Soil Investigation

1- All loads from a building is transferred to the footings , and the footing transfers it to the soil, so we need to know the bearing capacity of the soil.
2- Take the soil investigation crew to the site to perform the required tests.
3-Number of boreholes varies according the structure type, the consultant engineer decides on that who performs the tests, and he will locate the points on the site plan.
4-The crew asks you to locate the points on the ground that the consultant engineer indicates, so you need to locate that points by a total station , because the consultant engineer needs (X,Y,Z) for that points since he needs the slope of the natural ground also.

Note :

1-The structural drawings tells you the assumed or the actual bearing capacity.
2-Sometimes the drawings includes actual bearing capacity value, which means that the tests were already done for designing purposes, in this case no need to do this test.
3-Sometimes the bearing capacity is assumed by the designer of your project, so the resident engineer asks you to do the soils tests required for this purpose.
4-If the resident engineer asked you to perform the tests, then he should pay the contractor all costs of the soil test according to the general contract condition, but if there is a statement in the contract that requires the soil test , then you cannot demand the soil test cost.
5-If the contract is performing the soil test on his demand just for further information , he cannot claim for the cost.

Mobilization

1-All contracts includes an item that requires from the contractor to prepare office for the resident engineer , read the contract to get the requirements of the office, since it differs from a contract to another.
2-You, as a contractor's site engineer, need an office too, try to avoid combined office with accountant or any other contractor members since you need privacy and calmness to perform your office activities.
3-Check for source of water and electricity for the offices, make pits for the sewer system of the offices.
4-Check water sources and methods of bringing the water to the site for construction purposes, also check electricity power for construction purposes.
5-Avoid putting the offices in a location that might be an obstacle for future construction works, because it would be a costly and hard work to relocate the offices in the middle of the project.

Grading

Organic material, grass and plants..... should be removed for the entire site. grading is also necessary for cleaning the site and prepare it for layout. Check the site preparation or equivalent item in the contract that mentions the depth of cutting or any other particular conditions for the grading purpose.

Benchmark

It is very important to have benchmarks in the site. When you fix a benchmark, pay attention to the following :

a-Check the topography of the buildings and the depth of footings to assume the benchmark value, assume a value that prevents a negative value which makes your calculation on the site more complex. For example, if maximum difference in the natural ground is 12 meters, and the depth of footings is 2 meters, do not assume the benchmark value less than (12+2= 14 meters), so your highest point benchmark should not be less than 14 to avoid negative values in reduced levels in the footings of the lower points in the site.

b-Fix your benchmarks in locations far from trucks path, not to be an obstacle for movement in the site and mark it by flags so that everyone can notice it.

c-Fix the benchmarks in such a location to be obvious and easily can be seen when you survey during the project.

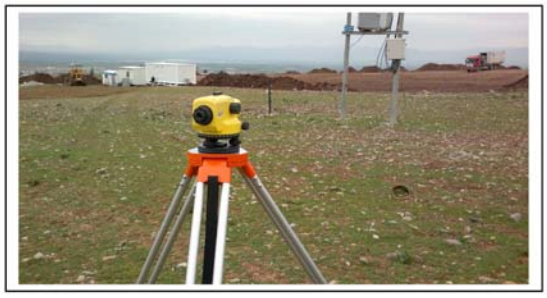
d-When you fix a benchmark, do not make it higher from the ground, try to make it flat with natural ground and excavate around the benchmark then and it with concrete.

e-When you fix a bar in the concrete for the benchmark, try not to be higher than the concrete more than 1 cm , sometimes when you send someone to the benchmark for getting a staff reading, the staff man puts the staff on the concrete instead of bar which leads to errors, but if the bar is not so high from the concrete, then the error in case of happening, will not be more than 1 cm.

d-Try to have permanent person as a staff man which makes your surveying work easier.

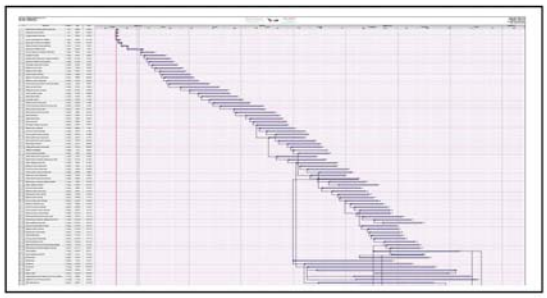
Checking Benchmarks

After fixing the benchmarks, survey for the benchmark values and fix their values accurately to two digits of precision. Before starting any project, check the level instrument for errors. Even if the level instrument is brand new, it needs to be checked on site prior to use. It is so important to complete measurement of all items at every stage of work, never let measurement to cumulative since it will lead to problems in preparing payments and variation orders which are so important for continuity of work.



Schedule

Prepare a work progress schedule by using a Primavera program , Microsoft Project program or any other methods to show the duration for the activities and provide resources for the project according to that schedule so the project to be finished within the specified duration. Perform a meeting with the contractor to know his abilities, number of crews and construction methods before preparing the schedule. An actual bar chart tells the contractor critical activities that cannot be delayed since they affect the whole project finishing date and other activities that have a reasonable elastic duration which not affects the project finishing date severely, depending on this the contractor know which crew is so important for the project progress more than other crews.



Contour Map

Prepare a contour for the site (note that this contour map should be after grading process). The interval of the contour map should be suitable with the difference in the natural ground elevations. For example if the total difference in the natural ground of the site is 2 meters, the intervals should not be large such as 0.50 meters, in such a case you will have only four lines in your contour map, you can make your intervals 0.20 meter to have enough contour lines. In case you needed the reduced level for points between the contour lines, you should interpolate it.

Checking drawings :

1-Try to get a soft copy of the drawings from the resident engineer, this will make preparing other drawings while work progress more easier and also can be used for measurement purposes.

2-Check all drawings when you get it, especially the drawings that are related to center lines, footings and columns and plans. since all layout processes are done by total stations nowadays, it is necessary to check the footing dimensions carefully.

Layout

Layout can be done by theodolite or total station. Total station is more accurate and reduces time and preferred to be used for layout process. The accuracy of staked out points for footing corners by total station can have a tolerance up to 2 cm, since the excavator cannot give you an accurate excavation. In case of repeated single footings you can fabricate square or rectangular steel form according to your footings dimensions to reduce staked out points.

Note : for measurement purpose of the footings, you need reduced level of bed of the footings and natural ground reduced level to calculate footing depth, so after finishing the layout, read the reduce level of the natural ground for the footings at required locations.

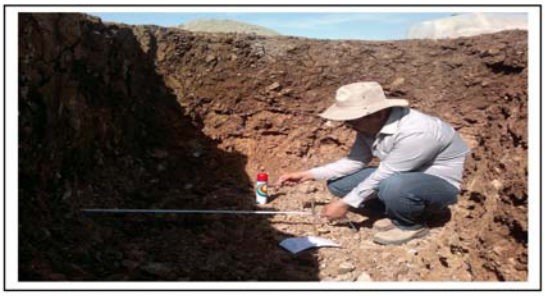
Excavation

Start excavation and provide enough equipment according to size of the works. Check minimum depths provided by bearing capacity test report and study the depth of footings and its relation with finish floor levels to avoid having a long column, if you encountered long column case, you can provide pedestals according to your structural designer decision or any other solutions provided by the structural engineers. Samples of materials should be sent to laboratory for testing at this stage, for example (sand, gravel, cement and reinforcement bars...), send the materials samples that you will need it in the next stage. When you bring reinforcement bars into the site, during unloading it avoid putting different diameter over each other, put each diameter together, sometimes you need a bar with specific diameter but it might be under other bundles of different diameter and you need equipment to remove it again which costs the contractor unnecessary expenditure. During the project, always examine the upcoming items and do the required test for the materials before reaching that item.

Note : Usually contractor needs estimated quantities for reinforcement and concrete or some other items at this stage for the purpose of resources and subcontracting.

Relocating Footing Centers

After finishing the layout and checking it, you will start excavation, during excavation process the center of footings may shift or the dimensions of the footings are not as required, or sometimes the dimensions are as required but the center of the excavation is shifting from its proper position. With a total station or any other equivalent method relocate the center of each footing and fix a bar. From the bar measure each side of excavation and if further excavation is required, mark it on the footing sides and complete the excavation with labors. Always try to put the excavated soil after marking away from edge of footings to prevent soil falling into the footings again during pouring concrete or reinforcing the footings.

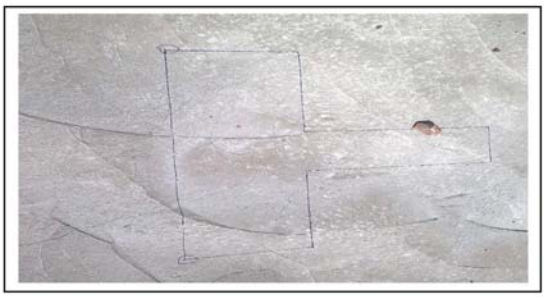


Lean Concrete

After leveling bed of excavation and adjusting the sides of the footings, lean concrete will be poured according to the specifications in the drawings. Sometimes (Nylon) is placed before pouring lean concrete depending on the drawings, when Nylon is placed, make sure that it reaches the corners at the bottom of the excavation and not to be tight in such away makes the concrete not to reach the corners.

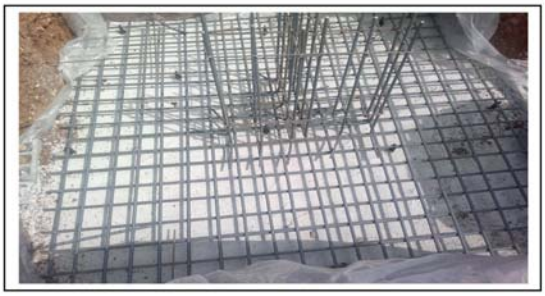
Stakeout Column Locations

Before starting reinforcement work, column locations should be fixed on the lean concrete, since dowels are coming out from the footings, the location of the columns should be accurately fixed. Total station can be used for the purpose of fixing column corners. If you have repeated columns, you can make a steel mould to reduce the staked out points and save time. After completing drawing the column or shear walls mould on the lean concrete, check it again since it is an important activity.



Footing Reinforcement

Check the drawings related to reinforcements and study it. Make calculations to set an arrangement for cutting the bars to minimize loss in the bars since cutting bars randomly might lead to large quantity of steel loss which costs the company too much money. Sometimes the drawings rules to have losses but always try to prepare a calculation for reinforcing crews. This calculation is important especially when you deal with large diameter of bars such as 20 mm dia. or larger. In the footings, the cover is (7 cm) , so if you distributed the bars depending on the spaces, the bars will be reduced in numbers, it is necessary to give the reinforcement crews number of bars per each footing instead of giving then spaces only. Prepare shop drawing for the crews since most crews do not understand the drawings directly. Column reinforcement should be vertical according to drawings to reduce any displacement in the column bars. Footing bars should be fixed in the corners since while pouring concrete the whole footing and column bars may shift due to lateral load while pouring fresh concrete for the footings. Provide plastic cover to be placed under footing bars. Before pouring concrete, footings should be cleaned from dust, Nylon should be adjusted again, According to the thickness in the drawings, bars should be fixed to indicate level on pouring concrete.

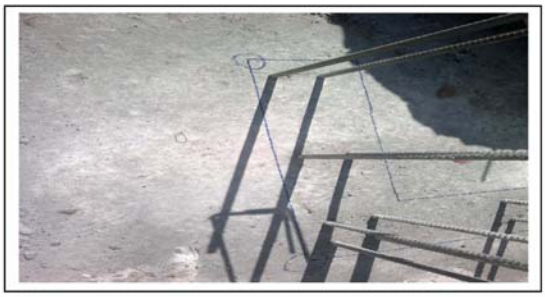


Pouring Concrete for Footings

Before staring pouring concrete, check vibrators and always have back up vibrators on site. Prepare enough labors for any other works that might be required while pouring concrete such as cleaning, adjusting Nylon....etc. Check water resource for curing purpose since due to hot weather, curing might be necessary after pouring part of the footings. All footings should be cleaned. Always make arrangements to have enough crews for trawling and leveling. Approval from resident engineer should be obtained a day before pouring. . Always make sure to pour the concrete at the center of the footing since starting pouring in the corners might shift all the footing reinforcement together, it is necessary to fix the footing and the column reinforcement laterally to reduce any lateral displacement. Vibrator should be used to reduce air content in the concrete since voids has significant influence on the concrete strength. Vibrators should not be used too much since it causes segregation. Control water cement ration and workability while pouring process.

Relocating Column Corners After RC Footing

After pouring concrete for the footings, column corners should be staked out again to eliminate any displacement that might occur while pouring concrete.



Concrete Curing

After pouring concrete for the footings, it is necessary to have a continuous curing, sometimes due to hot weather it is necessary to start curing process after pouring part of the footings while concreting process still ongoing and not finished. Usually we use water for curing process and it should be continuous for seven days. it is necessary to keep the concrete wet to reduce quick water evaporation from the concrete surface. Curing compounds can be use also instead of water, in such a case pay attention to method of using the curing compound according to it type and note the age shelf of the product to prevent using expired product. Curing compound is very suitable for columns since due its verticality it might be difficult to keep the columns wet all the time. After pouring the footings, read elevations on the footings for calculating the height of columns under tie beam and reinforcement length of the columns, tie reinforcement should be to the level of under tie beam and the main bars should be up to tie beam level plus bars overlap. Pay attention if the column cross sections are remaining the same under tie beam and above tie beam. The elevations got on the footings can be used for calculating depth of footings after deducting footing thickness and lean concrete thickness, natural ground level can be read from contour map or before excavation at the end of layout process.

Column Reinforcement

Check the drawings and all details and give the data to the reinforcing crew to start column reinforcement activity. It is necessary to give him length of main bars for cutting it, main bar length should be calculated from reduced level on footing concrete and the finish floor level for the building. Pay attention to give the main bar enough length for overlap for the level column. The crew needs height of the column under the tie beam also so that he knows the required height for ties. Arrange a pattern for cutting to avoid loss in the steel always. Spacers (Cover) should be placed for the column bars before starting formwork, it is necessary to have plastic covers at the top end of the column to keep clear covers as required and avoid shifting the bars to the sides.

Column Formwork

The crew will start formwork for the columns, make sure to have enough support for the column sides. After finishing the column formwork, place a sign on the column and tell the crew to indicate the concrete level. Clean inside the column before starting formwork.

Pouring Concrete for Columns

After finishing the formwork, the carpenter crew should handover you the columns, check verticality of the columns and make sure that enough supports and bolts are provided for the formwork. Prepare vibrators and back up vibrators. If the column height is too much, pour half of the column height and use the vibrator then pour the remaining part. It is so important to put a skilled labor for vibrating because poor vibrating will lead to reduce strength and segregation, and extra vibrating will lead to rise of low specific gravity materials and lowering the higher gravity materials of concrete materials. After pouring each column, it is necessary to check the verticality again while the concrete still fresh because when the formwork is full of concrete its verticality can be adjusted to millimeters .

Column Curing

Since the column is in a vertical position, it is hard to keep it wet, so it should be covered and cured with water all the time. It is more preferred to use curing compound for this purpose, use a certified and tested type of curing compound (Curecoat 220 widely used nowadays). In case of having segregation it should be repaired with SBR and then coated with curing compound. It is necessary to avoid missing any spot on the column surface, the curing compound should cover all the surface entirely. Curing compound and sprayers should be prepared before deforming of the column formwork.

Block Wall Under Tie Beam

When there is a tie beam over columns, under the tie beam should be built by walls to retain the soil inside the building. After pouring the footings of the walls, building with blocks or any other elements according to the contract should start. Before starting block wall, bottom of the tie beam reduced level should be indicated on the columns so that the mason can use it as a guide during laying block walls. Always check dimensions between walls and the verticality of the walls. Pay attention to fill all gaps between the blocks with cement mortar. while preparing the mortar note to have a good cement ratio in the mix. Avoid laying block joints on each other. Curing with water at early ages and during final setting is so important especially after a few hours from laying the blocks. Take into consideration the location of main water, sewer pipes and electrical cables so that to have sleeves in the walls for that purpose. Each block should be hammered on the top so that the block penetrates the cement mortar. Gaps between block heads should be filled with cement mortar.

Coating Columns

Sometimes the soil reports shows the existing of some materials in the soil that requires the members including reinforcing bars to be isolated from the soil by coating them with bituminous materials to avoid reaching the material from reaching the members and defecting it. Before starting coating the columns and shear walls, bars that are used in form work should be cut.

Filling Inside the Building

It is necessary to pay attention to avoid lateral loads from the soil on the block walls, fill inside and outside the perimeter walls in a balanced quantity of soil. Use granular material for filling. Filling should be in layers and each layer should be wetted and compacted well before placing another layer. Pay attention to the backfill areas for compaction. Fill to the required levels and take to consideration finish floor level, tile thickness, mortar thickness, concrete under tile and crush stone if existing.

Tie Beam

Check the drawings and give instructions to the carpenter group to start making ties for the tie beam, check the cover required by the drawings before giving them the dimensions. Prepare a sample of the tie before starting cutting bars for all ties. When you give them the required quantity of ties, try to give them 10% less than the required quantity. Prepare plastic covers for the reinforcement bars before starting fixing the beams. Indicate the reduce level of top the tie beam and mark it with strings to guide you during pouring concrete. Vibrator is necessary to be used while pouring concrete. Check all dimensions of the rooms and spaces before starting pouring concrete.

Columns of Ground Level

Check the drawings to indicate height of columns by checking floor heights and depth of beams. Pay attention to deeper beams since the govern the column height when you have different beam depths on the same column. Before placing column reinforcement, stakeout points on the corners of the building on the tie beam to eliminate any displacement in column location of columns while pouring the tie beam. Check the stair of the building and pour the connected columns with the stair according to the height in the drawings.




Stair at Ground Level

Check the drawings and calculate height of the building from floor to floor in order to calculate stair rises and its number. Sometimes the drawings are not accurate regarding to the stair or sometimes due to changes in floor heights on engineers demand, it is necessary to make a shop drawing for the stair detail and its footing location. do not give rapid information at all about the stair, prepare drawing always of the stair for the crew.

Slab Formwork for Ground Level

Fix a reduced level mark on the columns so that crew can measure from the mark the height to the bottom of the beams. Pay attention that some columns might have different heights on each side due to different beam depths from each side. Check the spaces between supports of the formwork.




Beam Reinforcement

Check the drawings for the required covers and beam dimensions then instruct the crew to prepare the ties. Prepare shop drawings for the crews. All beams are fixed above the beam formwork and then lowered into the formwork, it should be checked during working and inspected and get approval from the resident engineer before lowering it into the formwork. It is so important to clean the beam formwork and above the columns very well before lowering the beams. Fix plastic covers on sides and below the beam bars.




Slab Reinforcement

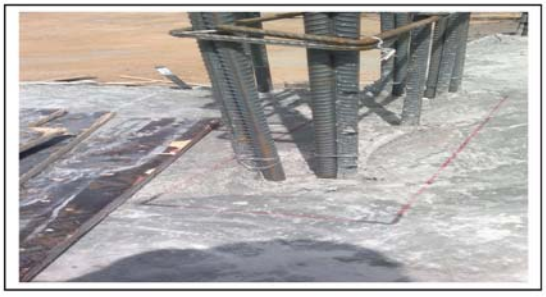
Check all drawings related to the slab reinforcement and give instruction to the crews to start reinforcement process. Clean all the roof from and dust and pieces of woods before the crew starting reinforcing since it would be more difficult to clean it after reinforcing . Put plastic covers to elevate the bars from the formwork. Check spacing and diameter of bars. It is so important to check (d) which is depth of the top layer bars from the formwork. Check with electrical and mechanical engineers all drawings for requirements of electrical piping or any other systems required from mechanical and electrical drawings. Clean all column cross sections and the slab especially when there is not false ceiling and the slab is finished with gypsum plastering from inside it is necessary to remove all tying wires from the slab surface to avoid rust . Check location of offset and length of additional bars according to the drawings and specifications. Electrical works starts with this item also.

Pouring Concrete for the Slab

Calculate the quantity of slab and beams or any other structure attached to the part of the main structure that you intend to pour in order to order concrete from the batch plant. Prepare enough crew for the pouring process such as trawlers, levelers, a person for the pump's hose control and all other necessary crews. Check electrical pipes for broken parts and repair it. when you pour concrete in hot weather prepare water source for curing since due to hot weather part of the slab needs curing before finishing the pouring process. Check the supports of the formwork for spacing and verticality and enough quantity of supports. When the supports are over soil, avoid wetting the soil at early ages after pouring. Prepare a steel cross to control the thickness of the concrete on the slab. Have enough labors for vibrating process. Prepare cubes for sampling.

Stakeout for Columns

After pouring the concrete of the slab and sufficient curing, start staking out for the columns of ground level to eliminate any displacement that might occur during lowering the beams reinforcements into the formwork.



Partition walls

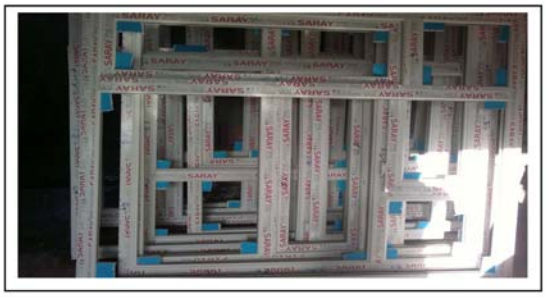
Before starting wall partitions, doors and windows dimensions and materials should be discussed. Prepare drawings for partitions locations and estimate the required quantity of materials required for each location and floor to avoid unnecessary material relocation. Check height and width of all openings during working, pay attention to verticality of all walls, enough space should be available for installing doors and windows after finishing thicknesses, for example if a door dimension is (1.00) meter wide, a space of (1.04) meter should be applied in the wall if the finishing material of the wall is gypsum which requires a (2)cm thickness on each side. Sometimes the drawings requires some special details such as connecting the partition walls to the columns by means of galvanized sheets, prepare materials for such details and get approve for it before starting it and prepare shop drawing for it. Tests for material that will be used in the walls should be done prior to work starting. Installing electrical conduits starts also with this activity.

Removing curing compound

For curing purpose of reinforced concrete columns, usually curing compound is applied to its surface, this coat of curing compound will not allow cement plastering to get required cohesion to the columns and will fall down after a short period of time, so this coating film should be removed before starting cement plastering. If the finishing material is another material that not require cohesion such as Aluminum board, it does not need to be removed. This coating film can be removed by sand blasting machine or chemical. I tried another method which was successful also, use car wash machines that has a high pressure (more than 170 bar) for this purpose since the curing compound has a water base.

Installing PVC windows

After completing partition walls, PVC windows can be installed. Some engineers prefer to complete finishing of walls and then installing the PVC windows, in such a case there will be space between the finishing surface and the window that will be filled by silicon usually, this silicone will lose its efficiency after awhile due to sun light and freezing and thawing cycles since good type of silicon is not used. I prefer to install the windows before starting finishing the walls so that the finishing material overlaps on the windows and eliminate all spaces, and in this case the windows should be covered by thin plastic sheets to keep it clean. Check all windows before installing and make sure that they are reinforced. Check all windows to be in a vertical and horizontal position.



Cement plastering

Check the elevations and the drawings to decide on the locations that should be finished with cement plastering and discuss it with the supervisor engineer. Send the sand sample for testing and check the resources to get a good quality of sand for the process. It is necessary that all walls should be cleaned from all kinds of wood and oils or anything else that might reduce the adhesion between the cement plastering and the wall. Study the priority of the places that needs to be completed firstly such as inside the shaft rooms that need to be finished first to start plumbing works. Check with electrician and plumbing crews before starting any plastering work to reduce and eliminate breaking cement plastering for electrical and plumbing works. The first layer of cement plastering is cement slurry that should be applied to the walls, it is very important to cure this cement slurry with water many times at the appropriate period since due to its high cement content and wall dryness it needs water curing after a short time. if the cement slurry is not water cured well then it will act like an isolation between the wall and the cement plastering and lead to cracks and even falling parts of the cement plastering. The cement slurry for bottom of slabs (cantilever) or any horizontal smooth concrete surfaces should be applied directly before the second layer of the cement plastering (higher cement content slurry). The second layer of cement plastering should be without curves, low spots or high spots and it should be straight and vertical, use a straight pipe (2 meter length) to achieve this. It is necessary to cure it sufficiently and within the right domain of time and needs a good attention to the process of curing. In the second layer, it is necessary to place the cement with the trawler firmly to the wall to increase the adhesion to the walls. When there is horizontal surfaces need to be plastered, it is necessary to be cleaned very well with brush and then by water to avoid the separation of between cement plastering and the surfaces.

Gypsum plastering

Check the elevations and the drawings to decide on the locations that should be finished with gypsum plastering and discuss it with the supervisor engineer. All surfaces that will be plastered should be clean (remove wood, dust, oil,.....etc) and incase of smooth surfaces it is better to add a layer of cement slurry and cured with water or using epoxy to roughen the surfaces. All electrical conduit grooves should be filled with cement mortar and cured with water. If the building consists of frame and partitions, it is better to put plastic wire or steel wire mesh between column and the partitions, between beams and top of partition walls also to reduce the cracks that occurs due to differential loading and different in the coefficient of thermal expansion of the materials that create the surfaces which should be plastered. It is so important to remove nails, reinforcing bars and plates before staring any plastering work as it will rust and will be obvious above the plastering after a few days, if the metal bases remain in the surface, then it should be painted accurately to avoid rust rising to the surface.

The first thing in the gypsum plastering is that the crew puts spheres of wet gypsum near the start point of a wall near the corner and put a straight pipe over it and makes it quiet vertical taking into consideration to have required thickness of plastering, then doing the same thing at the other end of the wall. After fixing two vertical straight lines at the start and end of the wall, he puts string over it to check the wall between them to check the required thickness, if the thickness is not enough at any location in between the start and end of the wall, then he adds thickness to the start and end lines till he gets the required thickness all over the surface. In between these two straight vertical lines, he will put a string and make more straight vertical lines in the same way depending on the string. The distance between the straight lines should not exceed (80 cm). The next step is filling the spaces between the lines and leveling it by using a straight pipe. Take into consideration the height required for the floor tile and skirting that should be left without plastering. Pay attention to the skirting thickness with its mortar, so it is necessary to have enough thickness of plastering at the bottom. most engineers check the wall at the middle height only for straightness and verticality, but it is important to check it for horizontality at the bottom and at the top also, it is necessary to check the bottom because the skirting will be placed straight and incase the gypsum plastering is not straight it will be very obvious, it is necessary at the top also for the same reason due to existing of false ceiling borders attaches to the walls which are straight metal sections.

After finishing the first layer, a thin layer is applied to the surfaces which is the finishing coat, if the finishing coat is not applied while the base coat is wet, then water should be used for wetting the surfaces. Some crews delay the finishing coat a few weeks, in this case extra water should be added to make it wet and to wash the surface from dust as well. Pay attention to the verticality of the edges and corners since these two items are very obvious in gypsum plastering works.

Cleaning

Cleaning inside the building and preparing it for plumbing and tilling works. Removing all trash and debris out of the building and cleaning the site work. It is necessary to clean the site all the time to keep accessing to the buildings as easy as possible and facilitating truck movements. All debris and trash should be removed by trucks from the site work.

Plumbing work

Check the drawings and start plumbing works by indicating location of all sanitary fixtures and depending on the fixture dimensions themselves to indicate core locations. Draw the plan and put all fixtures with appropriate dimensions in their required places to check the spaces. check the water system by applying pressure to the system for at least 24 hours and with a pressure two times of available pressure due to the design. Check the slope of sewer system before casing it and put water for leak and slope checking. Put caps to close all pipes openings.

Tile for Walls

Check the drawings to know the locations that need tiles for walls. If there is a smooth surface such as a fair face column, it is better to apply a good layer of cement slurry before tile work. Get the supervisor approval for dimension, color and size of the tile sample and check the availability of the required quantity, then send it to be tested. Put the first row as low as possible from the floor to avoid increasing floor tiles' mortar thickness which leads to decreasing height of doors and height of the floor. It is important to make sure that behind all tiles are filled with mortar. Check verticality, horizontality and straightness of the surface. Check the alignment of the joints between the tiles. To get a homogenous joint width use plastic crosses or nails. Make sure to cure the work tile with water. Make sure all electrical pipes, sleeves and water pipes or anything else under the tile to be completed before starting the work. The sockets needs opening in the tile, the opening should not be larger than the box dimensions to avoid gaps between the installed socket and edge of opening. Grouting is an important activity in the tile work, after finishing tile casing, the joints should be grouted with white cement, sometimes color is added to the white cement also. All joints should be filled totally with the white cement mortar and then to be cleaned, it is so important to clean all tiles while the cement still can be removed and cleaned, all joints should be smoothed very well to have a homogenous and straight shape.

False ceiling

After finishing the wall tile, false ceiling work in that locations can be started. In the locations where gypsum plastering is finished, false ceiling can be started also if it is required per the drawings. Before starting false ceiling, it is necessary to prepare a shop drawing for this activity taking into consideration the arrangement of lights in the rooms and corridors, for example if a corridor contains only one lighting fixture, it is necessary that number of ceiling tiles to be odd so that the lighting fixture be in the center of the short part of the corridor, prepare a shop drawing depending on location of lights and try to have equal slices on the edges. the false ceiling should be level, for this purpose some crews use the ceiling as a reference which is a wrong idea since it might not be quite level or the roof slab might have slope, it is better to have level marks on the corners and if it has not big differences then it is better to depend on the horizontal joint of the last row of the tile to eliminate any small differences that might be obvious due to its close to the false ceiling. It is better to install the frames completely at this stage but the tiles should be installed after installing glass and doors to prevent wind movement in the building which leads to moving the false ceiling and damaging it. In case of having painting for the gypsum walls, first layer of painting should be applied before installing false ceiling.

Floor tile

After cleaning the floor very well, estimate the required quantity of tile and sand for each part and distribute it the building to start this activity. Do not place the materials beside the walls, usually put it in the middle of the spaces. First thing is to place a line of tile beside the wall that will be used a reference for the entire floor. The first reference line should be always parallel to long direction of the spaces to minimize any differences in the perpendicular angles that might be available.

The level marks should be very accurate that will be used to control the elevations and slopes. Before starting the activity it is necessary to check the highest points in the entire floor that might be available due to availability of pipes and difference in the poured concrete for the floor, take into consideration to have enough mortar thickness in the locations where slope is required especially at drainage locations. Avoid voids under the tiles by putting a rich and wet mortar under the tile, many crews try to use semi dry mortar to accelerate their productivity but the result will be having a floor full of voids underneath which leads to weakness of floors and mobility of the floor tiles after a short time.

Use nails or plastic cross to control the joints width between tiles. All cutting of the tiles should be done by using grinder to have straight edges. In wet areas such as bath rooms and rest rooms there should be slope to drains, always check the availability of this slope by yourself or a representative of you and do not depend on any crew's promise. After staring floor tile in a floor or a part of floor, do not allow any activity in that are until finishing the tile work in that are to avoid labors walking on the tile which leads to mobile and disturb the leveled tiles and fill the joints between the tiles with trash.

The crew should always clean the tile for any completed part of the work and close the entrances to prevent the entry of labors. Before starting grouting the tiles, all tiles should be cleaned and all drains should be caped to prevent filling it with grouting cement, the first stage of grouting should be very wet to make sure that it will penetrate deeply to the mortar under the tiles, but in the second stage of grouting a mortar with moderate content of water can be used to fill all the joints. After filling the joints, all the joints should be wiped to have a uniform and straight shape, it is so important to make sure that crew cleans all the remained cement from the grouting before it hardens and clean it very well since it will be a very long and costly to remove it later. Cure the tile work with water during placing tiles and after the grouting is completed.

Skirting

After finishing the floor tile, skirting can be started, estimate the required quantity for every floor or spaces and distribute it. Make sure to keep the floor tile as clean as possible and avoid preparing mortars on it for the skirting purpose, use plastic sheets to keep the floor tile during skirting process. The skirting should be straight and if the dimensions of the skirting is the same as the floor tile, make sure to make their joints match. Check the verticality of the skirting and width of joints, fill behind the skirting very well and clean any mortar above the skirting tile. Size, color and dimension of the skirting should be approved by the supervisor engineer prior to use. Before Stating any activity, in general, get approval for materials that will be used and tests if required.

Installing doors

Get approval from the supervisor engineer for the doors that will be installed. All installed doors should be fixed very well and every door should be checked individually, make sure door is closing well without having gaps between the frame and the door wing. Have enough space at the bottom of the door for carpets.

Marble for stair

After getting approval of the marble that will be used and tested, it is necessary to calculate the exact quantity and dimensions of the marble since it cut and polished in the factory and minimum cut should be done on site. Height of rises is equal to the distance (height) between the tile level to the tile level of upper floor divided by number of rises, so net rises height is the product minus thread thickness (Hr = (Delta H / No. of rises)- thickness of thread. Whatever the product is, reduce it by one millimeter for easiness of installation. Pay attention to straightness and to be leveled, no voids should be allowed under the stair by using wet rich mix cement mortar. When you give the crew dimensions to work, check the remaining height every five stairs at least so that in case you have small tolerances in the height can be divided over several stairs not only on the last stair. Grouting for all joints is required for stability and preventing water to reach under the marble.

Handrail

After getting approval of the materials that will be used , start the work according to the drawings. Make sure all legs of the handrail are exactly at the center of threads and done on a straight line having the same distance from the edges of the stair. Check verticality and stability of the work and to use enough supports (larger diameter pipes) are used at start and end of handrail and change in directions. Stay with the drawings exactly since handrails need detailed drawings since each architecture might provide different drawings and requirements.

Installing glass, false ceiling, fixtures

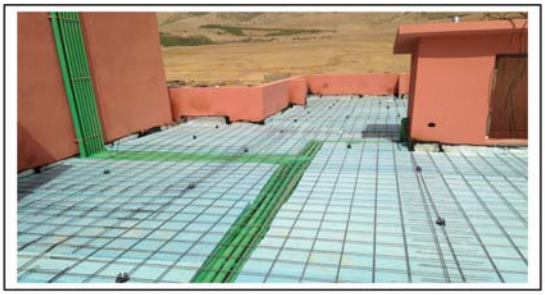
At this stage, electrical fixture (inside the building), glass for door and windows, water tanks, tiles of false ceiling and sanitary fixtures can be installed. After installing, water system, sewer system and electrical system (after installing boards and external fixtures) should be tested. Starting finishing painting inside the building and repair any damaged around electrical fixtures, wall corners and wall during painting process. Start cleaning inside the building to prepare it for signing off gradually.

Painting

Supervisor engineer will select type, color and locations of painting, after approving the paint type, samples on supervisor engineer's demand should be prepared on the building's wall for color approval, it is better to provide the estimated quantity of the paint, since sometimes the required quantity might not be available when it is needed. The brush that is used for painting the lower parts of the building should not be used for the upper parts since the lower parts are usually have more dust and might affect the appearance of the paint. Paint should be stored at a proper location and away from excessive heat or freezing, it should be kept away from sun. Read all instruction for the proposed paint, since method of storing and working might differ from a type to another. First layer of paint for external walls should contain a large amount of filler to increase water tightness of the external surface. Second layer of a normal filler painting can be used after filling the cracks and broken edges by proper types of paste that can be used for external faces. Last layer is better to be added after finishing all activities in the building to keep the surfaces clean until signing off the project.

Roof isolation

some projects include roof isolation, in this project the isolation includes isogam as first layer, XPS polystyrene, BRC and finally (9 cm) of concrete. The first thing to do is cleaning the roof from materials, debris and dust, it should be cleaned with water at final stage of cleaning. Applying isogam begins from water drains to the end, the direction of isogam should be perpendicular to flow direction of water to the drains and should have enough overlaps on each other. Second layer is a 5 cm high density extruded polystyrene (XPS) with a density of 32 kg/m^3 , this XPS has a groove at bottom which should be applied also with the direction of water flow. Final layer is (9 cm) concrete reinforced with BRC, during pouring the concrete it is so important to make sure that rain water flows continuously to the drain. Powders can be added to the concrete surface to increase dust and its water tightness. It is recommended to have mechanical trawler for finishing the concrete surface to have a very good result. The day after concrete is finished, joint locations should be indicated to be ready for cutting mechanically at the same day. joints should not be delayed to eliminate any cracks that might occur while the concrete strength still at low ranges regarding to its age. The joints should be cleaned and filled with foam and then by proper epoxy, method of using the epoxy differs according to its type, method of using is instructed on the product.



Walkways

Check the drawings with the supervisor engineer and indicate reduced levels of the walkways and depth of its footing taking into consideration the elevation of roads and buildings around the project or any future proposed roads. Clean around the building and start layout for the footing of the walkway's wall and excavate it according to the required levels, sometimes due to natural ground's slope, the excavation requires to have steps. Bed of excavation should be leveled and to have required width in its proper position from the building to have the required walkway width. Place strings according to levels to indicate top of footing's concrete and can also be used for leveling bed of the excavation. Pour concrete for the footing according to the strings and level it at the top. Start wall with required materials and build it to the required elevations taking into consideration sleeves for manholes, electrical manholes and main water supply. Sometimes due to too much slope in the natural ground, height of the wall will be too much and requires that the wall to build as a retaining wall to support the filling material, in this case the footing should be widened also according to the retaining wall's design, manholes should be build also after finishing the walkway's wall and connecting the manhole's outlet pipes. After completing the wall, filling should be with approved material and in layers, to be compacted as per directions of supervisor engineer. Start form work for the walkway's concrete according to details and it is necessary to put polyethylene sheet on the wall so that the concrete expansion and contraction will not mobile the last row of the wall. Pour concrete for the walkway and finish it according to requirements since some engineers prefer to roughen it with brush and others are not, Manhole frames main water supply should be fixed before staring concrete pouring. At the next day of pouring concrete, start jointing and filling the joints in the same way as in the isolation roof. Complete cement plastering for the wall and then painting if required.

Final stage and signing off

Installing any remaining fixtures, completing tests of water system, completing tests of sewer system, completing tests of electrical tests, check doors, check windows, cleaning inside the building and outside the building and make all preparations for signing off process.