Site Engineering Guide

FOUNDATIONS: PILE CAPS, PADS & STRIP FOOTINGS

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INTRODUCTION

The foundation phase of any construction project will typically follow on from some element of reduced level operation. Mistakes, omissions and errors at this stage can critically damage a project both financially and programme wise, not to mention the structural integrity of the build.

SETTING OUT

IN THE OFFICE

As with any other situation the 'site engineer' must review the drawings, carrying out their own checks and identifying an issues or outstanding information as required.

Drawing Checks

Review the drawings, General arrangements and detailed sections to identify any errors and omissions by the originator and to ensure you have sufficient information to set out the works. Don't forget to read the notes on the drawings, sometimes valuable information may be contained within which isn't shown on the drawings to avoid issuing RFI's for information already provided.

Issue Requests for Information's (RFI's) as required in the event of errors, omissions and additional information required to carry out the works. You may have suggestions to aid in the construction or value engineering options to discuss with the design team.

Carry out checks on the drawing, comparing dimensions between the Architect, Engineer and Structural Steelwork Contractor. It is not uncommon to discover errors or inconstancies between different originators drawings. If setting out holding down bolts use the structural steel contractors drawing not the Engineers, referring only to the Engineers for foundation sizes and configurations.

Formation levels

Review the drawings to determine the excavation levels; it may be advisable to mark up a drawing with the varying dig levels, if the pad and pile caps have varying depths, don't forget to allow for blinding if specified on the drawings.

Formations may given as figures below finished floor levels and you may be required to look at another drawing to determine the information you require. Review the sections to determine and locate different build ups of floor/slab construction?

Calculate Setting out Information

The drawings may have just featured the corners of the building or alternatively major gridlines, as part of your drawing checking you will have queried any erroneous information and have sufficient information to set out the works.

You should discuss with the workforce what setting out they prefer. For instance the drawings may only give the corners of the building; they may prefer the centre of the foundation requiring you to calculate the coordinates of the points as required, or alternatively you may wish to do this out onsite using a tape.

Concrete requirements

As the site engineer you will typically be asked to carry out a take off for the required quantity of concrete for the project, this will involve reviewing the drawings and calculating the volume of each pad or pile cap size and strip footing/ground beam. This will prove useful now as you check the drawing identifying any missing information and later when quantifying the day's concrete pour requirements

Issuing drawings

If the project features pads or pile caps with holding down bolts, after the site team has agreed the sequence of works or the initial starting point, the joiners will need to be issued with a drawing detailing the number required, configuration of the holding down bolts, type, projection etc to be ready to start

Drainage

Reviewing the drawings of the internal drainage and determine if pockets, sleeves or even voids are required in the strip footings/ground beams to accommodate drainage. The structural engineer may even have detailed a thickening in the footing where drainage passes through. All of which you will need to know when you start breaking ground.

Document management

Check that the drawings you are working to are current and that there have been no revisions in the drawings, marking all superseded drawings with S/S or alternatively superseded if you have a stamp. Never dispose of superseded drawings; they are useful for historical records and in the event of mistakes onsite tracing the origin. Always thoroughly review the latest revision drawings, comparing with the previous revision. Do not rely on the Engineer or Architect to cloud revised items. Finally ensure that the operatives are working to the latest revision drawings if you have issue them copies or extracts

> ***Tip***
> *All copies of drawings issued to the workforce should be marked UNCONTROLLED COPY and feature the drawing number and Revision, if it is a magnified copy of a drawing. For longevity of the drawing, the drawing should be laminated with a minimum of a 10mm seal around the outside of the drawing to ensure water tightness*

Record keeping

Maintaining records is an important role of the site engineers both for Quality Assurance purposes and to ensure that your employer can get paid for the works completed, failure to maintain site records can result in your employer not being paid the full sums owed to them.

Record keeping can be in a varied of forms, photographs, site diaries, RFI's, marked up drawings, all of which should be maintained in an organised manner.

A drawing should be marked up with the dates foundations where poured, this can be invaluable when trying to determine if revisions in drawings affect works already completed or in the event of issue onsite is discovered identifying responsibility.

Tip

You SHOULD retain a copy of all drawings and information you issue to the workforce, contractors and client/employer. Firstly in the event they lose their copy and need a replacement and secondly to determine responsibility in the event of an error or omission.

IN THE FIELD

Having in the office obtained all the information you require to begin construction you're now ready to begin setting out onsite in preparation for the start.

You may have needed to calculate your setting out points so that you are setting out the centre of foundation, how you choose to work will completely be up to yourself. The simplest method of working is detailed in figure 1.

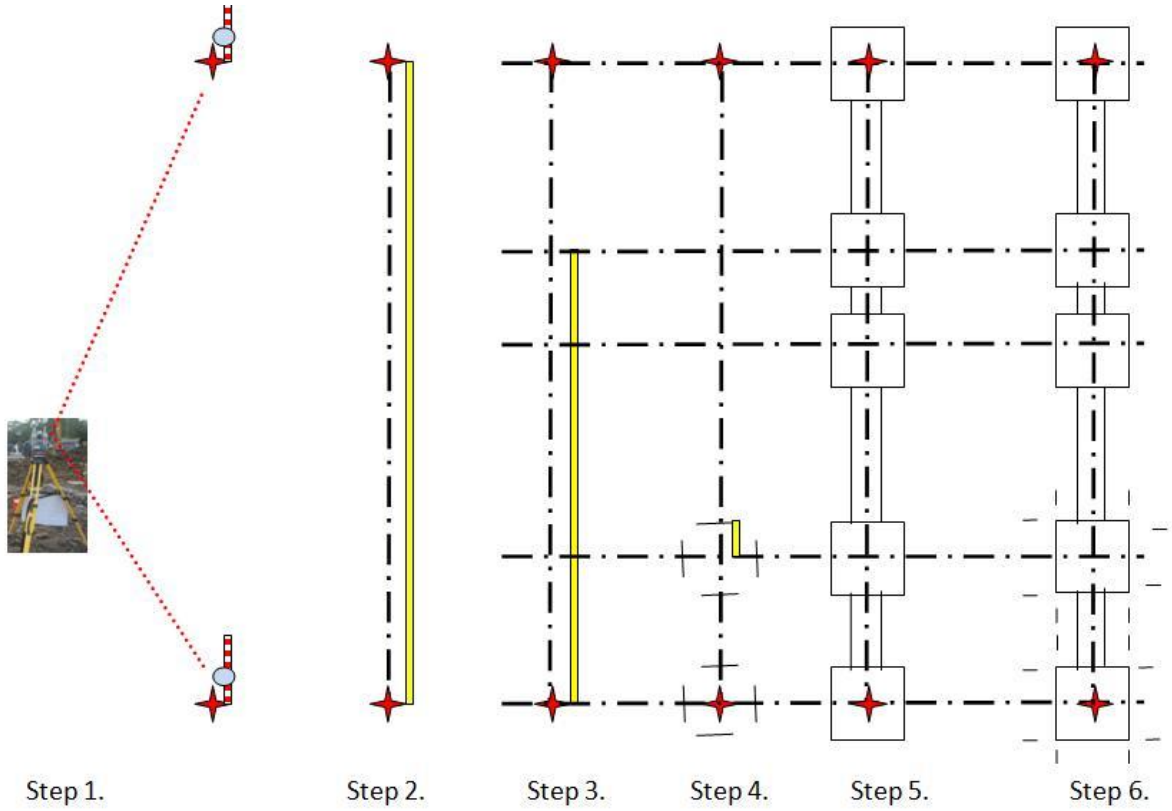

Figure 1

Steps 1 to 6 as shown in figure 1 above are now covered in detail below:

1. Set up and orientate the instrument, setting out two points on a single gridline

2. Check the distance between the points using a suitable length and quality tape measure.
3. Having checked the setting out as in step 2 and found it to be correct, begin measuring out the gridlines in between and marking with survey paint
4. Measure off the gridlines to mark the outside edge of the foundation, marking with paint
5. Now link up all the lines to make a solid outline around the edge of the foundation, including any ground beams/strip footings
6. Having marked the extent of the excavation mark offset points so that when the operatives loose the solid outline lines they can ensure the excavation is to the correct size and shape.

HOLDING DOWN BOLTS

CONSTRUCTION OF TEMPLATE

Typically the structural steelwork contractor will issue a General Arrangement or GA and a Holding-down Bolt Detail Drawing prior to the foundations starting. These two drawings will need to be read in conjunction with each other, the GA will show the location and type of Holding Down configuration whilst the detail drawing will show the different types, number of each type, dimensions from grid, embedment and projection above T.O.C. (Top of Concrete) Figure 2 is a typical holding down bolt detail as you would be expected to encounter.

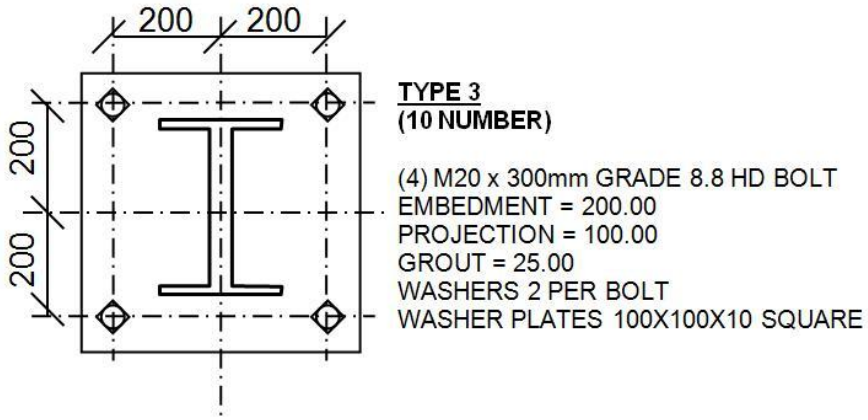

Figure 2

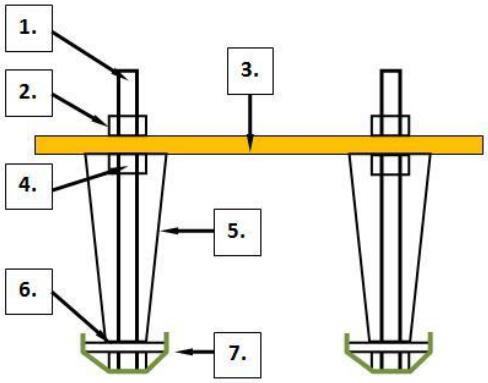

Figure 3

As the Site Engineer you most likely will be responsible for managing the joiner's onsite, who will be responsible for manufacturing the plywood templates for the base plates. Ensuring that the right quantity of each type and variety of types is manufactured in preparation for following days requirements. The

templates should be manufactured as shown in figure 3.

1. Holding down bolt
2. Holding down Bolt Nut
3. Plywood template of Base Plate
4. Additional HD Nut
5. Wax Paper Cone
6. Washer Plate
7. Denso Tape: Best Practise

Figure 4

The HD Bolt, Nut and Washer plate will be specified and most likely be supplied by the steelwork contractor. The Ground works contractor will be responsible for supplying the Ply template, denso tape and Wax Paper Cone.

The cones are to allow the bolts to have a construction tolerance, rotating within the circumference of the cone, whilst the denso tape ensures the head of the bolt has the freedom of movement to allow the rotation within the cone. Figure 4 shows 'denso' tape applied to the washer plates of assembled templates

Tip

The ply templates maybe reused however it is advisable to not remove, as this will opening up the wax cones to debris which may restrict movement of the bolts.

SETTING OUT

Effectively there are two methods of setting out your holding down bolts either to hang the bolts prior to concreting or floating the bolts in after pouring the concrete, both methods have their advantages and disadvantage and site conditions and restraints will ultimately dictate your method of work.

Tip

Creating a local grid for all your setting out can be a valuable use of your time early on in the project, which will allow you to easily check and set out for other trades as the project progresses, obviously great care will need to taken in carrying out the calculations and checking the local grids correspondence to the original grid orientation

Safety Tip

Working with wet concrete can cause serious harm and cement burns, always wear suitable protective gloves and eye protection to protect against the effects of contact and splashes .Ensuring that your forearms etc are covered with clothing and In the event you are splashed with concrete, wash off immediately/as soon as practical. In the event concrete comes into contact with your eyes, irrigate immediately and seek medical attention to avoid permanent damage.

Hanging – By Line & Distance

Method

1. Firstly set out two pegs with nails on the chosen gridline, with known offsets off the two extremes perpendicular gridlines.
2. Now setting the instrument on one peg, sighting the second peg, checking the measured distance to the calculated distance, accept or reject, repeating step one if necessary or move onto step three
3. Set out pegs or 'H' profiles on the gridline with a nail, measuring/calculating the distance from the nail to the centre of the base plate (intersection of two perpendicular gridlines) writing on the pegs
4. The joiners will now be able to pull a string line between nails and set the position of the bolts using the calculated distance. The joiners will either tie the template down to the reinforcement cage or alternatively hang by erecting a frame as shown in the image in figure 5.
5. Provide a level for the joiners to set the template, allowing for the thickness of the ply
6. Check the levels prior to pouring
7. Check the distance by setting up on one peg and sighting and checking the distance again between the two accepting or rejecting or alternatively the setting out you have previously provided.

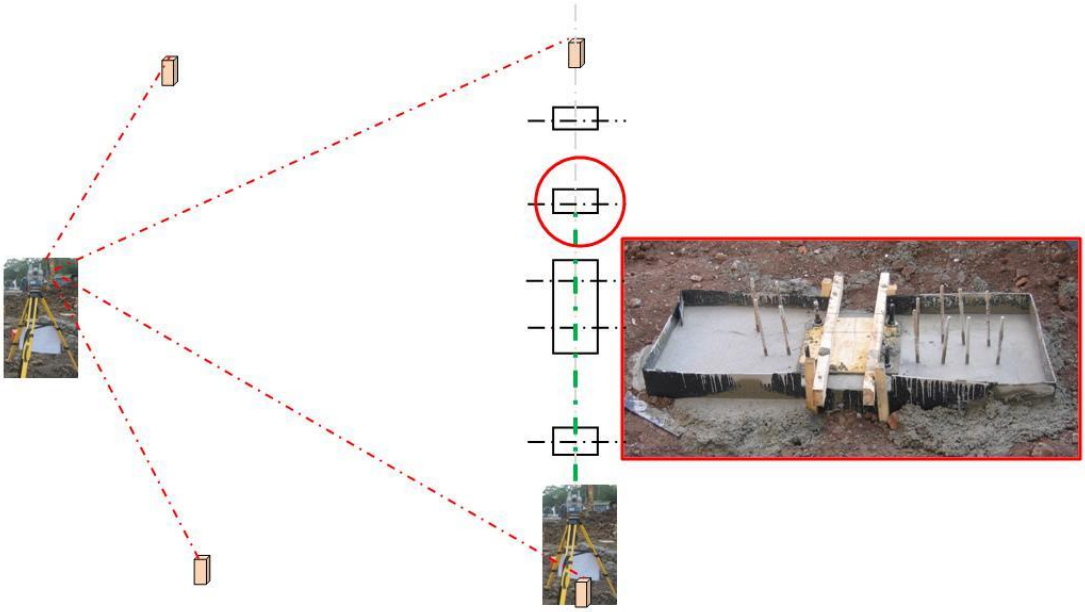

Figure 5: Hanging by Line and Distance Method

Advantages

- Potential greater accuracy in the setting out of holding down bolts
- Best suited to applications involving fixed cut and bent steel (cages) such as pile caps or pads with two layers of fabric mesh
- Great for long gridlines

- Best suited to bolt arrangements with a larger number of bolts or shear weight of arrangement
- Able to visually sight down line and check using telescope of instrument

Disadvantages

- More labour and material intensive – requiring additional work on the part of the joiners
- Potentially more engineering intensive

Hanging – By Resection

Method

1. Carry out a resection from your chosen control points/localised control points, accepting or rejecting the solution based on the error displayed.
2. Having accepted the resection and orientated yourself and working with either a local grid or a project grid which is orientated with the building gridlines begin
3. Set out pegs or 'H' profiles on the gridline with a nail, measuring/calculating the distance from the nail to the centre of the base plate (intersection of two perpendicular gridlines) writing on the pegs
4. The joiners will now be able to pull a string line between nails and set the position of the bolts using the calculated distance
5. Alternatively if your joiners are not proposing to hang the template from a frame and instead tie down using tie wire, you could wrap insulation tape around the reinforcing to provide a surface suitable for marking the gridlines on.
6. Provide a level for the joiners to set the template, allowing for the thickness of the ply
7. Check the levels prior to pouring.
8. Check the distance by carrying out another resection or alternatively checking with the setting out you've already provided

Advantages

- Potential greater accuracy in the setting out of holding down bolts
- Best suited to bolt arrangements with a larger number of bolts or shear weight of arrangement
- Best suited to applications involving fixed cut and bent steel such as pile caps or pads with two layers of fabric mesh

Disadvantages

- More labour and material intensive – requiring additional work on the part of the joiners
- Potentially more engineering intensive

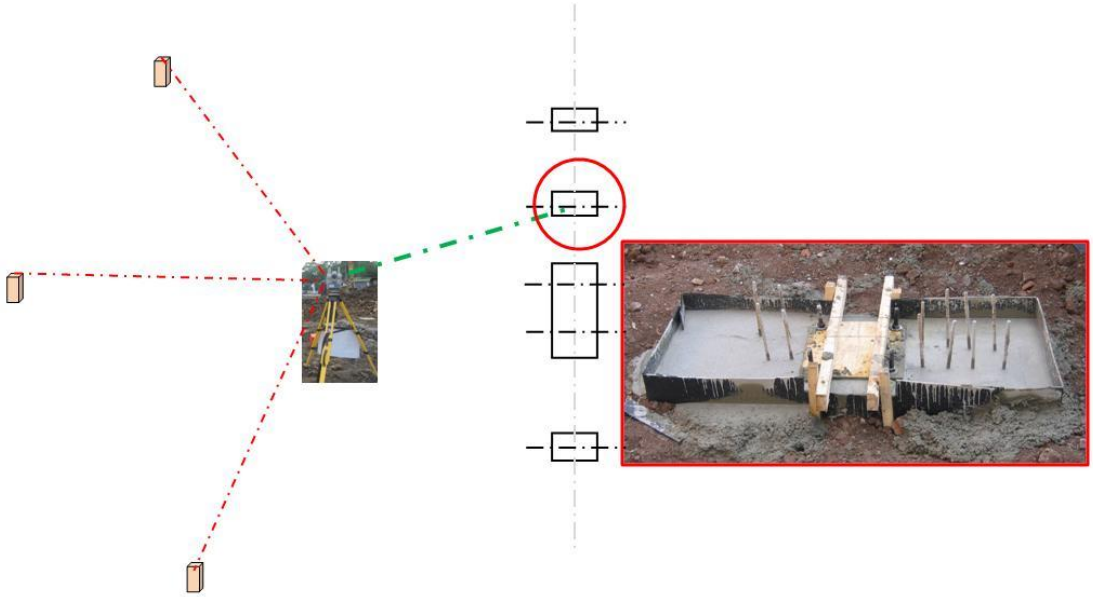

Figure 6: Hanging by Resection

Floating – By Line and Distance

Method

1. Again set out two pegs with nails on the gridline to be set out, with known distance off perpendicular gridlines. Having done so ahead of the concrete for the foundation being delivered to site.
2. Set up on one of the points, sighting the other point and carrying out a distance check, accepting or rejecting, it may be necessary to repeat step 1
3. Ensure the foundation has been poured to the correct level and the required finish attained
4. Find the centre of the columns/intersection of the gridlines, by measuring and adjusting the prism location until located
5. Ensure the correct bolts are obtained and float into the wet concrete, only float the template in half way
6. Check the position (centre) and orientation (line) of the template to grid, adjusting as required. You may be able to physically check the orientation yourself if the gridlines are marked on the template and you have a clear line of sight, otherwise use the mini prism
7. Now fully float the template into the concrete, carrying out a check on the position of the centre and orientation and level once installed
8. Carry out any remedial works to the finish of the concrete as required

Advantages

- Greater speed in construction
- Able to visually sight down line and check using telescope of instrument
- Great for projects using a local grid or a grid layout orientated to the gridlines
- Less labour intensive
- Great for long gridlines

Disadvantages

- Not suited to foundations involving fixed cut and bent steel such as pile caps or pads with two layers of fabric mesh. Would need to adjust reinforcement to accommodate bolts prior to pouring.
- Unsuitable to large, weighty templates of bolts
- Setting out will often become 'rushed' and towards the end of the day when the quality of natural light decreases
- Positioning of bolts and progress dependant on concrete suppliers performance.
- Hardening of concrete can add a time element to the works
- Potential to create void/poor compaction under the template

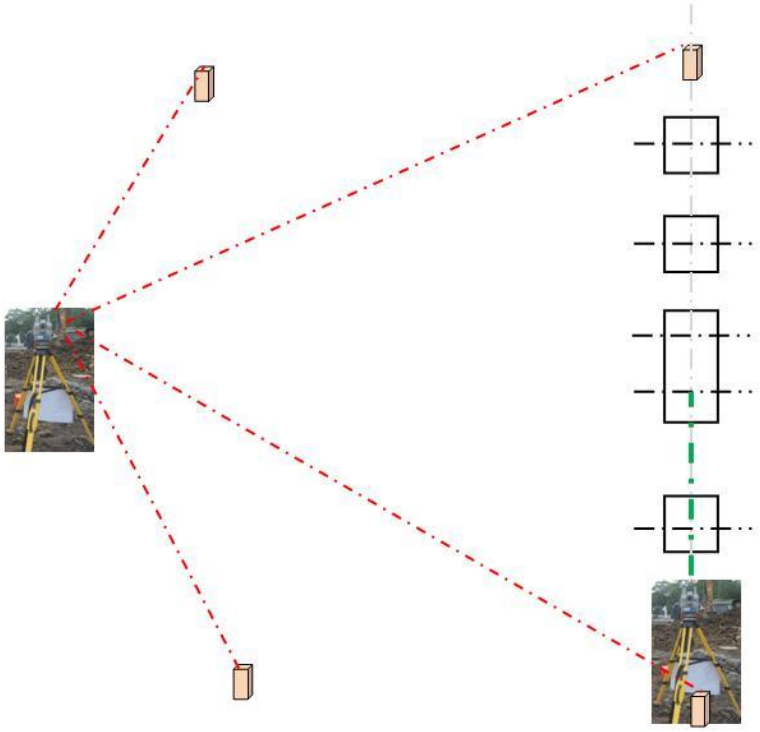

Figure 7: Floating by Line and Distance

<u>Floating – By Resection</u>

Method

1. Carry out a resection from your chosen control points/readily available and accept or reject the solution based on your error
2. Having accepted the resection and orientated yourself and working with either a local grid or a project grid which is orientated with the building gridlines begin
3. Ensure the foundation has been poured to the correct level
4. Locate the centre of the gridline intersection by measuring and adjusting the prism until found and mark the wet concrete
5. Float the bolt cluster into the wet concrete approximately half way and check the position and orientation to grid by measuring the centre and two points on the same gridline, adjust as required

6. Fully float the bolt cluster into the wet concrete and again check the centre and two points on the same gridline, adjusting as required, finally checking the level
7. Carry out the required remedial works as required to attain the required surface finish of the concrete

Advantages

- Greater speed in construction
- Less engineering intensive
- Less labour intensive
- Great for projects using a local grid or a grid layout orientated to the gridlines

Disadvantages

- Unsuitable for foundations involving fixed cut and bent steel such as pile caps or pads with two layers of fabric mesh
- Unsuitable to large, weighty templates of bolts
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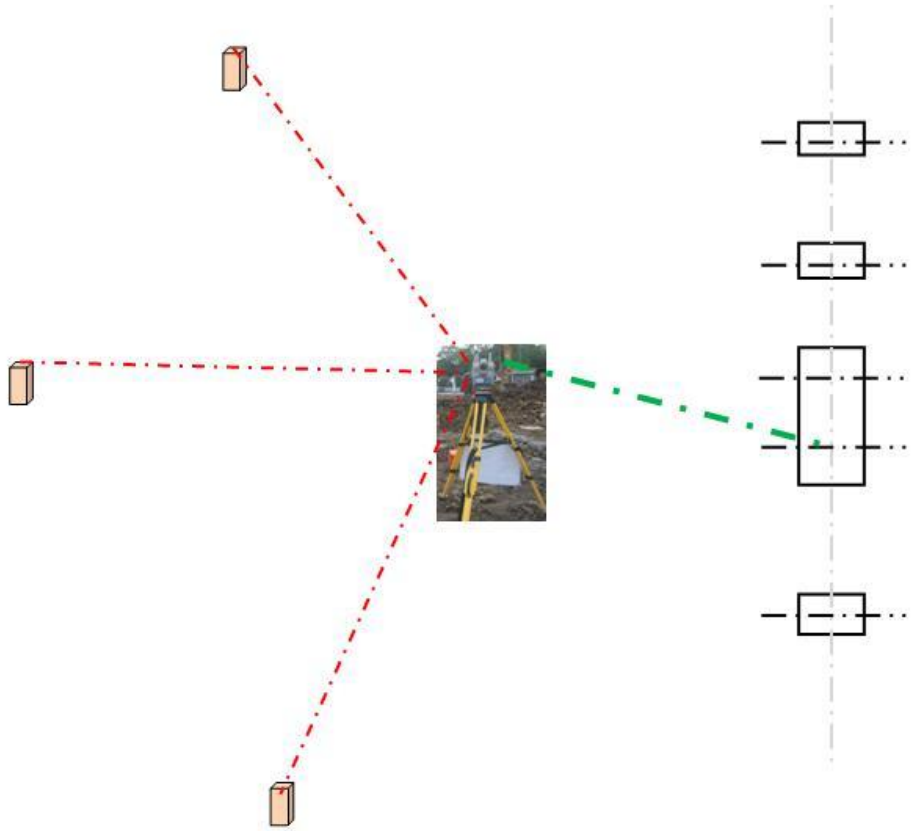

Figure 8: Floating by Resection

TOLERANCES

National Structural Steelwork Specification for Building Construction 5th or 'black book' as it's affectionately referred too. Is the source of reference with regard the prescribed construction tolerances for holding down bolts for any steelwork erection, unless the project specification specifies anything other, check the specification prior to starting the holding down bolts element of the works. Typical tolerance are given below

- Top of Concrete - Typically +/- 15mm relative to the specified/design level
- Bolt Projection – Typically +25mm to -5mm
- For Bolts with Cones – 25mm clearance around the bolt to the edge of the cone and +/- 10mm from the specified/designed location
- For Bolts with no Cones - +/- 3mm from the specified/designed location
- Any form of embedded/cast in connection - +/- 10mm from the specified/design position in both axis

CONSTRUCTION JOINTS

Unless your foundation layout is either for a single dwelling or alternatively pile cap/pad arrangement devoid of ground beams and strip footing you are likely to need construction joints between successive concrete pours. The need to link consecutive concrete pours together is to avoid the effects of differential settlement between the pours.

The need for construction joints will depend on: -

- How large a pour you can have prepared in a day
- Quantity of concrete you can have delivered in a day and placed
- Resources on site, labour, plant and materials
- Working room for plant to work, access to the workface, storage of materials and arising's.
- If there is any holding down bolts within the pour, takes time to install which ever method you elect to use.

In the event your foundations consist of fabric mesh or cut and bent steel it will most likely be easy to form construction joints since you will have the continuity of reinforcement. Simply requiring you to construct a stop end within the extent of the concrete pour, using a 'comb' although products do exist on the market to make forming stop ends easier such as insitu metal formwork.

Typically stop ends should be located either at one third or two thirds of the ground beam, again your Structural Engineer will detail this or you may wish to clarify this with them.

If the foundations are a mass pour configuration you may wish to hammer dowel bars into the face of the excavation so that when you continue the excavation you have continuity and are able to tie in the consecutive pours. Typically the dowel bars projection within each pour will need to be 40 x its diameter therefore for a 12mm bar, the bar would need to project 480mm and have a total length no less than 960mm.

Constructions joints should be suitably prepared to ensure a key with the successive pour, typically this would be done using a hand held scabbler, however with more awareness of the damaging effects of Hand Arm Vibration (HAV's) the use of scabblers has been reduced on site in favour of other methods such as using concrete retarders used in conjunction with a high power jet wash to expose the aggregate.

If no detail for a construction joint exists you may wish to raise a query with your structural engineer.

BUILDING CONTROL/THIRD PARTY INSPECTIONS

The local authority responsible for the borough the site is located will need to inspect all foundations before pouring, they should have received drawings of the project from the design team before hand, to plan check and approve and will then need to visit site at specific project milestones typically foundations and drainage etc to inspect the works. On the first inspection discuss with the officer what they wish to inspect and notification timescales

> ⚠ ***Tip***
> *Building Control will typically require 24 hours notice prior to an inspection being required.*

It is advised to have a copy of the drawing(s) available typically in A3 at hand when the building control officer arrives and accompany/escort them onsite since they will most likely not have been inducted for the project and to field any technical questions they may have.

The building control officer may ask you to carry out works e.g. increase the depth of the foundation, clean off the sides of the excavation or remove any standing water there maybe before pouring; these instructions must be complied with.

The building inspector will also need copies of the piling logs if any piling has been undertaken prior to the foundations starting, as the project progresses any revisions in drawings should also be issued to the building control officer onsite when undertaking an inspection.

Other third parties may also need to inspect the foundations before pouring e.g. NHBC if registered for guarantees or the clients own representative the clerk of works, if there is one. Best to ensure the programme has been discussed with the clerk of works and determine if they will require notification to inspect the works

QUALITY ASSURANCE

Quality Assurance or QA as it will be referred to from now on, is very important and most companies will have a procedure for inspecting the works as they progress to ensure that any deviation from the project drawings and specifications is quickly identified and corrective actions taken to prevent from happening again. Your building control officer will

not be able to inspect all elements of the work and will rely on your own QA procedures and may ask for copies to ensure compliance.

In the following sections the key elements to be inspected as the works proceed are discussed and divided into four critical sections of work encompassing elements that should be inspected at that stage of the process. You will find your companies own QA forms will feature many if not all of these items, attached in the appendix of this chapter is the authors own QA forms which have been created to follow a logical sequence of work and to avoid the laborious ticking and initialling of boxes for each individual inspected item, which can have the effect of discouraging individuals from completing the forms in the first point.

Below follows an exhaustive list of items to be checked onsite as the works progress, not all of them will be applicable to the type of foundations you are constructing, readers will be required to determine which elements are applicable to the works they are undertaking at that time.

INSPECTION OF EXCAVATION WORKS

Excavations clean and accurate

- Do the sizes of the excavations match those on the drawing, not undersized?
- Does the base of the excavation need loose/collapsed material shovelling out?
- Is the excavation square at the base? Is it rounded from the swing of the excavator bucket?

Correct formation level achieved form, formation suitable

- Has the excavation been taken down to the correct level on the project drawings?
- Has blinding been allowed for if specified?
- If foundations have more than one dig level, has the correct one been used for this excavation?
- Is the formation as expected? A clay material – report and discrepancies to the structural engineer
- Are there any seams of dark/black organic material within the formation level – will need to be excavated and removed (See figure 9)
- Any drains with the foundations creating a void? Will need to remove, if unable to remove excavated deeper at the sides of the drain – discuss with building control/structural engineer

Figure 9: Organic Material/Poor Formation

Excavation stability- Requires shoring?

- Can the excavation be left open?
- Any loose material on the sides which needs to be removed before it collapses in
- Does the side need battering or banking
- Can operatives safely work within to blind, fix steel etc

Figure 10: Pumping prior to Pouring

Ground water requires pumping out

- Any standing water within the excavation? Will damage the formation level
- Will affect the water cement ratio of the concrete
- Building control will need to inspect, will require standing water pumping out

Piles cropped and ready for testing

- Piles are correct size and layout? Check and report and discrepancies to the structural engineer
- Piles cropped to cut off level?
- Cropped piles are clean and free from loose material and ready for testing?
- Any and all de bonding foam and polystyrene removed from around the reinforcing?
- Correct number of bars project into the pile cap? Not broken any during cropping? Report missing bars/broken bars to the structural engineer for corrective works e.g. drill and fix detail.
- Pile reinforcement satisfies the 40D rule, e.g. 40 x the bars diameter – queries any discrepancies with the structural engineer.

Blinding laid, clean and compacted

- Blinding will typically be laid for foundation requiring steel fixing such as pile caps and ground beams, which is not simply fabric mesh to ensure the formation is not damaged between the excavation and pouring stages of the operations.
- Blinding will typically be anywhere between 50-75mm thick
- Allowance for blinding depths should have been made during excavation
- Typically blinding will be set low to allow for construction tolerances and to ensure that any deviations in level do not degrade the reinforcements cover levels
- In the event any excavation is to be left open over night the formation should be blinded.

<u>PRE POUR INSPECTION</u>

Piles tested and passed

- As already discussed if your foundations feature piles of any description and they have required testing have they passed?
- If not they will need additional trimming to the depth as stipulated by the tester to ensure a satisfactory reading.

Reinforcing

- Correct bar types used as specified on drawing and bending schedule
- Correct number of bars installed as specified
- Spacing of bars correct, may alternate depending on the direction of the bars
- Cleanliness – bars not caked in mud or still have type tags on?
- Length of Lap – as specified on drawings?
- Cover of reinforcement correct on top, bottom and sides drawings may specify greater cover on the base than other sides

Figure 11: No Cover

Formwork accurate and stable

- Formwork maybe timber shutters, pans or even in-situ disposable formwork
- Is the formwork plumb and stable?
- Have the shutters been cleaned after previous use?
- Has soap oil been applied if formwork to be stripped and reused?
- Are divi-dag bars tightened?
- In the event of using insitu formwork, backfilled and with no areas where reinforcement cover has been lost due to bulging?

Steps in footings work to courses

- Steps if specified in footings match coursing in of brick and block work
- No split blocks required?

Cleanliness

- No loose material from sides of excavation fallen in?
- No gloves, spray cans, protective mushrooms, timber, shuttering or food packaging within the reinforcement cage? (Yes it can be found in there)

Holding down bolts

- Correct size bolts used? Check yourself
- Correct bolt layout/template used? Check, don't rely on the type marked on the template to be correct
- Washers have 'denso' tape fitted?
- Bolts not too large for the depth of the foundation? Query with structural engineer, typically should be 200mm between base and embedded bolt
- If bolts being hung, in correct position and to correct level - Check

Construction joints

- Starters bars projecting on construction joints if detailed?
- Faces prepared
- Provision made for cold joints if delays in receiving concrete from suppliers?

Finished level of concrete

- Level given or laser and staff set?
- If using the existing ground as a shutter, is the ground level higher than the top of concrete? – check
- Shuttering if used is higher than top of concrete? may require a plant on the shutters
- levels given on shutters e.g. nails at finished level or grout check/fillet

Operatives aware of concrete finish

- Slab to be poured over strip footing/ground beams? Requiring a surface to 'key' too.
- Masonry to be built directly off the footing/ground beam, required to be relatively level and not to rough, affecting bedding of the bricks and blocks.

Resident engineer/Building Control notified for inspection

- Resident engineer or clerk of works invited to inspect the works before pouring
- Other third party such as NHBC required to inspect before pouring and done so
- Building control inspected and happy with works before pouring?

FINAL POUR INSPECTION

Concrete delivered as specification

- Check the deliver ticket
- If pouring in more than one place on site at once, correct mix for your works
- If more than one contractor onsite pouring at the same site, correct contractor

No additional water added to concrete

- Operatives not insisting on adding water to mix to ease placement
- Additional water affects the water cement ratio and the mix will be designed with a specific water cement ratio

Concrete correctly placed and levelled

- Compaction equipment being used to ensure removal of voids
- The use of a high slump mix does not negate the need to use compaction equipment.
- Concrete not over compacted leading to 'honeycombing'
- Required surface finish achieved
- Operatives check and achieving the required level – holding staff plumb?

Concrete cubes taken

- The concrete supplier may take their own cubes for their own purposes of Quality Control.
- Sufficient number of moulds cleaned, soap oiled and assembled as required for taking cubes
- Cubes not over compacted, poker vibrators should not be used to compact cubes, a hand tamp should be used.
- Correct number of cubes taken for testing and a spare? e.g. 4 for 1 test at 7 days, two tested at 28 days and spare in the event of receiving poor results during testing

- Sufficient data taken for cube testing, supplier, delivery ticket number, location/use of the concrete be specific don't just use 'foundations' give gridlines.
- In the event your company employs a testing house to carry out both the manufacture and testing of the cubes ensure that you furnish them with the information above.

INSPECTION OF FINISHED WORKS

Formwork removed and voids backfilled

- If using timber shuttering or pans to form the foundations, they will need to be stripped and removed
- Back filling completed and appropriate compaction equipment used, e.g. a compaction plate used to compact materials in layers and not the back bucket of the excavator.

Holding down bolts

- Bolts cracked? – Template removed and bolts free to move around within the cone for tolerance in construction and aid in erection.
- Cones clean? Not collapsed or filled with concrete/other foreign material.
- Cones removed, ready for erecting columns and grouting of columns

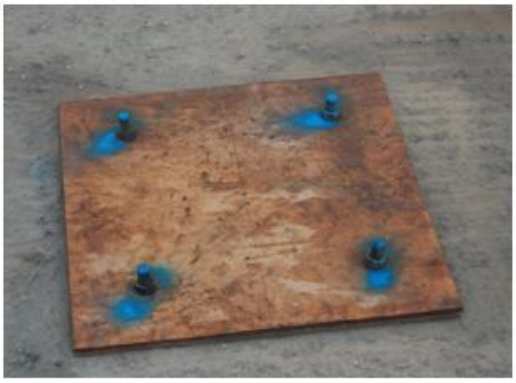

Figure 12: Not enough Projection

Figure 13: Incorrect configuration

- Correct projection?
- Correct configuration?
- In the correct position?
- Report any discrepancies to your supervisor/Structural Steel contractor for a timely solution, may be possible to amend the base plates to suite as-built situations or worse case scenario breaking out and casting again.

Level of foundations checked

- Correct finish level?
- Requires corrective measures - scable?

Setting out carried out for preceding trades

- Undertaking this early on will often identify issues like those identified above
- Face lines for masonry offset or the corners of the masonry

- For structural steelwork, gridlines marked at base plates and or offsets of gridlines ready for plumbing and lining the steelwork

Any required corrective works completed

- Any corrective works required as a result of your diligent checks completed ahead of the proceeding trade? to avoid costly delays both in time and financial

Area clean and tidy for proceeding trades

- Area of works cleaned of all waste materials such as timber, steel, shuttering and concrete snots
- Excavations backfilled correctly – no risk of cranes or MEWPS working in areas over turning?

PRECEDING TRADES

As soon as is practically possible and a suitably sized section of works is available you should perform the setting out for the preceding trades. This avoids unnecessary delays and the associated costs, as well as allowing you the ability to utilise favourable weather conditions and identify any issues early on so that corrective works can be undertaken in advance of the trade starting.

Especially considering foundations will almost always end up filling up holding water, its best to set out whenever conditions are favourable.

MASONRY

The provision of face lines is always preferable to gridlines with offsets as this potentially has a greater margin for error.

You may wish to discuss what setting out the contractor/operatives would prefer and review what information has been given by the design team. Options will typically be corner points or face lines, each have their own advantages and disadvantages and setting out will be by placing cartridge nails into the hardened concrete

Corner Points

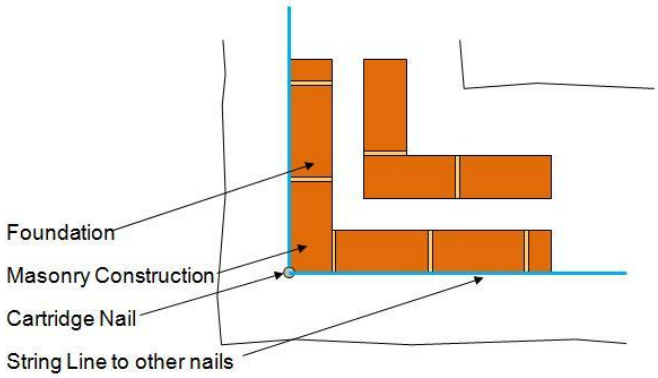

Figure 14

Advantages

- Less engineering required in both calculations/setting out
- Less materials required – cartridge nails

Disadvantages

- Not able to check setting out – Corner point built on/Lost
- Nail can foul bed of masonry
- More involved to set point out accurately in two planes

Face Lines

Advantages

- Ability to use original setting out to check accuracy of the building
- Nails can't foul the bed of masonry
- Nail only need to be accurate in one plane

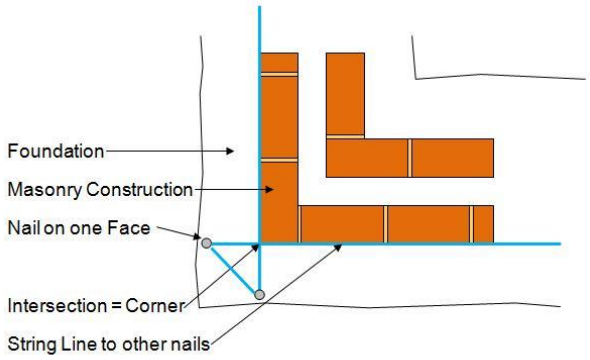

Figure 15

Tip

Mark corresponding nails with separate coloured tapes or spray paint or alternatively arrows marking direction form nail to face to avoid any confusion onsite

Disadvantages

- More engineering involved – calculation and setting out time
- More material involved – cartridge nails
- Works best with local grids or Total stations with onboard programs

STRUCTURAL STEELWORK

The structural steelwork contractor and there erecting team and or erection contractor may specify setting out, typically this will be grid lines marked on the foundations to allow them to install the columns on grid during erection rather than erecting the frame and then pushing and pulling the structure to get on grid.

An advantage of marking the gridlines on the foundations is the ability to check the holding down bolts for position, orientation and layout, identifying any issues early on so that the structural steelwork contractor can if possible revise the base plates to suite the as-built or worse case scenario, the groundwork's contractor has time to break out the foundation

incorrect foundation and re pour. Another advantage is for your ability of checking the steel frame for plumb line and level.

Additional or alternatively you may chose or be asked to set out offset points from gridlines typically 1.0m to be used to plumb and line the steel frame. It is advised to speak with the project Quantity Surveyor or alternatively the contractor to find out what setting out attendances are required to ensure that the required setting out is completed ahead of the contractor starting onsite.

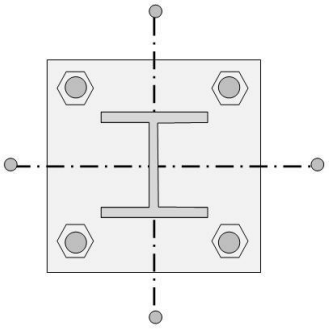

Figure 16: Gridlines Marked on Foundation

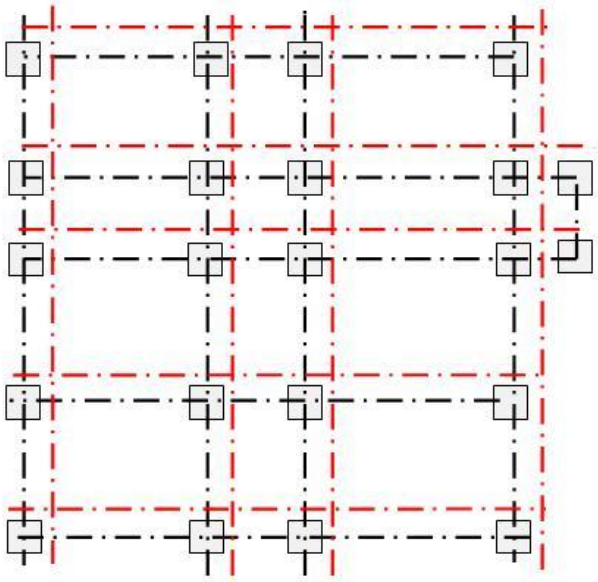

Figure 17: Offset Gridlines for Lining and Plumbing

APPENDIX

QA: Pile Caps and Ground Beams
QA: Foundations

Site Engineering Guide www.ajb-settingout.co.uk	Project Name:	
	Location of Inspection (Gridlines)	
Specification/Drawing Ref		

N^{o}	Item	Tick	Initial: Notes or Issues to report
1	**Inspection of Excavation Works**		
1a	Excavations: Clean and Accurate Correct formation level achieved Formation Suitable? Excavation stability: - Shoring required? – installed if required		
1b	Formation suitable		
1c	Shoring required? Installed if required		
1d	Piles been cropped to level, clean and prepared for testing		
1e	ALL Piles present and within positional tolerance		
1f	Blinding laid, clean and compacted		
2	**Pre Pour Inspection**		
2a	Piles integrity tested and PASSED		
2b	Reinforcing: - Correct Bar Type Bar spacing Cleanliness Length of LAP Cover Top, Bottom, Sides		
2c	Formwork accurate, suitable and adequately propped		
2d	Cleanliness		
2e	Holding down bolts: - Correct Projection Correct size/layout Washers ‘denso’ tapped		
2f	Concrete interfaces, scrabbled/prepared (If applicable)		
2g	*Resident Engineer/Building Control notified and inspected:*	Signed:	
3	**Final Pour Inspection**		
3a	Concrete delivered as specification		
3b	Concrete correctly placed and levelled		
3c	Concrete cubes taken		
3d	Weather protection in place if applicable		
4	**Inspection of Finished Works**		
4a	Formwork removed and any voids backfilled		
4b	Have holding down bolts been: - Cracked and are free ‘Cones’ clean of Concrete Cones removed in preparation for grouting		
4c	Level of Pile cap(s) checked		
4d	Gridlines marked on Pile cap(s) reporting any issues likely to affect proceeding trades		

Guidance notes for completing this form:

- Attach/print General Arrangement on reverse of this form and mark items/areas applicable to this sheet
- Tick ALL items relevant for inspection, initial inspection stage when completed and infill notes as required
- Continue additional notes overleaf or on additional piece of paper if required
- Attached photographs if applicable
- If at all possible obtain a counter signature from the Resident Engineer/Clerk of Works/ Building Control prior to pouring.

Site Engineering Guide www.ajb-settingout.co.uk	Project Name:	
	Location of Inspection (Gridlines)	
Specification/Drawing Ref		

N^{o}	Item	Tick	Initial: Notes or Issues to report
1	**Inspection of Excavation Works**		
1a	Excavations: Clean and Accurate Correct formation level achieved Formation Suitable? Excavation stability: - Shoring required? – installed if required		
1b	ALL Piles present and within positional tolerance		
1c	Ground water requires pumping out?		
1d	Blinding laid, clean and compacted		
2	**Pre Pour Inspection**		
2a	Reinforcing: - Correct Bar Type Bar Spacing Cleanliness Length of LAP Cover Top, Bottom, sides		
2b	Formwork accurate, suitable and adequately propped - Steps in footings work to courses		
2c	Cleanliness		
2d	Holding down Bolts: - Correct Projection Correct Size/Layout Washers ‘denso’ taped		
2e	Concrete Interfaces, scrabbled/prepared (if applicable)		
2f	If using reduced level as finished level of concrete, check sides of excavation level		
2g	Operatives aware of Concrete Finish Level		
2h	*Resident Engineer/Building Control notified and inspected:*	Signed:	
3	**Final Pour Inspection**		
3a	Concrete Delivered as Specification		
3b	No additional water added by Contractor		
3c	Concrete correctly placed and levelled		
3d	Concrete cubes taken		
4	**Inspection of Finished works**		
4a	Formwork removed and any voids backfilled		
	Have holding down bolts been: - Cracked and are free ‘Cones’ clean of concrete Cones removed in preparation for grouting		
4b	Level of foundations checked		
4c	Setting out completed for proceeding trades reporting any issues in likely to affect proceeding trades		

Guidance notes for completing this form:

- Attach/print General Arrangement on reverse of this form and mark items/areas applicable to this sheet
- Tick ALL items relevant for inspection, initial inspection stage when completed and infill notes as required
- Continue additional notes overleaf or on additional piece of paper if required
- Attached photographs if applicable

- If at all possible obtain a counter signature from the Resident Engineer/Clerk of Works/ Building Control prior to pouring.