2.1 Specification for construction

Specifications describe the materials and workmanship required for a development. They do not include cost, quantity or drawn information, and so need to be read alongside other information such as quantities, schedules and drawings. Specifications vary considerably depending on the stage to which the design has been developed, ranging from performance specifications (open specifications) that require further design work to be carried out, to prescriptive specifications (closed specifications) where the design is already complete.

Having a prescriptive specification when a contract is tendered gives the client more certainty about the end product, whereas a performance specification gives suppliers more scope to innovate, and adopt cost effective methods of work, potentially offering better value for money. Typically, performance specifications are written on projects that are straight-forward and are well-known building types, whereas prescriptive specifications are written for more complex buildings, or buildings where the client has requirements that might not be familiar to suppliers and where certainty regarding the exact nature of the completed development is more important to the client. An exception to this might be a repeat client such as a large retailer, where a specific, branded end result is required and so whilst the building type is well known, the specification is likely to be prescriptive.

Most projects will involve a combination of performance and prescriptive specifications. Items crucial to the design will be specified prescriptively (such as external cladding) whilst less critical items are specified only by performance (such as service lifts).

Key to deciding whether to specify a building component prescriptively or not is considering who is most likely to achieve best value, the client, the designers or the contractor:

- Large clients may be able to procure certain products at competitive rates themselves(for example the government).

- Some designers may have particular experience of using a specific product (although some clients may not allow designers to specify particular products as they believe it restricts competition and innovation and may relieve the contractor of their liability for 'fitness for purpose').

The contractor may be best placed to specify products that affect build ability.

Specifications should be developed alongside the design, increasing in level of detail as the design progresses. They should not be left until the preparation of production information. By tender they should describe every aspect of the building in such a way that there is no uncertainty about what the contractor is pricing.

Aspects of the works are generally specified by:

- Products (by standard, a description of attributes, naming (perhaps allowing equivalent Alternatives) or by nominating suppliers).
- Workmanship (by compliance with manufacturers requirements, reference to a code of practice or standards, or by approval of samples or by testing).
- It should be possible to verify standards of products and workmanship by testing, inspection, mock-ups and samples, and documentation such as manufacturers certificates.
- Specifications should be structured according to work packages mirroring the separation of the works into sub-contracts. This makes it easier for the contractor to price and so may result in a more accurate tender. A standard classification system should be followed such as Uniclass.

The Building Sequence

It's fairly self-evident that to successfully build a home, you need to know not only the parts involved, but just as important, how they all go together . . . and in what order!

Here then is a description, in broad terms, of the actual construction sequence for a typical home. An important disclaimer is in order here. Many things including, among others, the area of the country where it is being built, the design of the home, the availability of subs and materials, and the preference of the contractor, i.e. you, determine the actual sequence of construction. Here's an example:

> Many builders prefer to delay pouring the driveway until the end of the project.
>
> This is to prevent damage by heavy equipment like the drywall delivery truck, and to conserve construction loan interest, since concrete is fairly expensive.
>
> There is a builder in Atlanta who likes to pour his driveway as soon as the foundation is in. When you go to his site, you are always able to stay out of the mud!

In addition, as you will discover in the pages on planning your construction schedule, frequently more than one construction activity can be going on at the same time!

With that entire in mind, here is a general construction sequence with a brief explanation where terms may be unfamiliar. You will get greater detail on all of these as you link to their own page.

1. STAKE LOT
2. TEMPORARY UTILITIES
3. CLEAR AND ROUGH GRADE
4. WELL
5. EXCAVATE
6. FOOTINGS
7. FOUNDATION
8. WATERPROOF AND FOUNDATION
DRAIN
9. SEWER AND WATER TAPS
10. BACKFILL
11. SLAB PLUMBING
12. SLAB OR BASEMENT FLOOR
13. FRAMING, WINDOWS, AND EXT DOORS
14. EXTERIOR SIDING AND TRIM
15. GARAGE DOOR AND EXTERIOR LOCKS
16. BACK-OUT FRAMING
17. FIREPLACE AND CHIMNEY
18. STAIRS
19. ROUGH HVAC
20. ROUGH PLUMBING
26. INSULATION
27. TEMPORARY HEAT
28. DRYWALL
29. CABINETS
30. INTERIOR DOORS AND TRIM
31. PAINT AND WALLPAPER
32. WOOD FLOORS
33. COUNTER TOPS
34. VINYL AND CERAMIC TILE
35. SAND AND FINISH WOOD FLOORS
36. APPLIANCES & SPECIAL EQUIPM'T
37. FINISH ELECTRICAL
38. FINISH PLUMBING
39. FINISH HVAC & FINAL HEAT
40. SHOWER DOORS AND MIRRORS
41. CARPET
42. HARDWARE AND SCREENS
43. DRYWALL REPAIRS
44. CLEAN UP
45. FINAL PAINT
46. FINAL WOOD FLOOR FINISH

21. ROOFING	47. RETAINING WALLS
22. ROUGH ELECTRICAL	48. WALKS, DRIVES, AND PATIOS
23. ELECTRIC & GAS METER SET	49. SEPTIC TANK AND DRAIN FIELD
24. GUTTERS AND DOWNSPOUTS	50. FINISH GRADING &
25. EXTERIOR PAINT	LANDSCAPING

1. STAKE LOT

This will usually involve a surveyor who will come out and accurately drive stakes to locate yourhome on the lot. They will be used by the excavators and foundation subcontractors to guide their work.

2. TEMPORARY UTILITIES

You will need to have water, electric power, and toilet facilitiesavailable during the construction process.

3. CLEAR AND ROUGH GRADE

Clearing the Lot

Clearing is the removal of trees and undergrowth from the actual construction site and yard areas. Rough grading is moving the dirt around to establish the approximate drainage patterns, yard areas, drive and walk levels, etc. that you hope to achieve.

Temporary Electric "Saw Service"

Excavation for a basement home. Notice the temporary ramp that has been constructed so that the dozer can get down in the hole.

4. WELL

If you are going to have a well, you might as well dig it up front so that you will have the wateravailable for construction.

5. EXCAVATE

This is where a piece of earth-moving equipment digs the hole for your foundation, and, if youwill have one, your basement.

6. FOOTINGS

This is the structure where the house interfaces with the earth that supportsit. All of the weight of the home rests on the footing.

This sub is drilling a hole to pour a "caisson" - a special type of footing used in areas with highly active soils.

7.FOUNDATION

The foundation is the wall on which the first floor rests. It may be short - if you will have a crawlspace, or tall - if you will have a basement.

8. WATERPROOFING AND FOUNDATION DRAIN

A waterproofing material or membrane (or both) is applied to the foundation walls which will be below grade to minimize water accumulating in the basement or in

the crawl space. Foundation drains run along the footings and remove water accumulating in that area.

This is a water meter pit. One copper pipe is coming from the city supply line in the street. The other pipe will supply the new home with water. A meter to supply billing information to the city will connect the two.

1. SEWER AND WATER TAPS

If you are connecting to municipal water and sewer, this is where the pipes are laid to the houseand actually connected (tapped into) the water and sewer mains.

2. BACKFILL

Pushing the excavated dirt into the hole next to the foundation wall around the house (inside andout). This is a good time to establish the necessary drainage away from the house at the foundation wall.

This plumbing will be beneath and poking through a floor slab.

3.SLAB PLUMBING

Any plumbing that needs to go into the basement floor is installed here.

3. SLAB OR BASEMENT FLOOR

The "slab" is the concrete basement floor. It is poured at this point. In some parts of the country, plans may call for a "structural wood floor" (more on this later). Now is when it would be installed.

4. FRAMING, WINDOWS, AND EXTERIOR DOORS

This is where it starts to look like a house! The floors, walls, ceiling, and roof are the focus ofthis construction activity. The framer usually installs the windows and exterior doors.

Applying a brick veneer to wood frame construction.

5. EXTERIOR SIDING AND TRIM

Whatever you're using - brick veneer, siding, stucco, etc.- here is where it gets done.

6. GARAGE DOOR AND EXTERIOR LOCKS

Some people wait until the end to get the garage door in. But we think having it in place creates a good place to store materials and equipment during construction. Installing the exterior locks means that the whole house is secure.

7. BACK-OUT FRAMING

This is a general category that includes partition walls that have not been installed, pillars, soffitsfor wall cabinets, and drywall nailers.

8. FIREPLACE AND CHIMNEY

A prefabricated fireplace should be installed before the roughs (below). A prefab will have a framed chimney. A masonry fireplace and chimney can be installed before the brick veneer (see"Exterior Siding and Trim" above).

This is an insulated duct board that can be cut with a knife, which makes installation easier.

9. S

Get these in now so that the subs working inside can get from one floor to the other withoutdepending on ladders.

10. ROUGH HVAC

The HVAC (heating, ventilation, air conditioning) sub is the first of the three "mechanical" subs(plumbing, electrical, HVAC) to come to the job. He will install the duct work for your HVAC system and possibly the furnace. He comes first because the stuff he puts into the walls is the biggest and most inflexible.

11. ROUGH PLUMBING

Next comes the plumber to install his pipes.

12. ROOFING

With plumbing and HVAC vent pipes through the roof, the roofer can install the roofing.

13. ROUGH ELECTRICAL

Codes call for the house to be "dried in" before the wiring is installed. With the exterior windows and doors in place and the roof on, it"s time. For roughs, the electrician will put in the boxes (switch, outlet, and lighting) and will pull the wires into them. Cable, telephone, speaker wires, etc. are also installed at this point.

14. ELECTRIC & GAS METER SET

You'll need these in place to get some heat in the house for the drywall installation.

15. GUTTERS AND DOWNSPOUTS

It's good to get the water away from the house as soon as possible.

16. EXTERIOR PAINT

Many surfaces on the outside need to be protected from the elements. So you'll want to paint as soon as is practical.

The Electrician.

Insulated Basement.

18. INSULATION

Once everything else is in the walls and rough inspections are completed, it's time to insulated your home.

19.TEMPORARY HEAT

With the meters set (above), the HVAC sub can get some temporary heat in the house. This will be critical for getting the drywall joint compound (mud) to dry in a timely fashion. The carpet sub also needs a warm home so that the carpet is installed at a temperature comparable to normalliving conditions.

20.DRYWALL

Sometimes called "Sheetrock." This will be "hung" (nailed or screwed to the wall studs and ceiling joists), taped (at the joints), and "mudded" (joint compound applied) . . . after the in-wallplumbing, HVAC, electrical, and insulation have been inspected!

21.CABINETS

Base and wall.

22.INTERIOR DOORS AND TRIM

The trim materials installed here may include the door casing, base mould, window stool and apron, window casing, chair rail, crown mould, built-in cabinets, stair railing parts, and others.

23.PAINT AND WALLPAPER

The first coat of paint is usually sprayed. Get it in before the hard wood floors are installed.

24.HARDWOOD FLOORS

Now it's time to install your hardwood floors.

25.COUNTER TOPS

Counter tops are next. This may involve a different sub than the one who installed the cabinets.

26.VINYL AND CERAMIC TILE

Vinyl floor coverings and ceramic tile are installed. Two different subs. probably should havemade these two different steps, but I was trying to make it come out to an even 50!

27. SAND AND FINISH WOOD FLOORS

This is the first of two finishes. The last is done just before you move in.

28. APPLIANCES AND SPECIAL EQUIPMENT

This would include all of your major appliances - washer, dryer, range, oven, refrigerator, as wellas any other special equipment you have specified.

29.FINISH ELECTRICAL

Here is where the electrician comes back to install the switches, outlets, light fixtures, ceiling fans, door bells, etc. He will also hook up the appliances, furnace, air conditioner, doorbell, andso forth.

30.FINISH PLUMBING

The plumber will install the sinks, lavatories,toilets, and all the faucets.

31.FINISH HVAC & FINAL HEAT

Your heating sub will install the registers and get the furnace and air conditioning running properly.

32.SHOWER DOORS AND MIRRORS

Install shower doors. Hang mirrors.

33.CARPET

Now it's starting to feel like home!

34.HARDWARE AND SCREENS

Typically, this is door, window, and closet hardware. Window screens.

35.DRYWALL REPAIRS

You may need to get the drywall subcontractor back out to patch some dings caused by the other subs‟ work. This is normal.

36.CLEAN UP

This is the final interior clean up.

37.FINAL PAINT

Touching up drywall repairs and so forth.

38.FINAL WOOD FLOOR FINISH

This should be your last inside job before moving in.

39.RETAINING WALLS

These outside jobs can be going on while the work proceeds inside. You should not have thesegoing on while the outside is being painted

40.WALKS, DRIVES, AND PATIOS

You should wait until the delivered to the home, because the drywall truckis very heavy, and drywall has been could damage your flat work

Retaining wall, steps, and walk.

41.SEPTIC TANK AND DRAIN FIELD

Same as above on the timing with regard to thedrywall delivery. The tank holds the waste andallows microbic action on the solids. The drainfield is where the effluent leaches into the soil.

42.FINISH GRADING AND LANDSCAPING

The final finished grades are established to ensure proper drainage away from the home, and to prepare the yard for landscaping. Trees, shrubs, grass, etc. are installed.

CONSTRUCTION CO ORDINATION:

Coordination can be seen as a process of managing resources in an organized manner so that a higher degree of operational efficiency can be achieved for a given project.

Two coordination methods have been identified as appropriate to be used in the design process,namely, direct contact and meetings.

Direct contact

Direct contact has been identified as the simplest form, and one that involves minimal cost among the methods of coordination .Two types of direct contacts are used in projects: direct formal contact and direct informal contact. Each method encompasses different approaches in gathering useful information. A combination of these methods could send reasonably accurate messages quickly in all directions, and could be able to deal with all the major uncertainties that arise within the project organization. Because of the iterative nature of the design process, the number of participants and the fragmentation of building systems, the increased use of direct contact is critically required.

Direct formal contact

Direct formal contact refers to the documented information that could be obtained by letters, memos and reports. This approach is more formal, and is widely used as a means of communication among the different organizations that are involved in a project. Direct formal contact has been identified as one of the means used by designers for obtaining design information.

In managing a risky project, proper documents are always needed to protect the

participants involved. Formal documents could be used for litigation or as evidence in any contract dispute, such as variation claims in projects. Therefore, it is important to use direct formal contact in handling uncertainty in the refurbishment design, such as in design changes.

Direct informal contact

Any information obtained using informal conversations such as telephone calls or discussions is categorized under direct informal contact (Bennett, 1991). As the design process has a large number of participants and a high degree of interdependence of building design, the demand for informal contact is increased (Pietroforte, 1997). The uncertain nature of refurbishment projects requires an approach that is more flexible.

One of the advantages of using direct informal contact is that information can be gathered quickly without the need for any formal procedure. Informal contact provides clearer information in a short time, and hence is useful in confirming certain issues pertaining to the design process. The refurbishment design process involves a large amount of information flow. Therefore, direct informal contact could resolve the problem of inefficiency in flow of design information, especially when design changes occur during the construction stage.

Meeting

The purpose of meetings is to keep key participants informed, and to handle shared problems arising in the projects (Laufer *et al*, 1992). Meetings are one way to increase the amount of information in construction projects, as a meeting mostly covers the current issues of the design. All the feedback and comments from the design team's participants could be discussed instantly in the meeting. The design process normally involves participants from different organizations, who form a group known as a design team. Meetings are seen as a medium to increase

interaction among the design team members. There are two types of meetings in construction projects: scheduled and unscheduled meetings (Conhenca-Zall *et al,* 1994). Both types are important in achieving better integration in the management of the refurbishment design process

Scheduled meeting

Scheduled meetings for the design process are conducted at intervals of one a week to report on the progress of the design work and to discuss any issues that arise. The scheduled meeting for design diminishes slowly once the construction stage starts. A scheduled meeting can transform into an unscheduled meeting if any problems crop up during the construction stage. The functions of a scheduled meeting are to coordinate and to act as a means of conveying information about current progress of work and recent design changes (Perry and Sanderson, 1998). In a construction project, the scheduled meeting is an appropriate venue and suitable time for the project participants to discuss any issues related to the project. Problems in design could be discussed and finalized during the meeting, which could lead to a reduction in design errors during the construction stage.

Unscheduled meetings in the design process

An unscheduled meeting would be held if there was any urgent need to solve current issues related to design. This type of meeting normally takes over from a scheduled meeting in the design process when work has started onsite or between the intervals of scheduled meetings. Problems arising onsite, such as discrepancies in drawings that need to be solved urgently, are typical situations when an unscheduled meeting would be called. However, the need to attend unscheduled meetings requires the participants in refurbishment projects to be flexible and responsive (Rahmat, 1997). They may need to forgo their routine activities in order to attend unscheduled meetings for refurbishment projects. The allocation of time and overhead cost for refurbishment design works tends to increase if there are

many unscheduled meetings during the construction stage. The need for unscheduled meetings increases during the construction stage, as many unknown items start to be discovered. The unscheduled meeting is probably suitable to cater to the uncertainty of design information in refurbishment projects. The unscheduled meeting would be least important if there were no urgent decisions to be confirmed. Minordesign problems that arise could be discussed at the next scheduled meeting of the project.