Notes on construction 5/1/79 Ingrid King

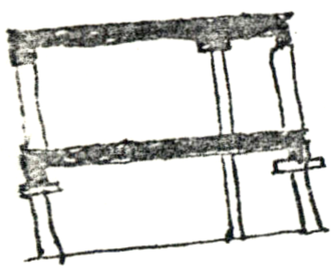
In the following there will be refered to primary and secondary structure particularly primary and secondary beams. Basically I am refering to a system of bays where the primary structuee consists of beams spanning between exterior walls and/or columns where the load is transfered directly down. Secondary beams. on the other hand, typically span between primary beams, do not necessarily rest on columns, have shorter spans, and are smaller members. In principle, secondary beams can be considered in invisible (in the slab), or at leastnot necessarily space defining.

In terms of transference of vertival forces, i.e. alignment of columns and bearing walls from floor to floor, Hajo has come up with an interesting scheme, which might have more general application. Roughly his spaces get smaller and smaller as you go up the levels, or each floor represents some kind of reasonable subdivision of the room layout of the space below, which generates a treelike configuration of the vertival forces on the interior of the building. Of course the spaces don't have to get smaller, but if they do, this subdividion takes place. Also, in his scheme, the very smallest room division on the top floor, is carried out in a lighter material, or wood, in his case coupled with a wooden roof structure. This may or may not be a reasonable aspect of this gradient.

We have discussed before, the idea of starting with the main rooms or major space, to generate order in the interior of the building. This idea seems equally relevant in order to arrive at a clear structural organization. If the walls of the main space or spaces is from the beginning conceived as the primary beams in one direction,or the other,or both, one has a good basis for developing both smaller space and secondary structure. One thing should immediately be noted here: If the walls of the space is to represent primary structure, this must be a definite ingredient in the location and understanding of the space it self, yet, as will be described below, this does not mean a riggid design and that thes space will not undergo changes.

It also may in general seems reasonable to generate the structure form more or less from the ground up, in large part because a major space tends to be located on lower levels. Of course on the top floor, large space is also not much of a problem. However where large space occurs, it has influences the organization of smaller rooms above.

With the idea of starting with main space and working outwards and upwards, with the location of primary beams being a definite aspect from the beginning, the design of smaller space may influence the initial conception of the major space. In instances where loads from above do not fall on space defining primary beams, columns might have to be added so that this load can be carried by shorter span secondary beams, which as was expressed in the beginning, can be considered as invisible. This kind of further structural definition should be assumed to happen yet it should enter as a refinement of space and structure, rather than redesign.



In general, decisions about structure should be similar to designing with patterns; namely: Each level of decisions should be definite and clearly accomplishing something you want, yet it should be sufficiently cloud-like in terms of fixing things, so that further differentiation can take place by lower level decsions. As exemplified in description above, large decisions about space and structure, must be clear for the entire building, before space and structure refined and finalized by smaller or local concerns.

Previous discussions about vertical shift planes represented by exterior walls and other distinct alignments in the building, still seems reasonable, and the above supplements this idea. The concern for regularity, however, is not confronted directly by this discussion. At the present time it seems like column spacing should not be determined too quickly, i.e. don't staat with a preconception of a large grid. It seems like

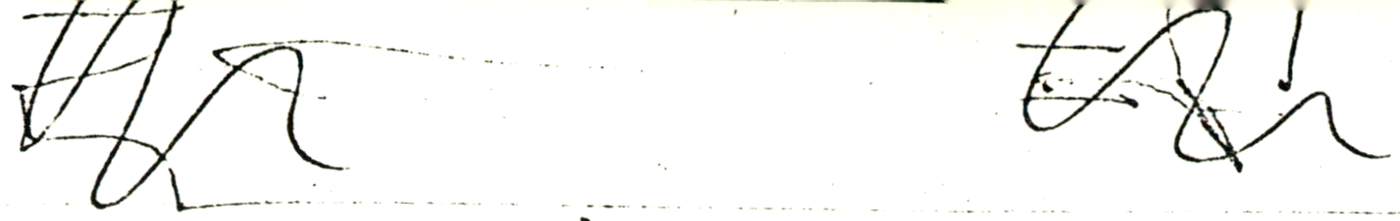
the larger spaces and and the primary beams should be determined first, and that a reasonable column spacing should be derived in the process of developing the smaller spaces, and tie in with the particular dimensions of the large space. - There are also examples where the regularity is generated by windows (Hajo) rather than by articulated columns, which seems fine; i.e. the exterior wall is seen as bearing walls within which the columns have an irregular location. However as in Hajo's example, the invisible columns must be vertically continuous where they support primary beams.

Tentative sequence for developing structure.

1. Locate shift planes; exterior walls, and continous vertical planes that separates the largest distinct volumes within a large building. Spans between such planes should be no more than 40 feet(?)
2 Locate primary structure on the basis of location and dimension of main spaces. The walls of such space should be seen as primary beams, spanning in one or the other direction or both, and although this space is defined by load bearing columns in the cornes (which may be interior to the overall building), these beams should be extended to the shift planes. In other words, draw a sketch where the walls of the main space is extended as lines to exterior or other continuous walls, and decide how you want the primary structure to affect the overall further spatial organization.
3 Lay out smaller space on the same floor paying due respect to this primary structure, but don't forget that this is a cloudlike decision. You very likely will find that there are other spatial configurations in the addition to the "main space" that will generate additional primary structure.
4 Work up or down between first and second floor, depending on where the main spaces are; then proceed up the levels. Work with sketches that show primary and secondary structure as well as

room layout below, but make sure that these sketches represents well deliberated decisions, so that they actually are something to work with. A wall that is carried by a primary beam below, is no problem; a wall that is not, must be carried by a secondary beam which must be taken care of in the organization of the floor below. A secondary beam spans between primary beams, and the span should be relatively shorter.

"Primary beams"do not usully represent clear spanning beams, although sometimes they do. Most of the time they will be beamsxvcxvcxbvpbvtbdcbycbvdbmnbvdbvthvughucbuchvcbvuhnsbmabvohvgbbebvdbtuhvcbvcbvvdnesxvnxucxvnxvekecwadxyxutxvexsonabkecxntevvavdxycwvdhvopenxugscxetx. supported by wall, by series of clumns, etc. In genral it may be useful to think of any supporting wall as a series of reasonably spac ed columns, all of this, in order todetermine regular the bay structure of smaller space, and in pauxkxcuhax the spacing of the xexxxeguhax vertical columns in the exterior walls. - This is most unclear. I.e. when and how to determine the regularity, but I don't think it is actually difficult.



The procedure to be followed is one in which the layout of the building, from a functional and spatial point of view, proceeds in step with the structural design of the building. The reasons for this are basic:

1) If the structure were to come first then careful design according to detailed functional considerations and the pattern "STRUCTURE FOLLOWS SOCIAL SPACE" would be subordinated - BAD

2) If the functional design were to come first, then the actual physical "stuff" of the building would be chaotic, most likely. We have, at this point, no way of organizing the actual construction elements of the building, in some rational way, without structural consideration.

So first of all, conception of structure should enter into the planning phases of buildings, as early as possible.

In the procedure to be outlined later, the following assumptions should be made:

1) No particular spanning system is implied, and you may visualize ~~[illegible]~~ any system which ultimately comes down to regularly paced bays.

For example:

a) columns, primary beams, secondary beams
b) bearing walls, arches, vaults
etc.

Systems which do <u>not</u> seem to be appropriate are those which do not ultimately come down to regularly spaced bays, such as

a) wood-stud construction.
b) <u>reinforced</u> concrete construction which is not articulated according to function, and which provides a "universal space" to be used as a support for non-load-bearing walls which define function.

2) There are different levels of structure — primary, secondary, tertiary, etc. The primary structure generally consists of the heaviest columns, and the longest spans.

3) The different levels of structure may correspond to different materials — for example, reinforced poured-in-place concrete, concrete block, wood ...

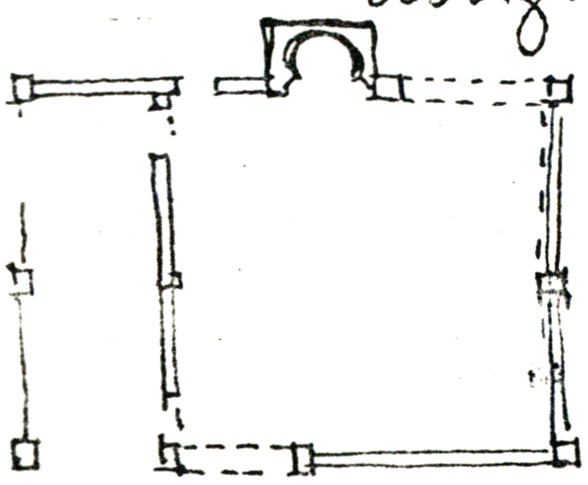
4) The primary beams are generally visible below. The secondary + tertiary beams ~~may~~ be visible below, but only when they are resolved into a regular and pleasing pattern. Otherwise they are covered by the ceiling.

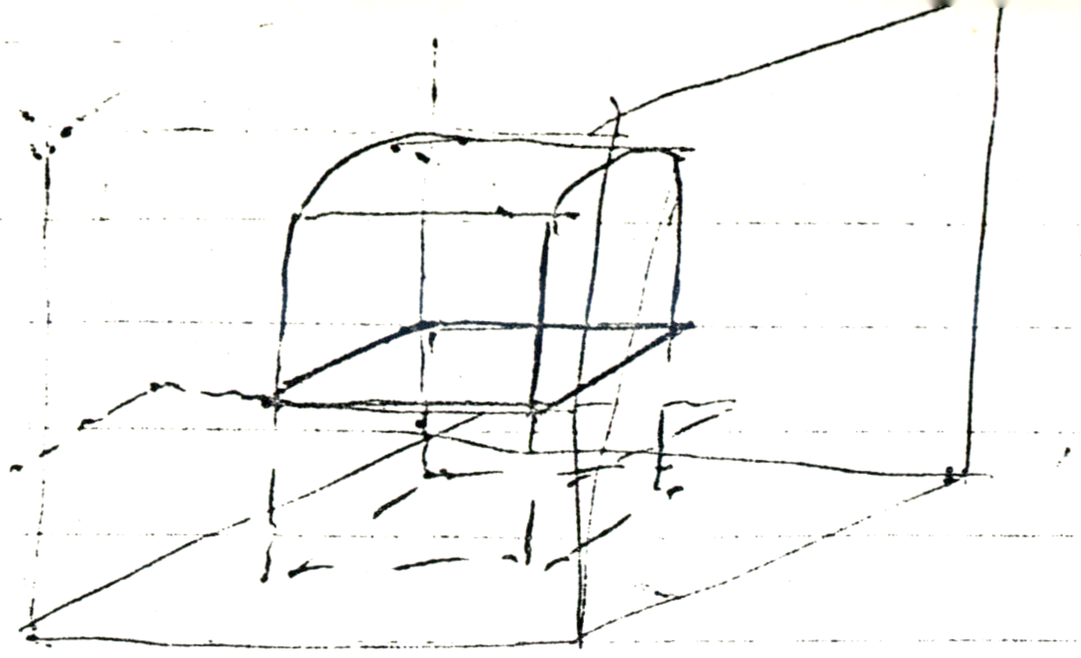
The procedure is as follows. It should be read in conjunction with the procedure for planning the building.

1) First go through the basics of laying out the overall building configuration.
2) Roughly design the ~~main~~ largest spaces of the building. This will include the largest public spaces, and the ~~circ~~ main circulation. In a building of 5-6 stories, the largest spaces will tend to be in the lowest ~~three~~ floors, the smallest spaces will tend to be in the upper floors. Your design must be concerned with <u>space</u> and <u>volume</u>, equally with <u>plan</u>.
3) At the same time, you must decide, very roughly how you are going to
   a) support the floor of your main spaces (if they are not at ground)
   b) span the ceiling of your main space.

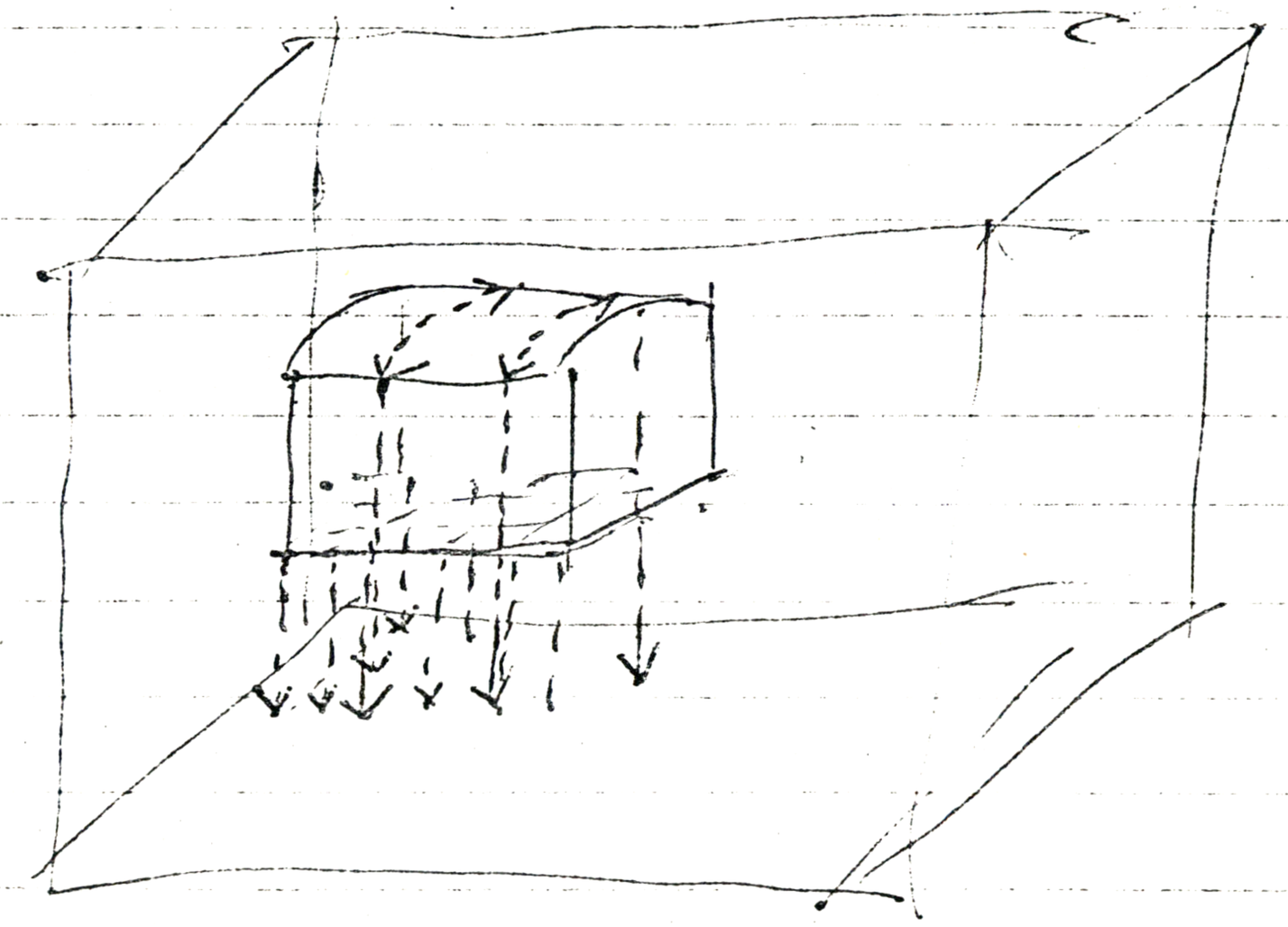
Draw the main spaces, showing how the forces are carried to the ground.

4) Now, a) the structural elements (columns) which will be at the edges of the main spaces, should be carried vertically down to the ground.
   b) the beams at the edge should be carried horizontally.

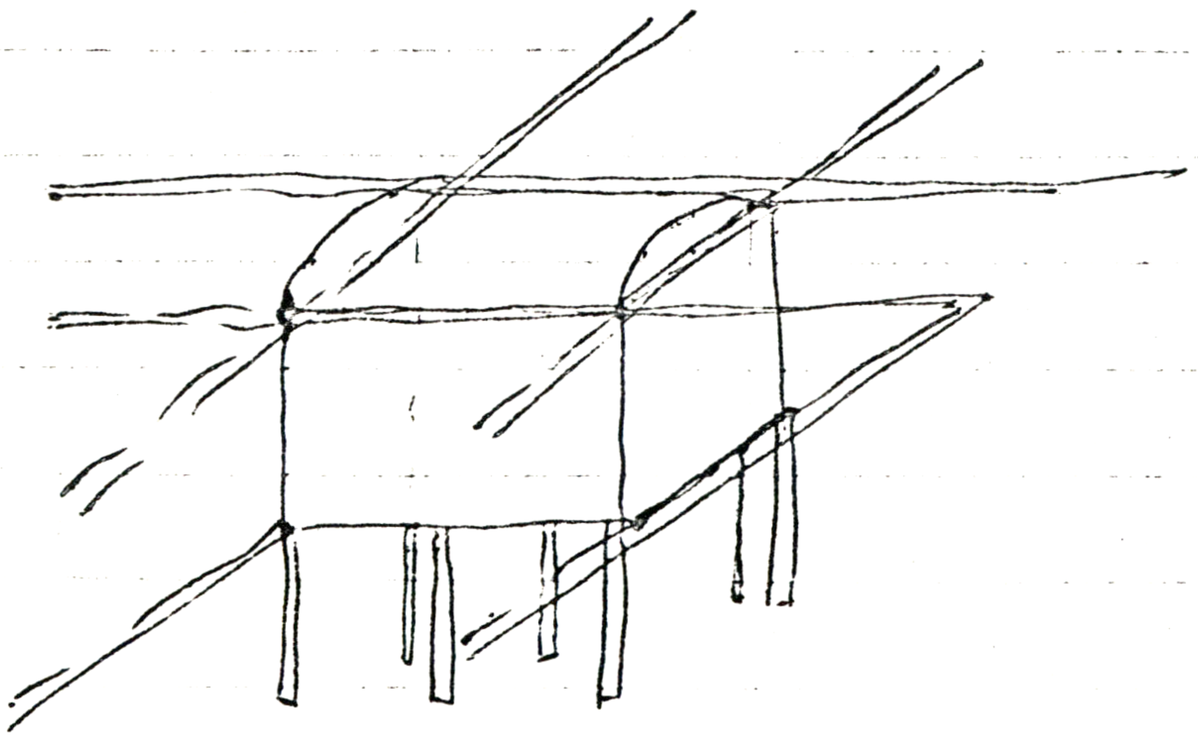




1) Volume of main space located within building mass

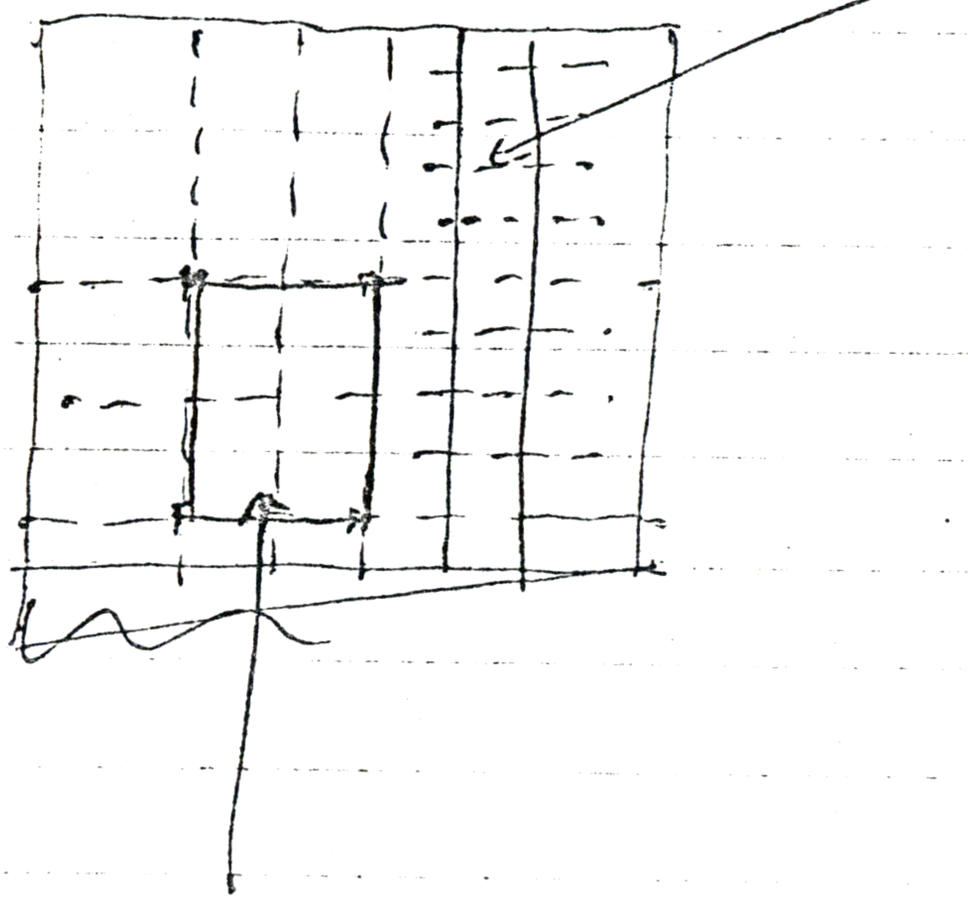


2) Loads of main space are carried to the ground.



3) Texture location of columns + beams, connected to main space.

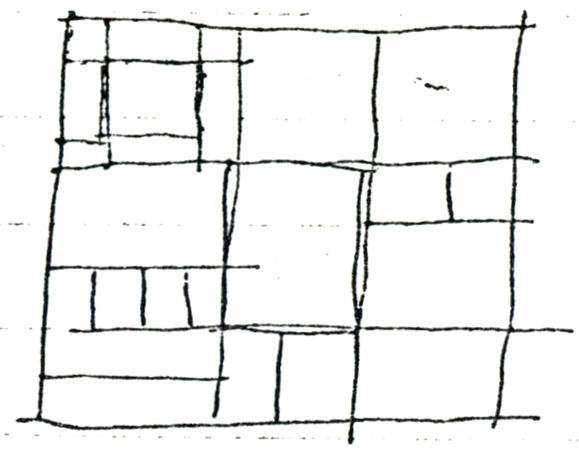
5) The determination of the structure for these main spaces begins to set up a grid, based on the original "functional" plan for the main space itself.



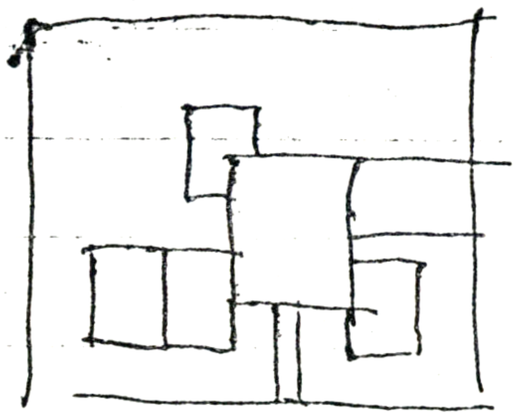
The position of the columns can of course be adjusted, but at this point, some of the main structure is more-or-less fixed.

6) Now the planning of the spaces ~~some~~ smaller than the main spaces can go ahead, but at this time, working ~~as much as possible~~ within the primary grid, and the process repeats.

The result of this procedure is to set up Aalto's grid system.



rather than



, for example.

POINTS TO NOTE:

- The columns (or bearing walls) of the primary system are continuous down through the building for the main rooms.

- In order to have secondary beams, with their necessarily shorter spans, it may sometimes be necessary to introduce additional columns, but this should happen in places which do not destroy the additional spatial concepts — i.e., they should be either at the edges of major spaces, or outside them, unless the original spatial concept included the

possibility of columns in the main space.

There are two related questions to answer.

1) Where and how does regularity occur?
2) How does regularity appear on the facade?