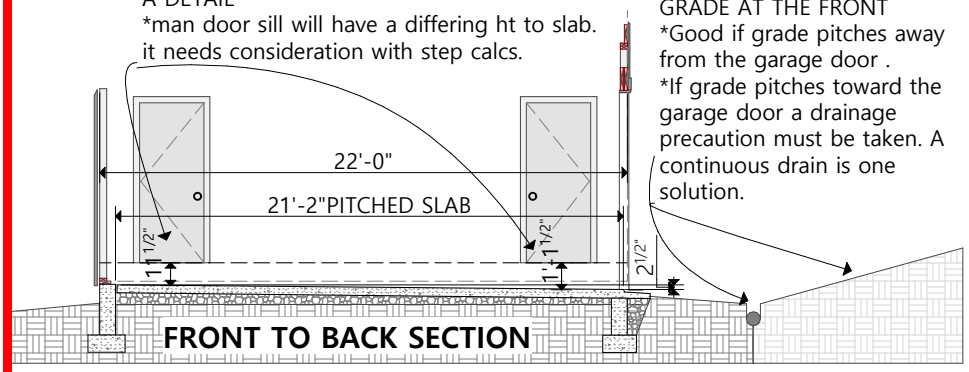
GARAGE FLOOR DROPPED ELEVATION

***CODE**_CODE USED TO REQUIRE THE GARAGE FLOOR BE BELOW THE HOUSE FLOOR, OR A RAISED THRESHOLD (OF 4" TO 6") BE BUILT AT THE MAN DOOR SO GAS FUMES WOULD NOT ENTER INTO THE HOUSE (ESSENTIALLY) UNDER THE DOOR. GAS FUMES ARE HEAVIER THAT AIR AND THEREFORE HOOVER/HUG THE GROUND. ALTHOUGH THIS REQUIREMENT IS NO LONGER IN THE IRC CODE IT MAY BE LOCALLY REQUIRED.

***PRACTICAL RESPONSE**_THE DANGER OF THE GAS FUME ISSUE HAS BEEN MITIGATED PARTLY WITH "TIGHTER' CARS, AND PARTLY BECAUSE THE WEATHERTIGHT MAN DOORS NO LONGER PERMIT FREE FLOW OF AIR BETWEEN THE GARAGE & HOUSE THAT SIMPLE POSITIVE & NEGATIVE PRESSURE WILL CAUSE. STILL NOXIOUS ODORS FROM ANY GAS OR OIL TOOLS AND EQUIPMENT NEEDS TO BE CONSIDERED AND MANAGED WITH SOME COMMON SENSE. ALL AIRBORNE GASES AND ODORS MOVE AROUND WITHOUT OUR SEEING IT.

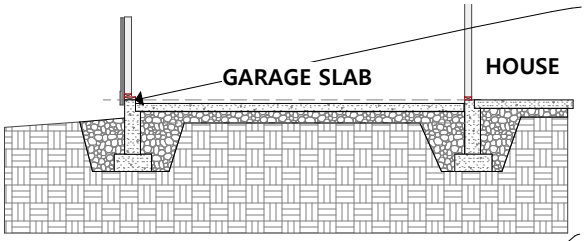
A DETAIL
*man door sill will have a differing ht to slab. it needs consideration with step calcs.

GRADE AT THE FRONT
*Good if grade pitches away from the garage door .
*If grade pitches toward the garage door a drainage precaution must be taken. A continuous drain is one solution.

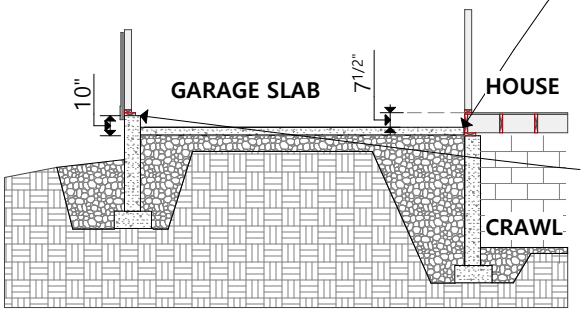


FRONT TO BACK SECTION

LEFT TO RIGHT SECTIONS BELOW

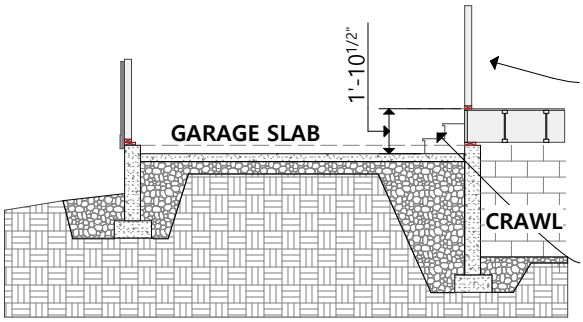


LEVEL WALL/PITCHED SLAB
*Stem wall construction allows a notch & curb to be placed in the stem wall so the slab can be poured and pitched while the wall plate remains level.
*An integral pour requires some concrete forming techniques to assure a pitched floor and a level plate line for the frame walls.



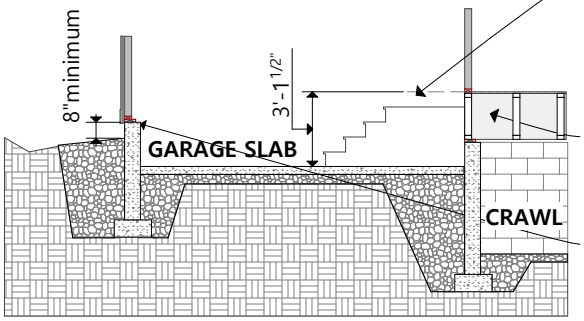
AGAINST THE HOUSE WALL
*If the house wall is flush with the foundation the slab can be poured up against (with a separation material)the framing band.
*this allows the step up dimension to be whatever one wants. 7+" as shown or close to flush with the main floor.

RAISED FOUNDATION WALL
*This sample section requires the foundation be higher not for grade conditions, but so the slab can float against the exterior flundation wall.
*This one is set to the top of the main floor deck so the wall framing and siding line is consistent. Those may need to be adjusted to fit the foundation construction system limits.



LEVEL FOUNDATION WALL
*Keeping the top of foundation consistent from house to garage keeps things simple.
*In this sample section there is no liability in keeping them level other than taller exterior garage frame walls.

STAIR WITHOUT LANDING
*3 risers is ok without railing or landing.



STAIR WITH LANDING
*With 4 or more risers a landing is advised
*The amount of space required and the position of the stairs absolutely needs consideration for vehicle to fit. (d8.6)

FLOOR FRAMING
*with a floating slab below the foundation line the depth as shown, the type of floor framing does not matter.

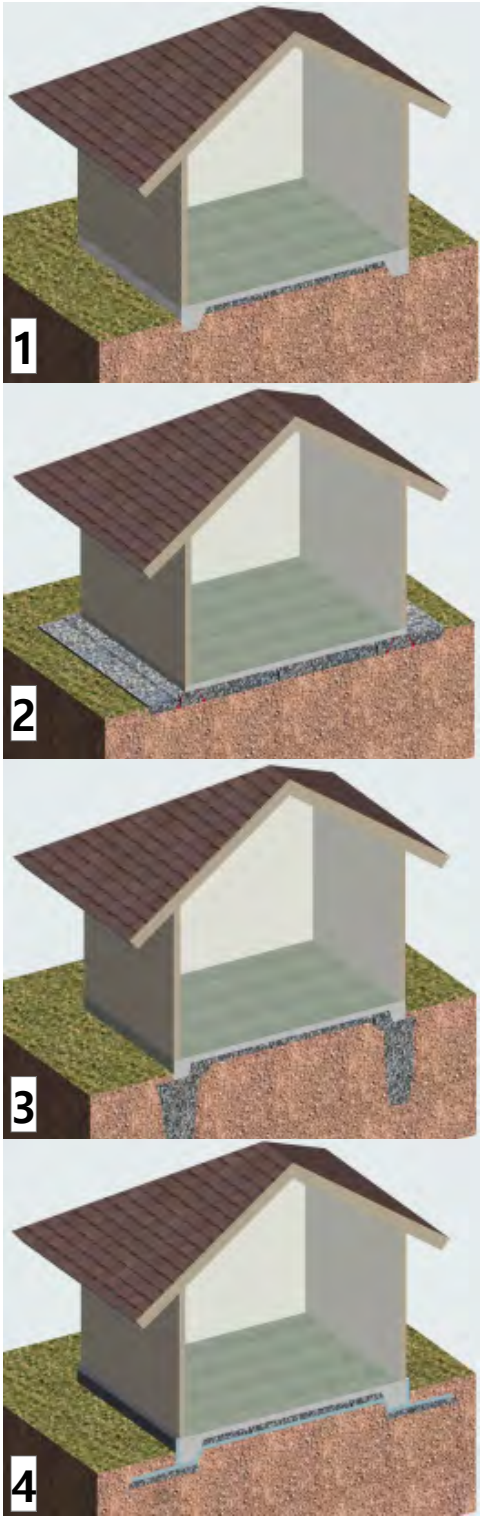
FOUNDATION WALL HT IS FLEXIBLE
*Garage foundation can be raised or lowered to conform to grade. Or to an alignment of a siding/trim condition.

INDEPENDENT 'FLOATING' FOUNDATION PROJECTS

***FLEXIBILITY & SIMPLE**_A SLAB ON GRADE IS A COMMON CHOICE FOR SIMPLE RESIDENTIAL PROJECTS SUCH AS PATIOS, STORAGE SHEDS, DETACHED GARAGES OR CARPORTS. THE SLAB IS INEXPENSIVE AND USEFUL.
***REASONS**_FULL FOUNDATION SYSTEMS FOR SMALL PROJECTS LIKE THESE CAN BECOME DISPROPOTIONALLY EXPENSIVE. ARE THERE WAYS TO BEAT THE SYSTEM BECOMES A LEGITIMATE QUESTION, KEEPING IN MIND THAT THESE NON-HABITABLE STRUCTURES ARE NECESSARILY SUBJECT TO THE SAME CONCERNS AND STANDARDS REQUIRED BY THE HOME ITSELF.
***SOILS**_IN GENERAL DRAINABLE SOILS OFFER MORE FLEXIBILITY JUST BECAUSE THEY HOLD LESS WATER AND THEREFORE LESS MOVEMENT POTENTIAL. SLOPE IS ANOTHER CLEAR CONDITION.
***FROST DEPTH**_DEEPER FROST LINES COMPOUND THIS PROBLEM. FROST HEAVING IS ANOTHER OF MOTHER NATURE'S FIRM REALITIES THAT ARE EASY TO DISMISS AND DISREGARD UNTILL ONE EXPERIENCES THEIR FORCE FIRST HAND. AN INSTRUCTIVE THINKING LESSON REGARDING FROST CAN BE GAINED BY SEARCHING PERMAFROST FOUNDATIONS. CULTURE AND FOLKS IN THE SERIOUS NORTH HAVE ALWAYS HAD TO DEAL WITH THIS.

SLAB CONSTRUCTION APPROACHES

***1*CONVENTIONAL SLAB ON GRADE**_STANDARD FARE IN CLIMATES WITH MINIMAL FROST DEPTHS
***2*FLOATING SLAB**_THIS APPROACH TYPICALLY WOULD HAVE A DEEPER SUB BASE, AND ONE THAT GETS BELOW ANY WET EARTH. THE IDEA IS THE WHOLE SLAB BASE IS SO WELL DRAINED THAT HEAVING DOESN'T HAVE ENOUGH WATER VOLUME TO DO MUCH HARM. AN ADDITIONAL PRECAUTION WOULD BE USING A "STRUCTURAL SLAB" THAT, SHOULD HEAVING OCCUR, WOULD MOVE AS ONE STRUCTURAL ENTITY RATHER THAN CRACKING/BREAKING APART . BASIC DRAINABLE SOIL IS A GOOD BEGINNING FOR THIS APPROACH.
***3*DEEP GRAVEL FOUNDATIONS**_GRAVEL FOOTINGS OF ANY DEPTH ARE VIABLE. THE INTENT IS TO GET THE PERIMETER DIG BELOW FROST. A NARROW BUCKET (12") SUGGESTED TO KEEP GRAVEL VOLUME LIMITED. COMPACTION IN LIFTS IS TYPICALLY ADVISED. IN THIS CASE IF THE GRAVEL IS UNIFORM IN WIDTH/DEPTH THEN LIKELY ANY SETTLEMENT WOULD BE UNIFORM +/- AND NOT MUCH OF AN ISSUE. THIS APPROACH IS CONSIDERABLE LESS COSTLY THAN A REAL FOUNDATION WALL. NOTE THESE GRAVEL FOOTING/FOUNDATION WALLS ARE A FREQUENTLY USED FIX FOR WET SOIL CONDITIONS. THE GRAVEL PERMITS LOADING TO BE DISTRIBUTED USING THE SIDE WALLS OF THE DIG AS WELL AS THE BOTTOM.
***4*FROST PROTECTED SHALLOW FOUNDATION (FPSF)**_THIS TECHNIQUE VALID FOR HEATED STRUCTURES. SEE R403.3 FOR SOME SIMPLE DESIGN PARAMETERS BASED ON THE CLIMATE SITUATION. WITH UNHEATED STRUCTURES A CONCERN IS KEEPING THE SOIL FROM FREEZING FROM THE INSIDE THRU THE SLAB. THIS WOULD BE A LOCAL CLIMATE DESIGN PROBLEM. THE ILLUSTRATION IS SHOWING UNDER SLAB INSULATION AS A RESPONSE TO THIS SITUATION/POTENTIAL.



SLOPED SITE RESTRICTIONS

***PIERS SYSTEM**_ANY PIER SYSTEM CAN 'ABSORB' BOTH SLOPE DIFFERENTIALS AND PROBLEMATIC SOIL-BETTER THAN A SLAB SYSTEM. A FRAME DECK FROM TOP OF LEVELED PIERS WOULD BE STRUCTURED/BUILT AS NEEDED. THE CHALLLENGE IS TO BEAT THE SYSTEM ON THE PIER COSTS.
***ABOVE FROST LINE PIER OPTIONS**_FOLLOWING THE APPROACH SHOWN IN #2 ABOVE, PIER FOOTINGS CAN BE GRAVEL AND DO NOT HAVE TO REACH BELOW FROST LINE. (CHECK LOCAL AUTHORIIES ON REQUIREMENTS FOR NON-HABITABLE UTILITY STRUCTURES). SAME WATER CONTENT IN THE SOIL CONCERN EXISTS. MORE WATER, MORE HEAVE POTENTIAL. PIER CONSTUCTIONS DO OFFER THE OPPOORTUNITY OF OCCASIONAL JACKING AND RE-LEVELING.
***BELOW FROST LINE PIER OPTIONS**_NOTE THE CONSTRUCTION ADDENDUM a.3 SHOWS A SEQUENCE OF PIER TYPES EACH OF WHICH HAS SOME OF ITS OWN CHARACTERISTICS AND THERFORE SUITABILITIES. ALL OF WHICH SUGGEST BELOW THE FROST LINE CONSTRUCTION.