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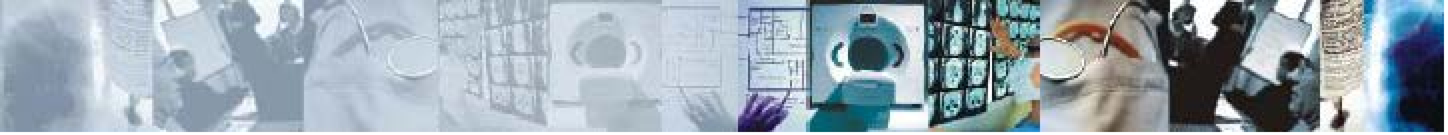

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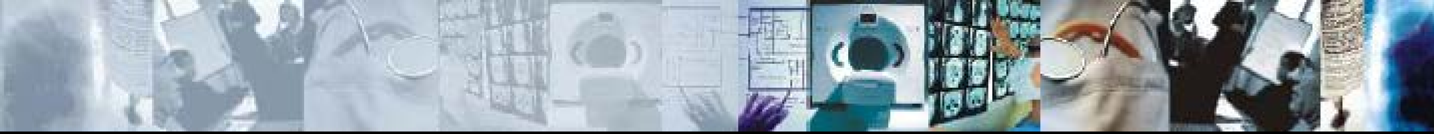
Welcome You To

An Introduction to Healthcare Facility Design

Architects Lecture Series 2004 – No. 1

The Planning Grid:

Creating a Framework for Design



A design tool

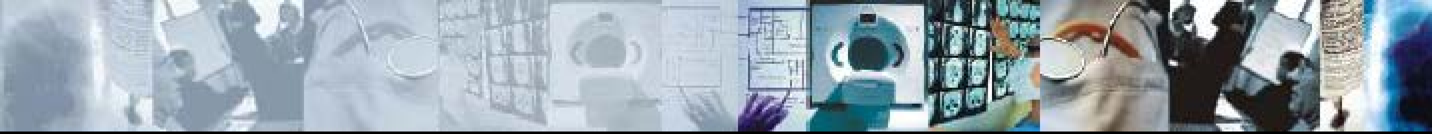
used to create some kind of

Order

out of

“Chaos”.

It kind of gives us a handle on which we can hang our hats before rolling up our sleeves, loosening our ties and getting down to some serious work. ☺



How we derive the planning grid:

- In urban situations with a podium / tower

  =layout of the inpatient tower.

- The module(s) used to determine this grid

  =inpatient facilities (rooms + toilets)

- In the example given on the next slide the planning grid module is (in red) of 3.90 M x 8.50 M

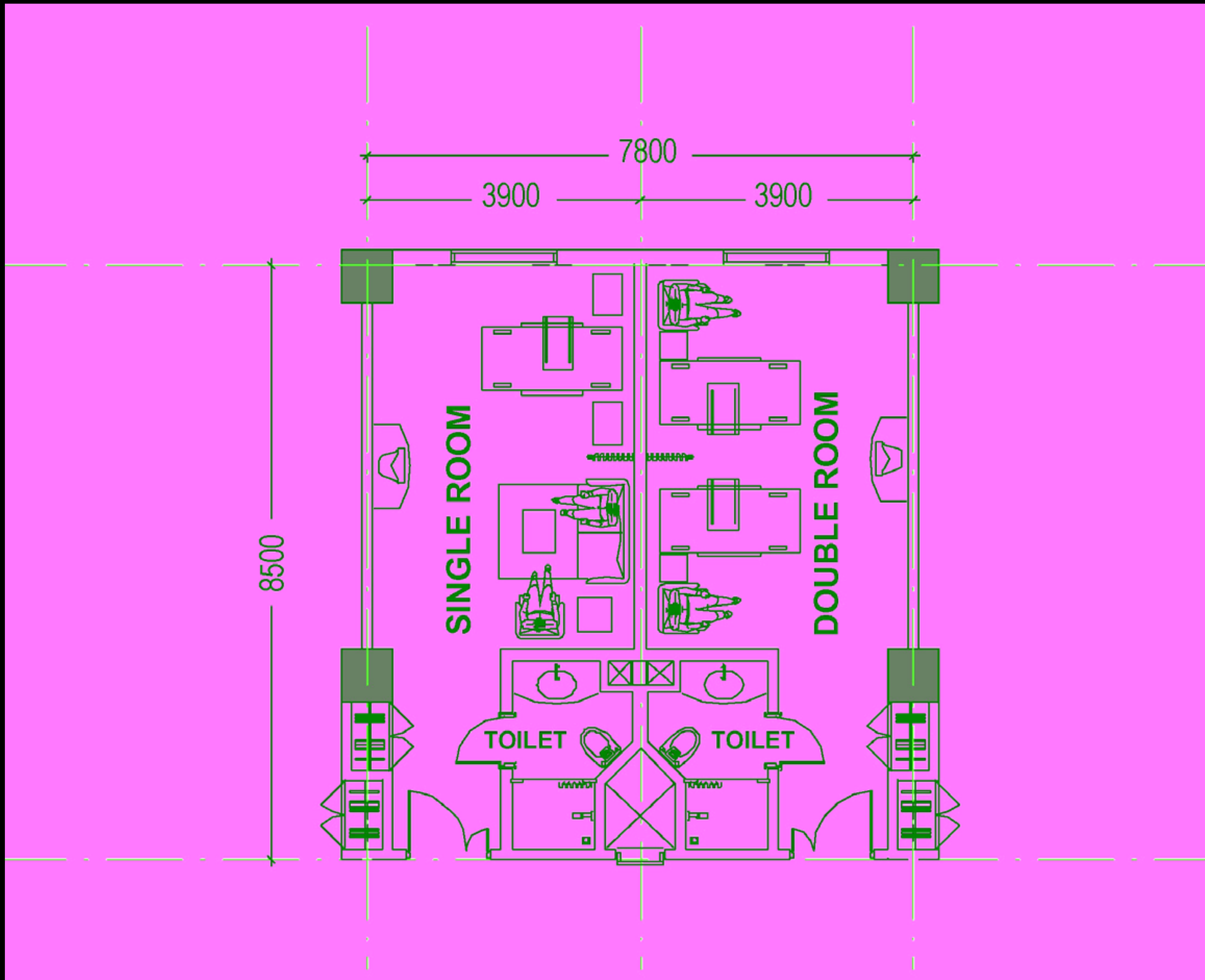
  =single bed patient room

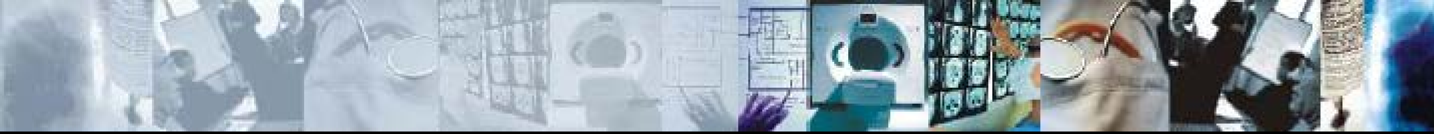
  =double bed patient room

  =toilets.

sketch

The Planning Grid…





- **Adding an access corridor and stringing the rooms out in a line**

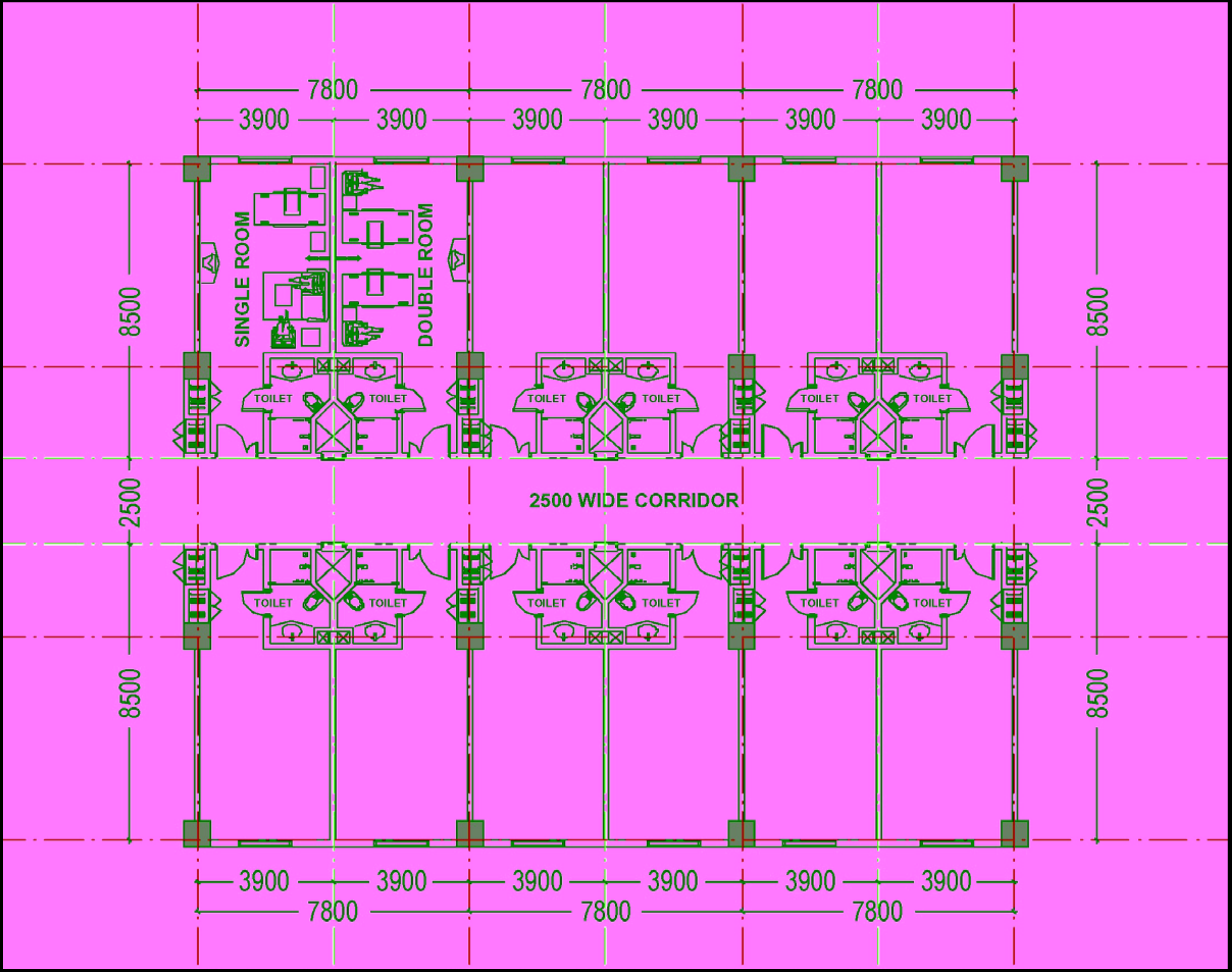
  =planning grid starts taking form.

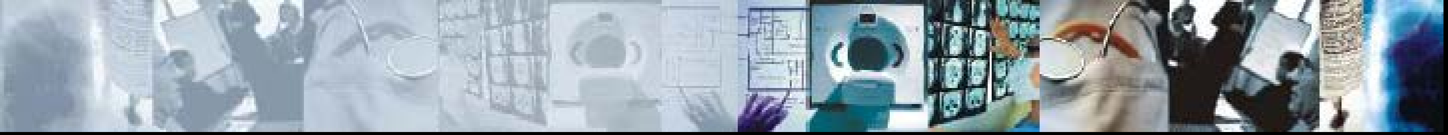
- **the *structural* grid (in blue)**

  =derived from the planning grid.

The structural grid need not necessarily be the same as the planning grid, but is usually derived from it.

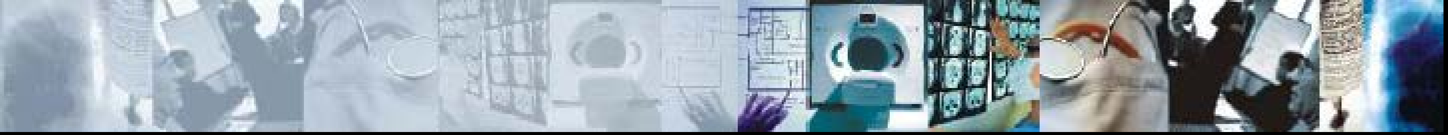
The Structural Grid...





- **The designer has decided to twist the entire inpatient tower block at an angle to the horizontal / vertical one.**

This is just one example of how the planning grid could take almost any conceivable shape depending on what the designer wants to do with it.



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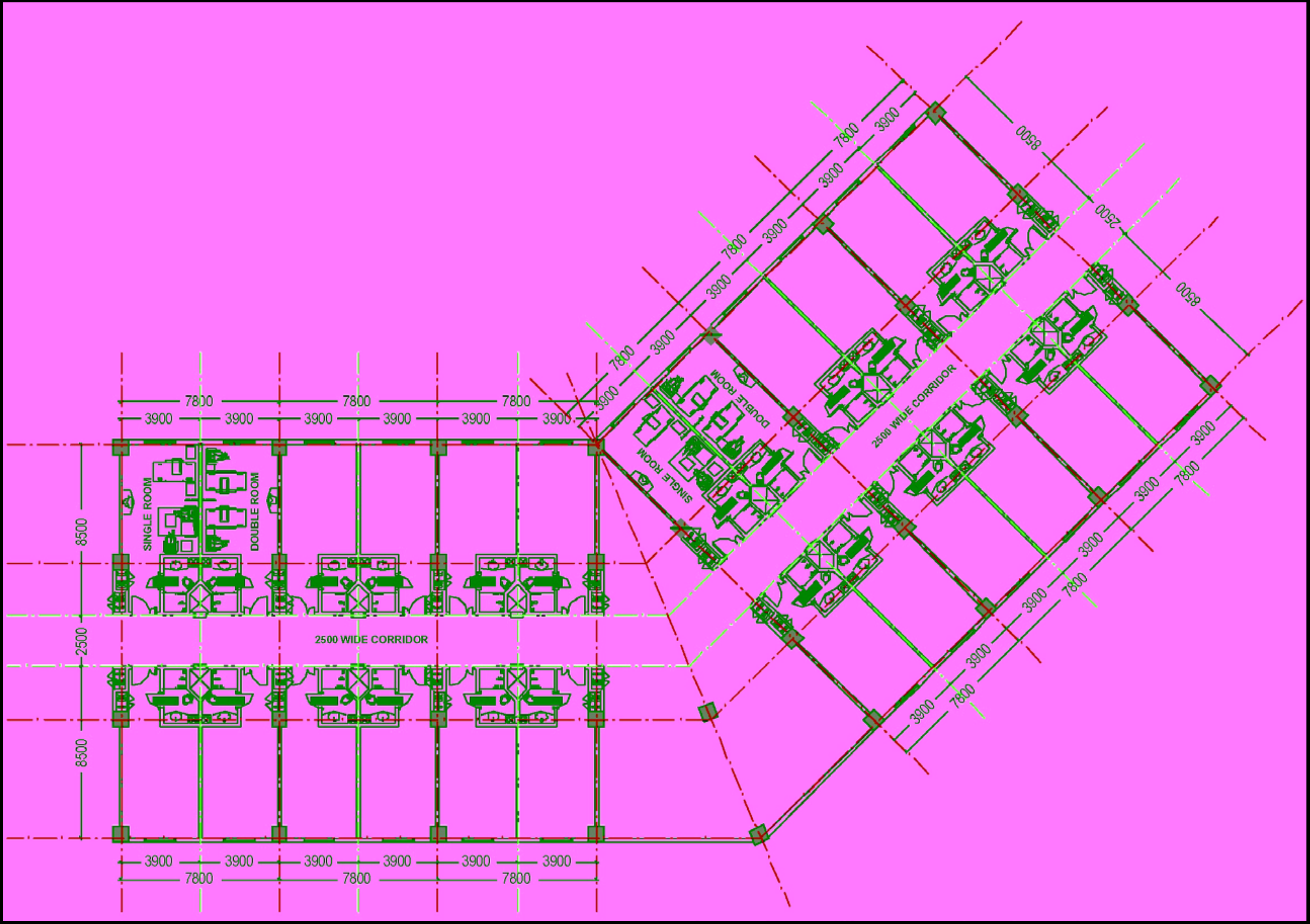
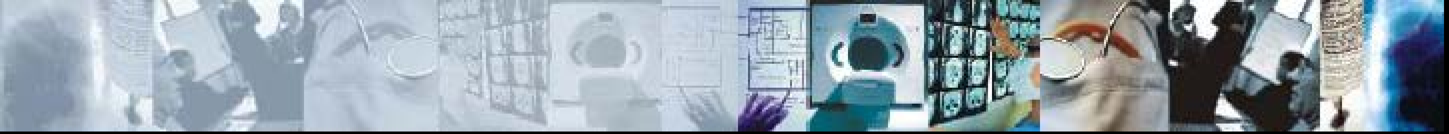


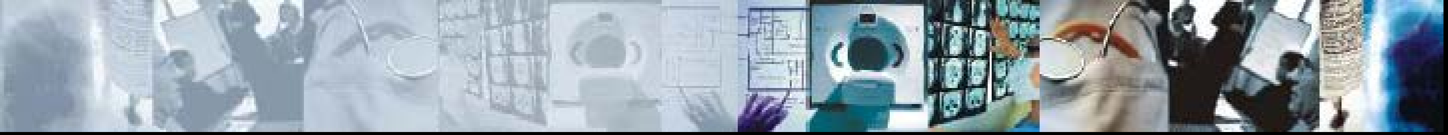
Surely I could have given a more creative example than this!



Altered sketch

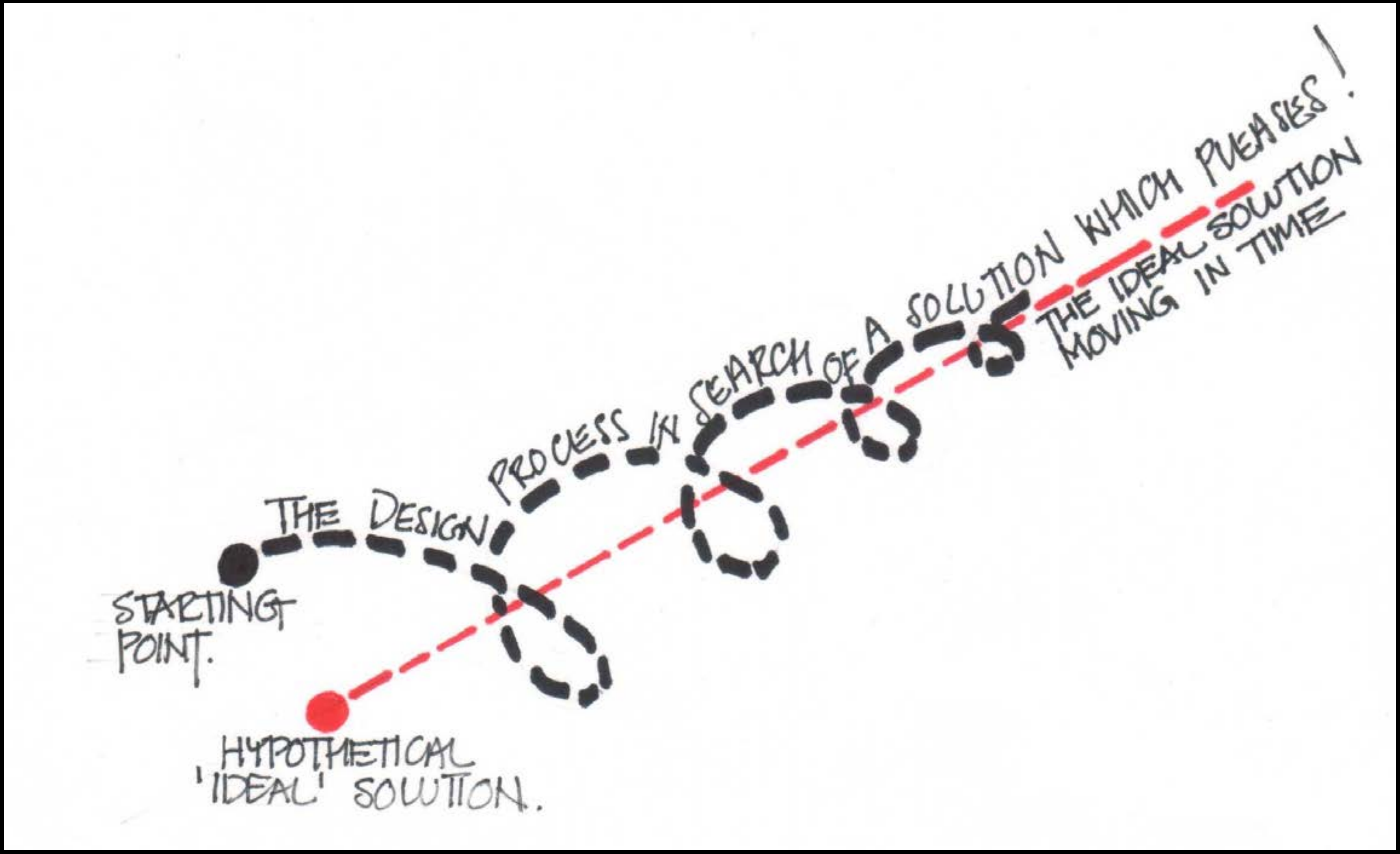
Can we conclude:

In vertically organized healthcare facilities, we design from the top (inpatient tower) down (the diagnostic / therapeutic / interventional podium).



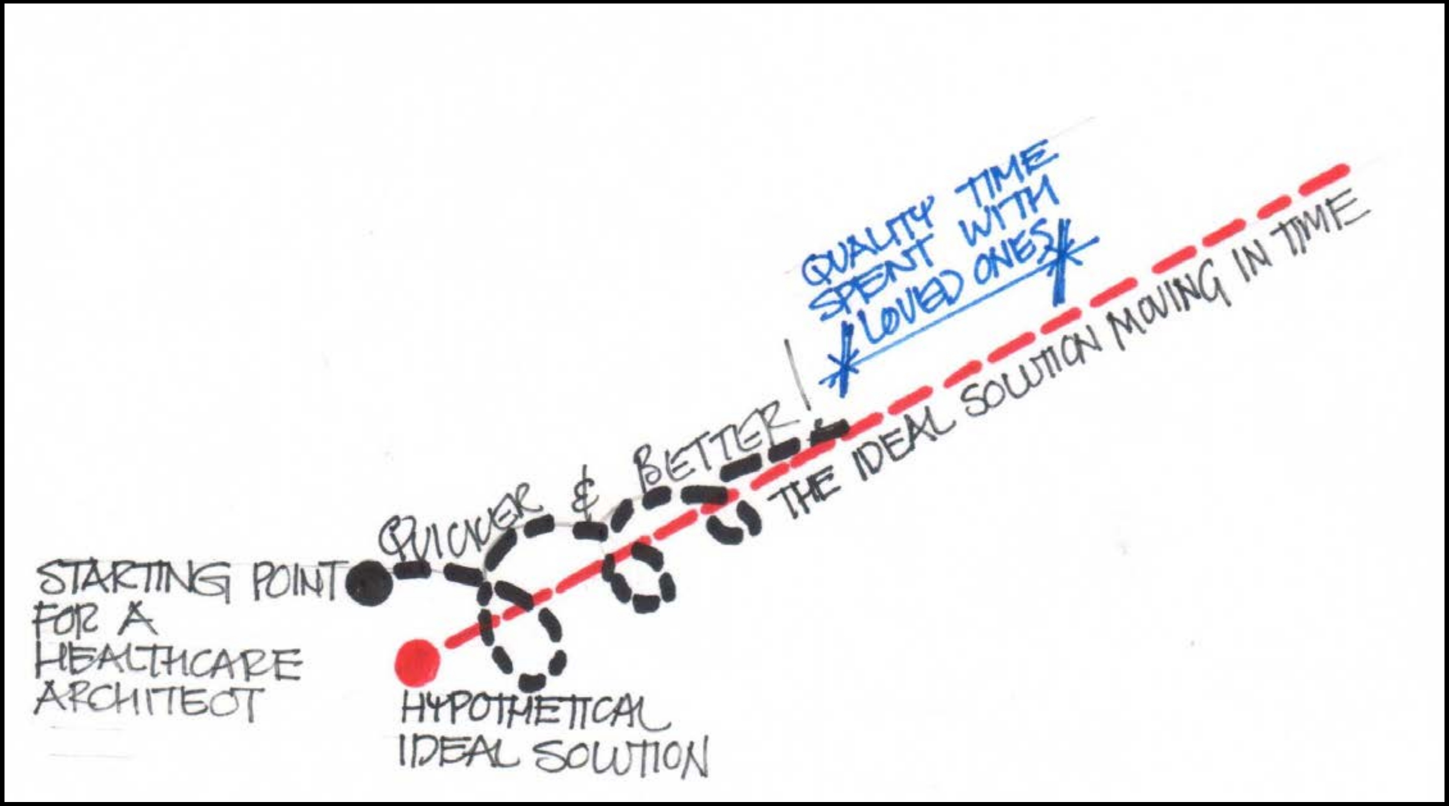
Not really.

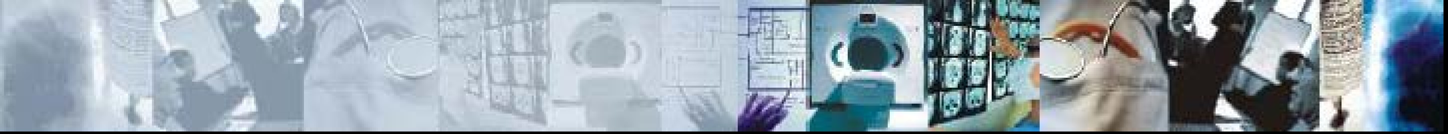
Actually we design in a kind of collapsing spiral with a time dimension.



The design process

for a healthcare architect...





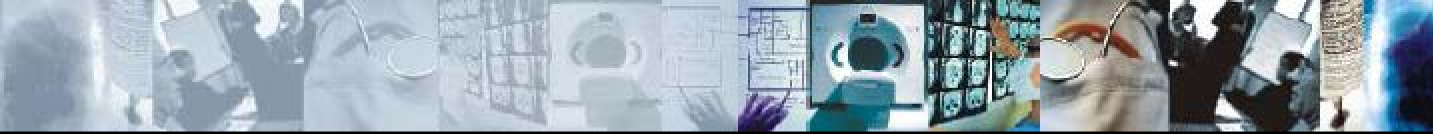
In semi-urban or rural situations, where the site is larger

In this situation, the planning grid will be determined by what designers call as their 'concept' for the hospital.

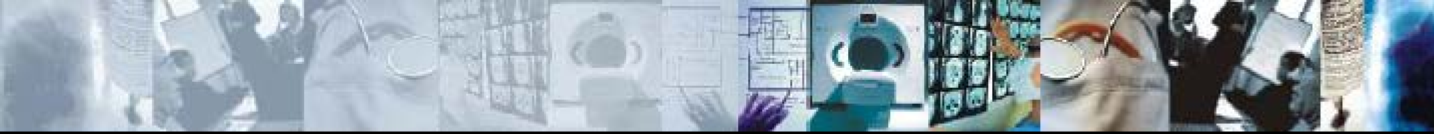
This freedom enables many

different types of building layout and form.

Muthoot Grids



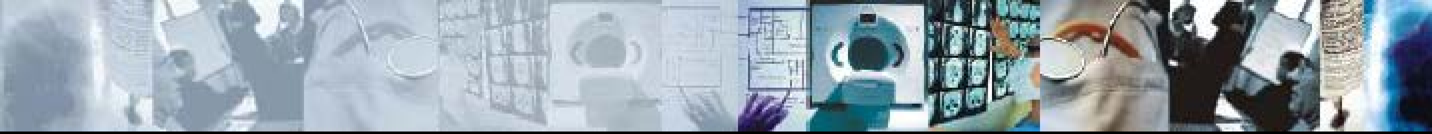
Muthoot Plan



The planning grid is subject to great local variation

Façade design might also vary greatly, there being less discipline to be followed.

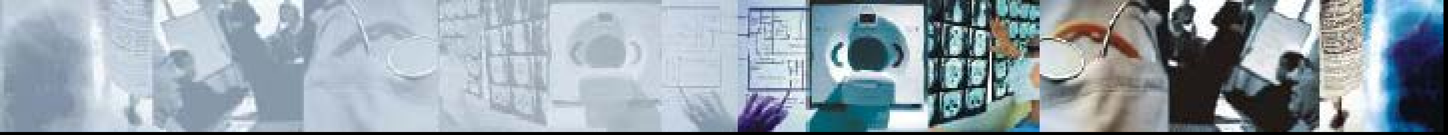
Different parts of the hospital may have different planning grids derived from the functional planning requirements of the hospital departments they house.



Certain spaces in the hospital may be designed without using any geometrical planning grid at all.

Bangalore concept-
Auditorium + Axis

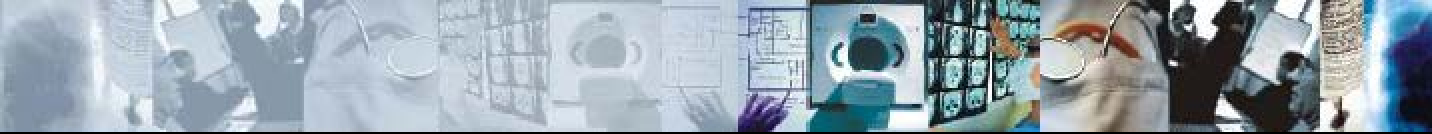
These areas are usually ancillary facilities such as auditoriums, entrance lobbies or spaces in which patients are recuperating after treatment.



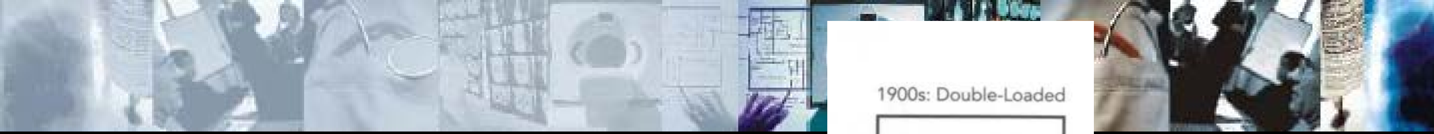
Healthcare facilities often present a complex and challenging design proposition

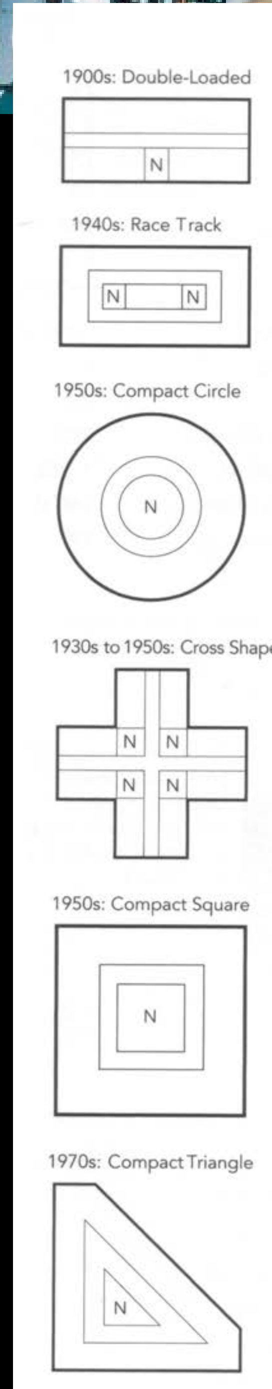
Thus any means of imposing some "order on the problem" or limiting your options in a meaningful way is not to be sneezed at.

The key word there was "meaningful"

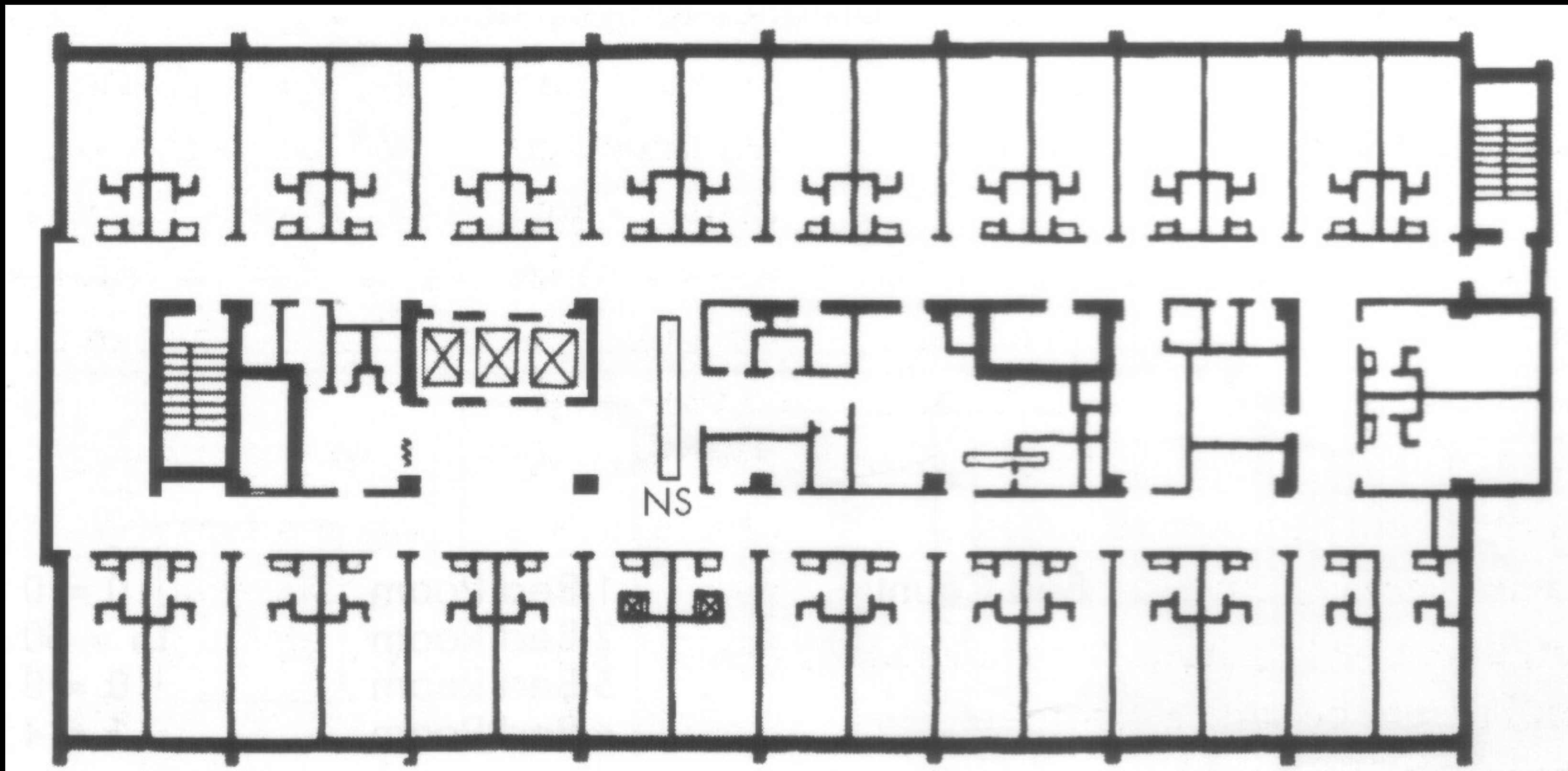


Some examples of inpatient room floor layouts follow…



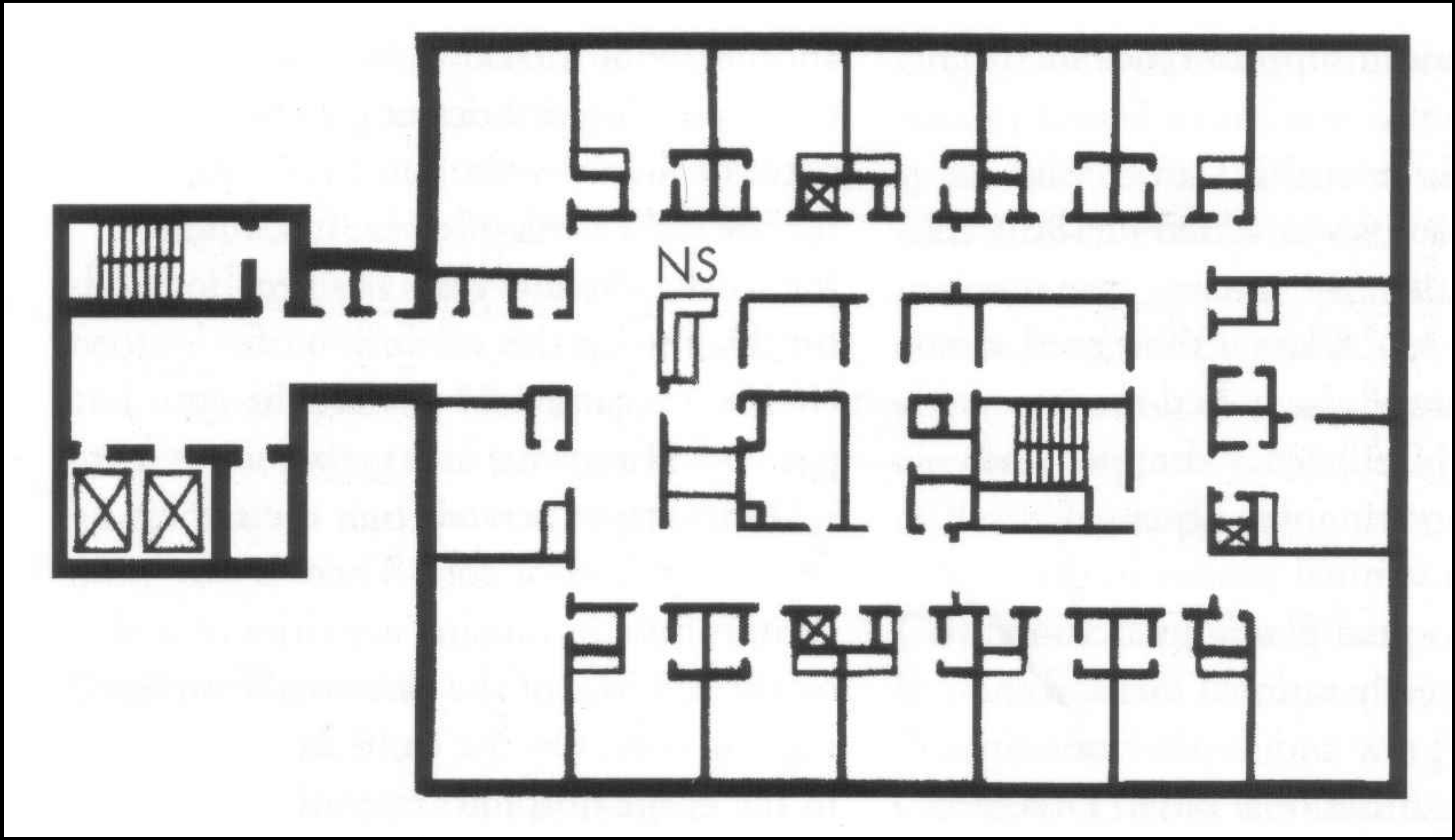


Cut into three + enlarge



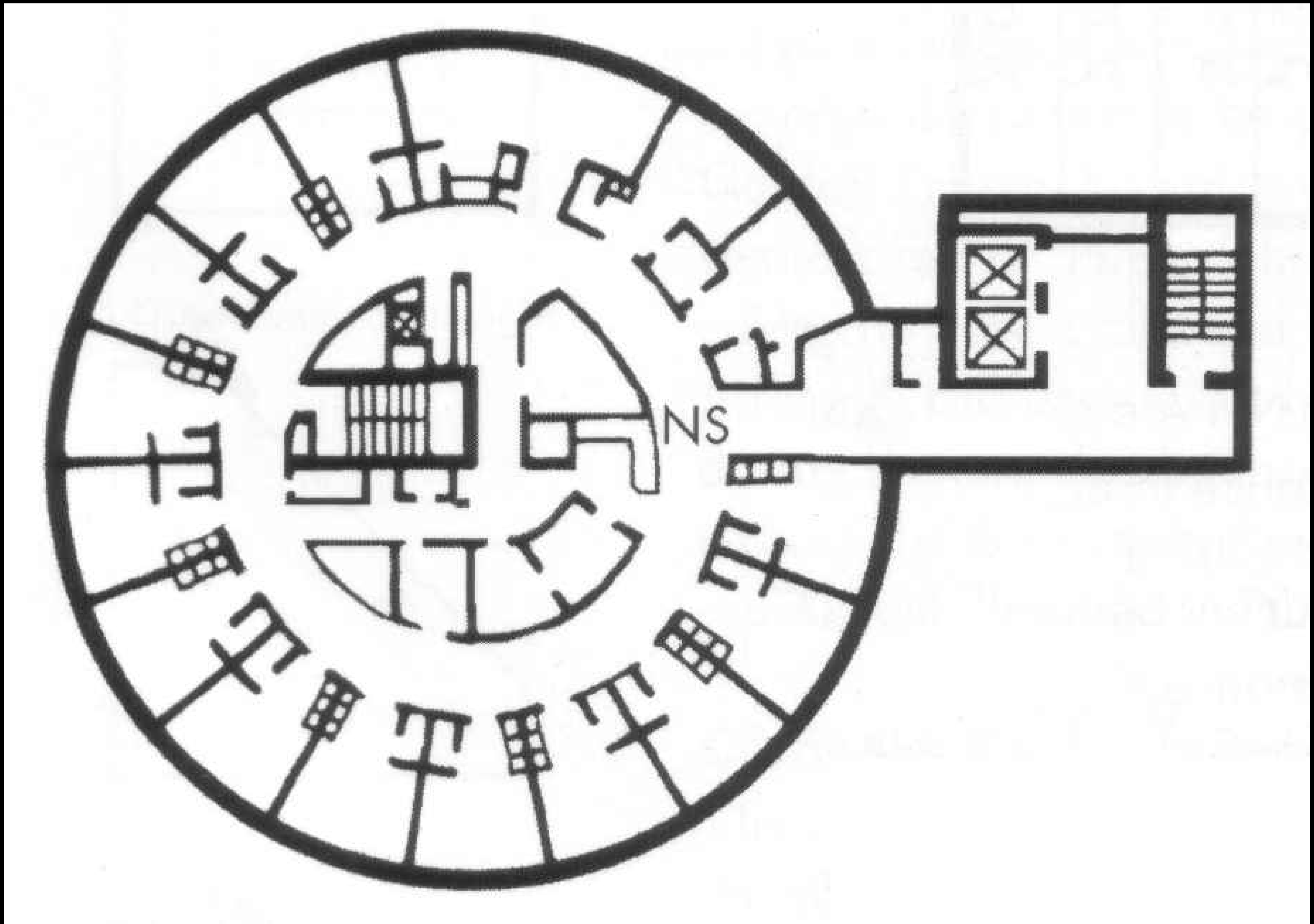
Double Corridor (racetrack) Plan

Holy Cross Hospital, Los Angeles, California



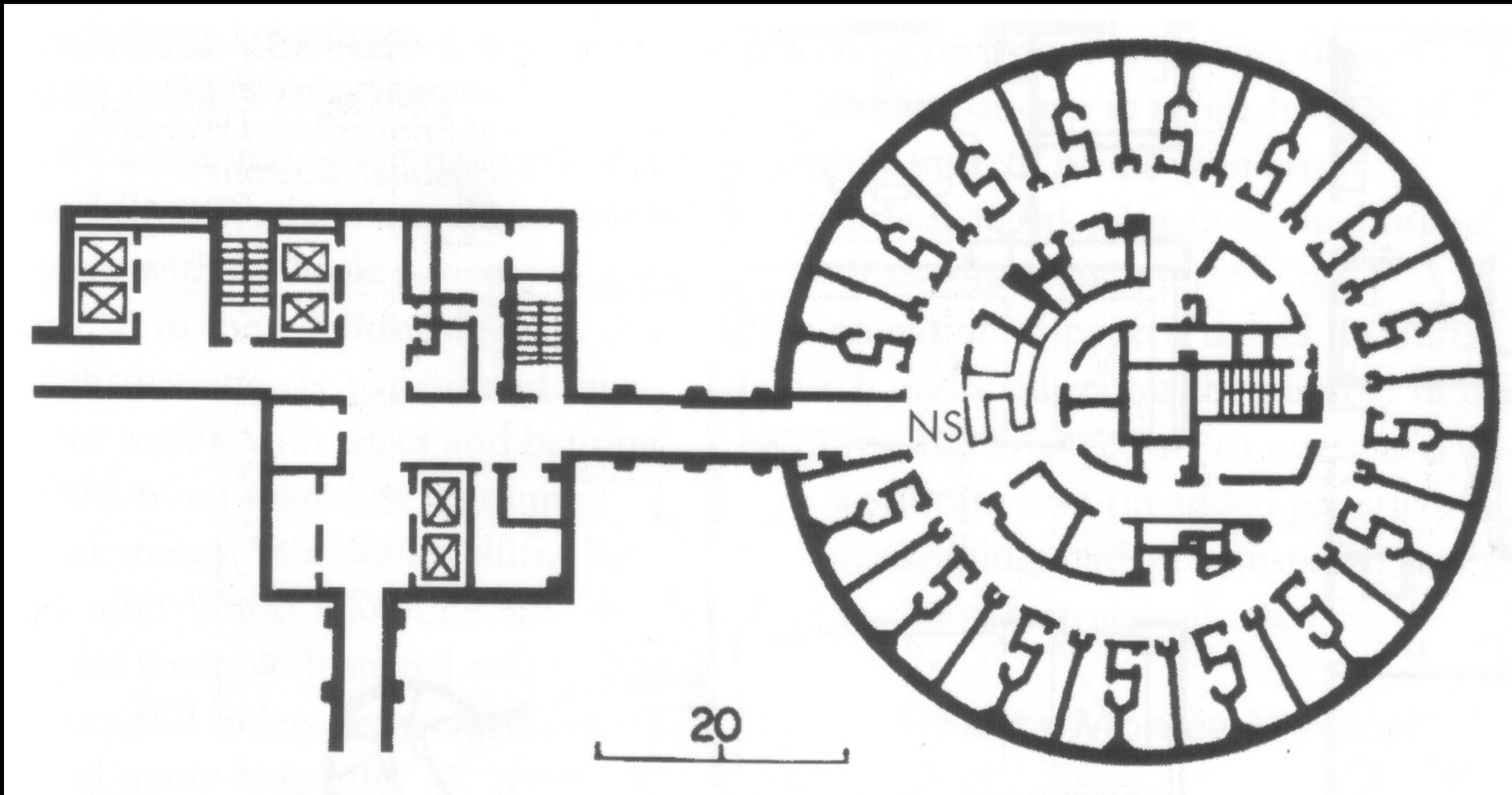
Compact Rectangular Plan

Providence Hospital, Anchorage, Alaska



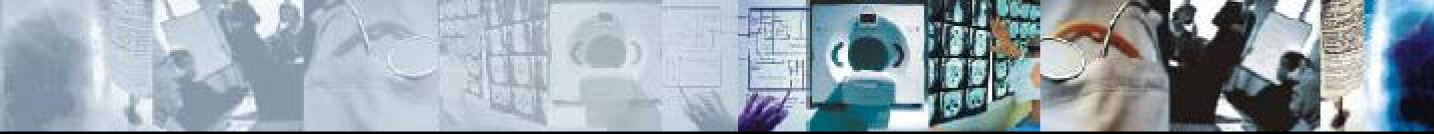
Compact Circular Plan

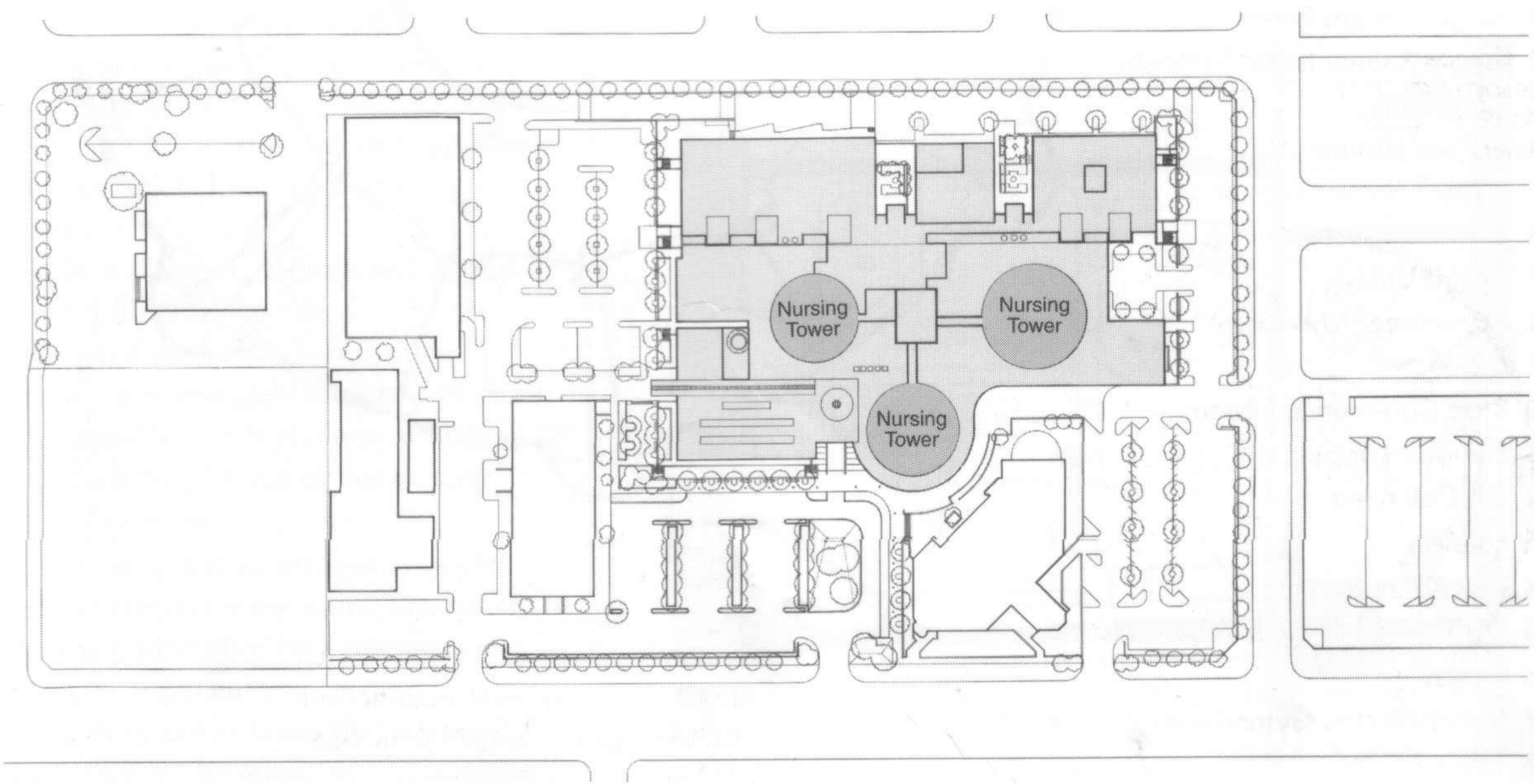
Valley Presbyterian Hospital Phase 1, Van Nuys, California



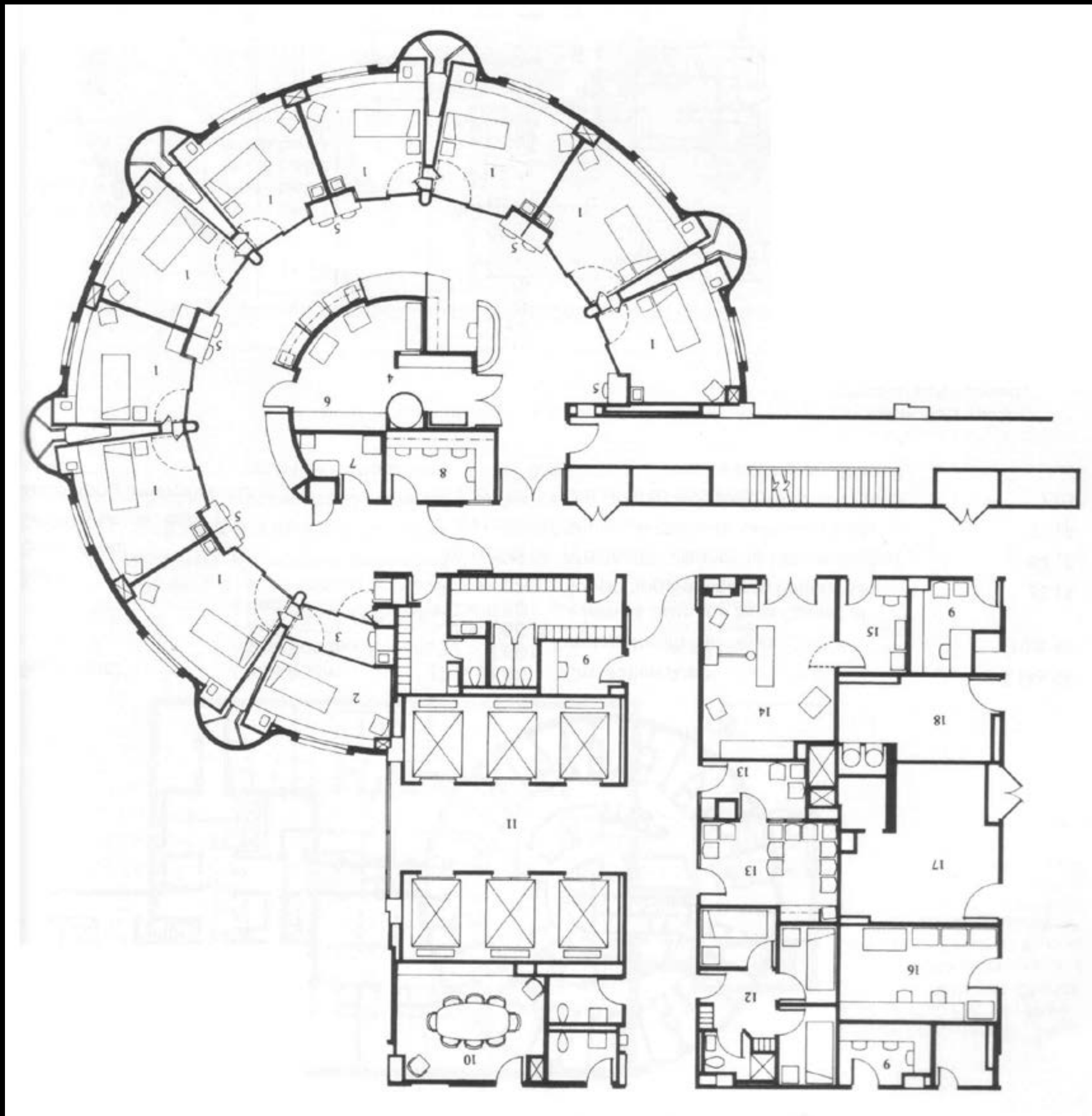
Compact Circular Plan

Valley Presbyterian Hospital Phase 3, Van Nuys, California



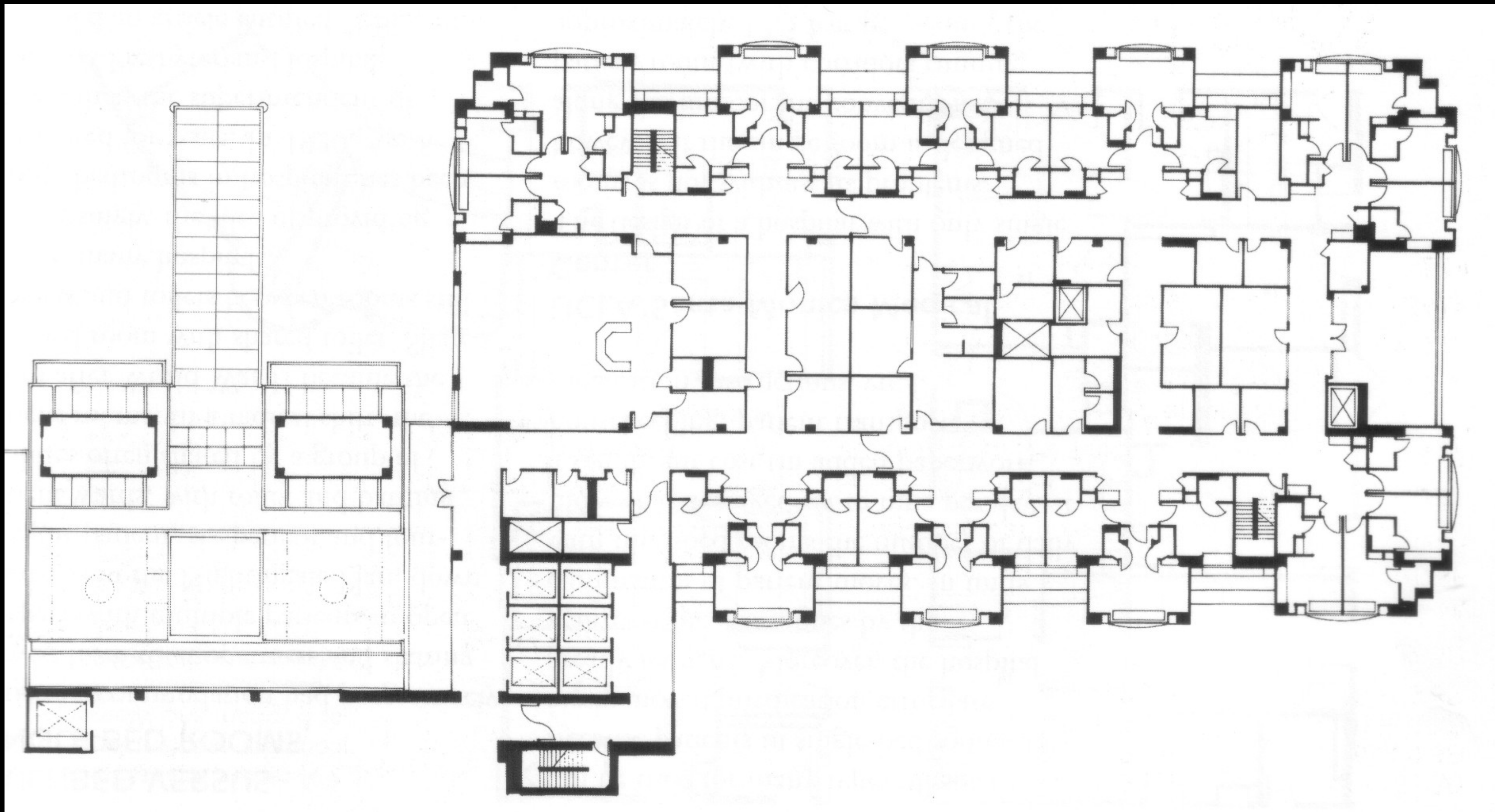


Valley Presbyterian Hospital at full growth



An adaptation of the compact circular plan at

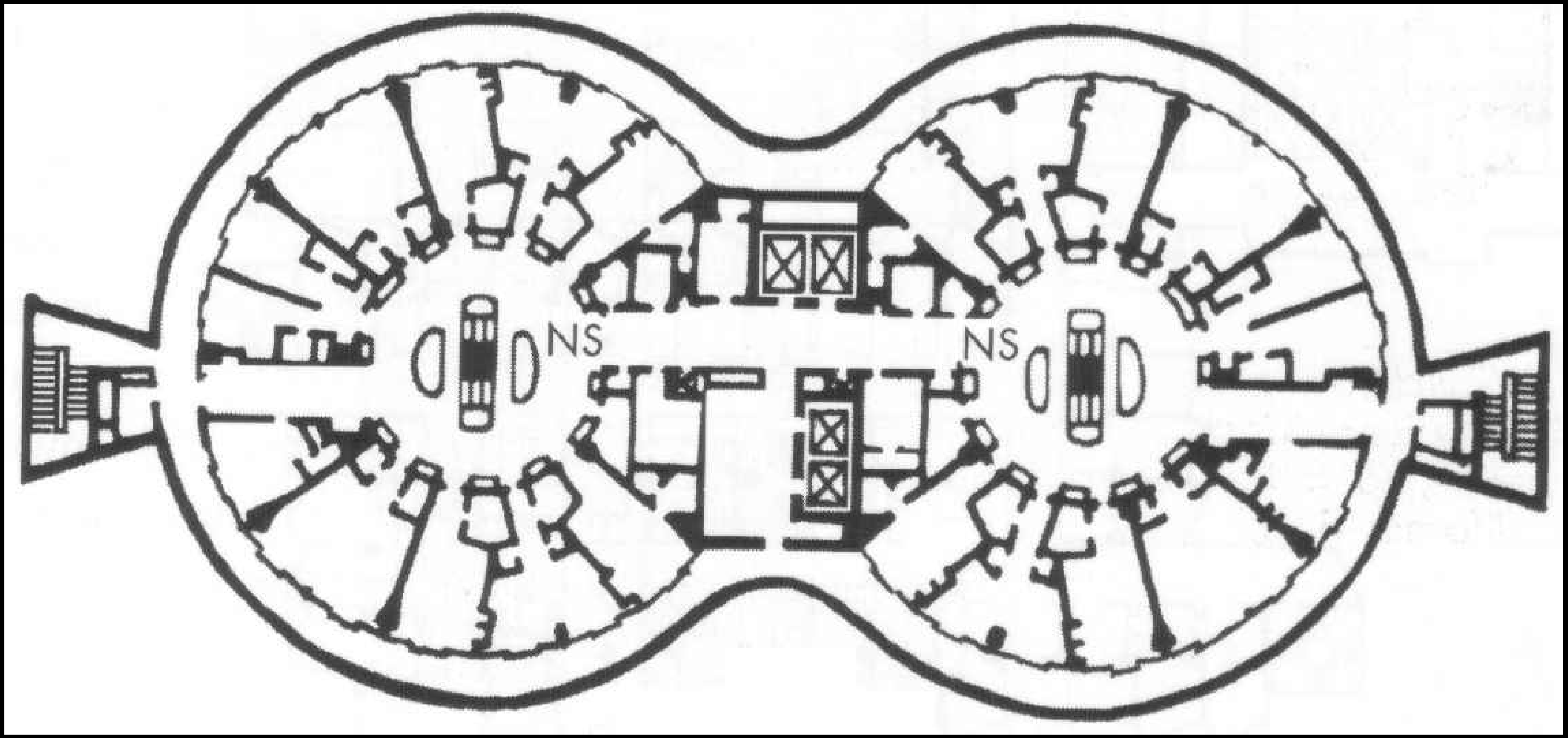
Brigham and Women's Hospital, Boston, Mass.



Inpatient Unit plans that overlap or stagger groups of 3 or 4 rooms

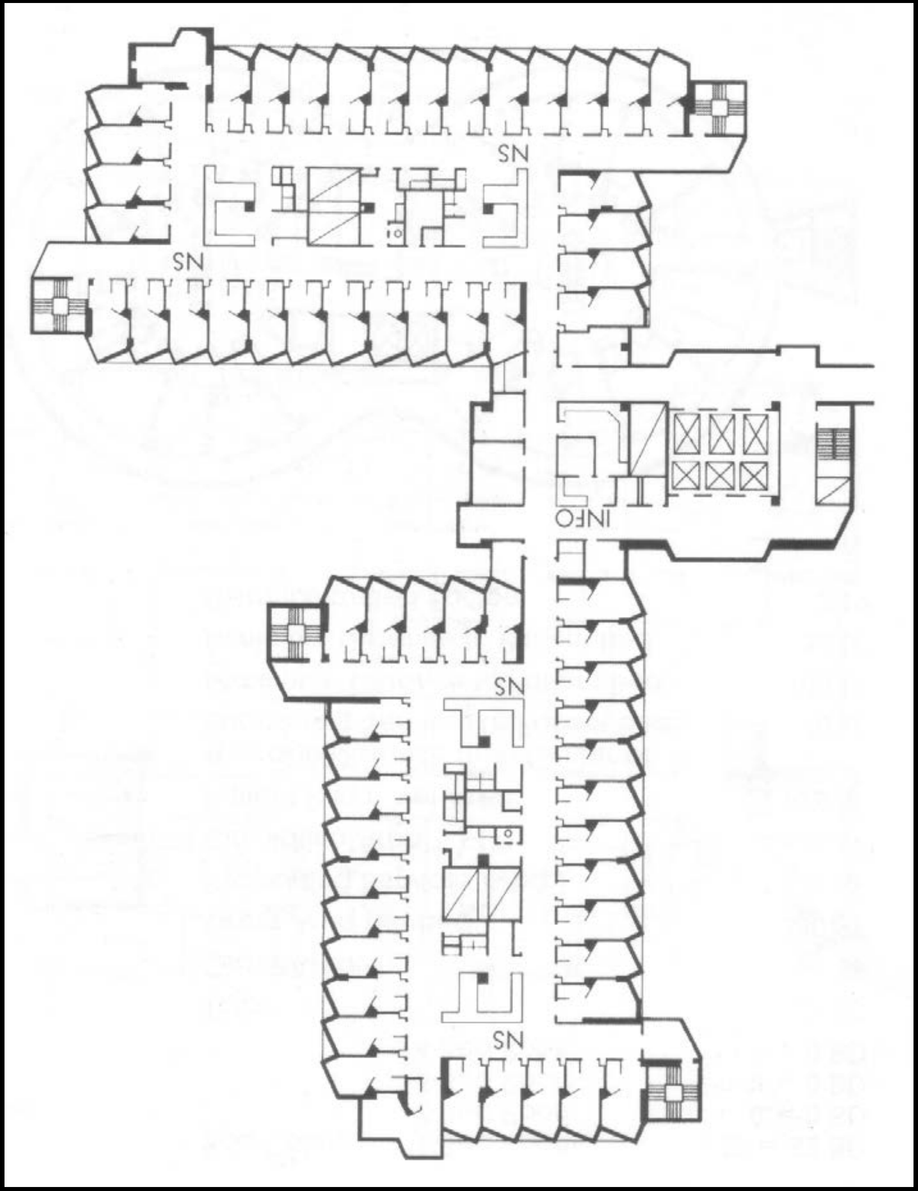
UCLA, Santa Monica Medical Center, Santa Monica, California

UCLA/Santa Monica Medical Center, Santa Monica, California



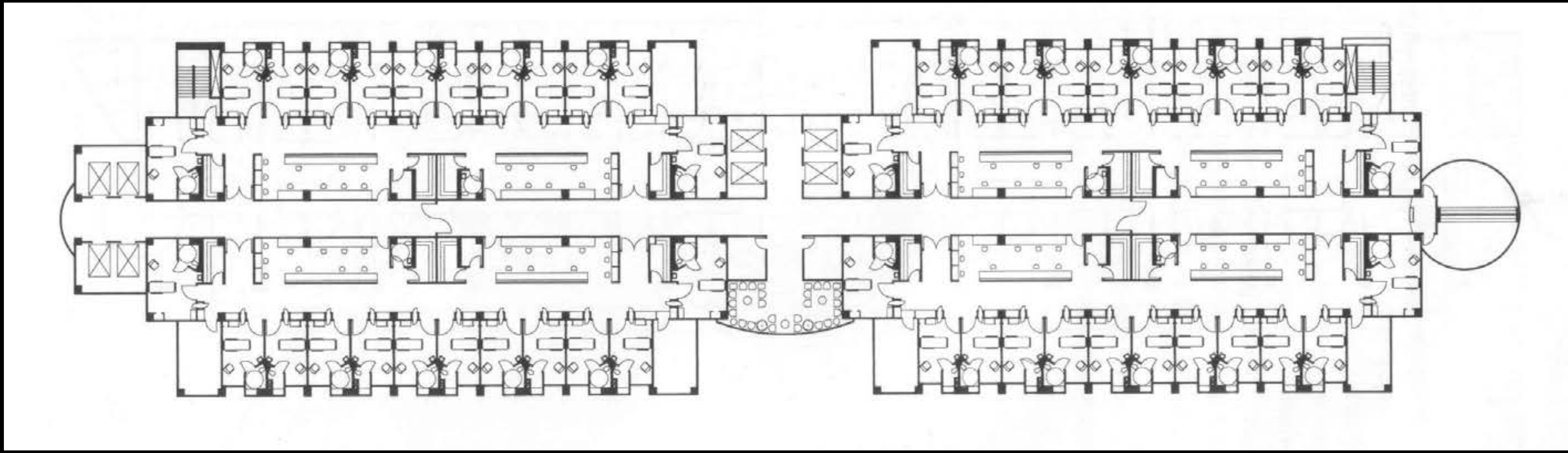
Compact Unit with peripheral corridor

Kaiser Foundation Hospital, Panorama City, California



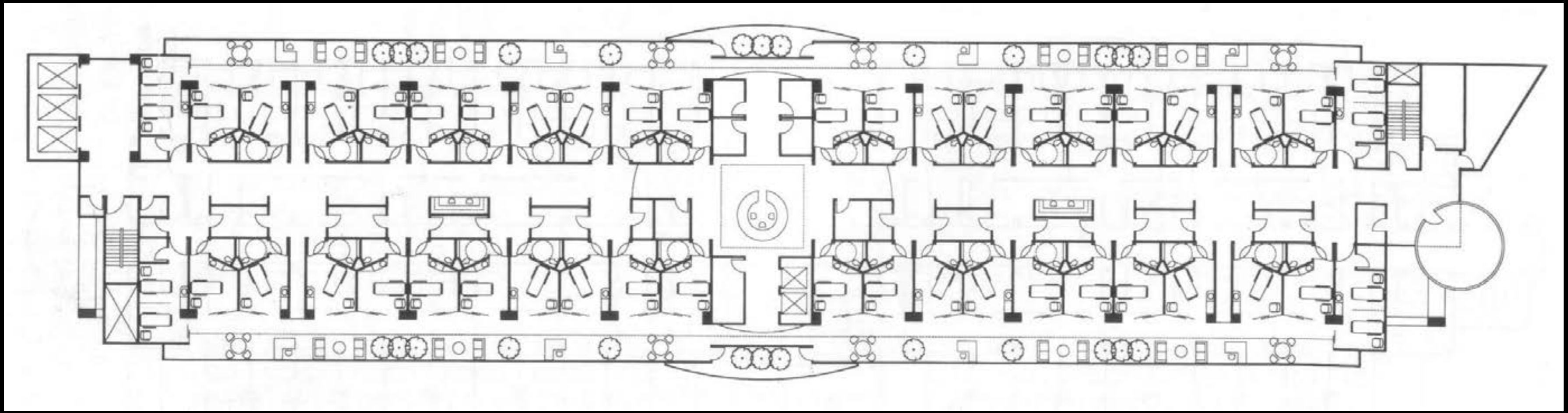
Maximization of patient-nurse link by removal of all non-care functions from the nursing unit

St. Vincent’s Hospital, Los Angeles, California



Scheme A of two alternative, experimental designs (mock-ups evaluated)

St. Luke's Medical Center, Milwaukee, Wisconsin



Scheme B of two alternative, experimental designs (mock-ups evaluated)

St. Luke's Medical Center, Milwaukee, Wisconsin

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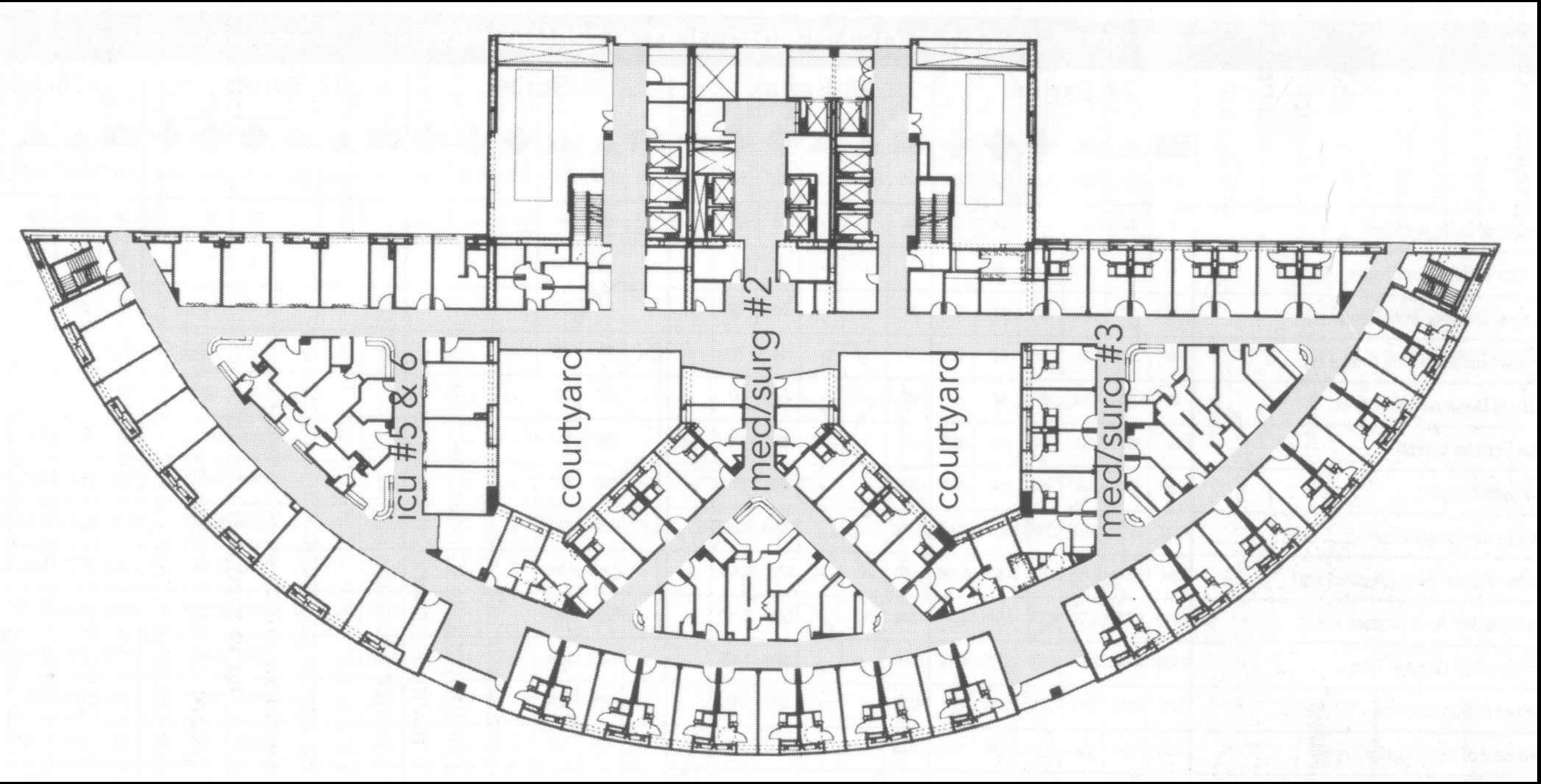
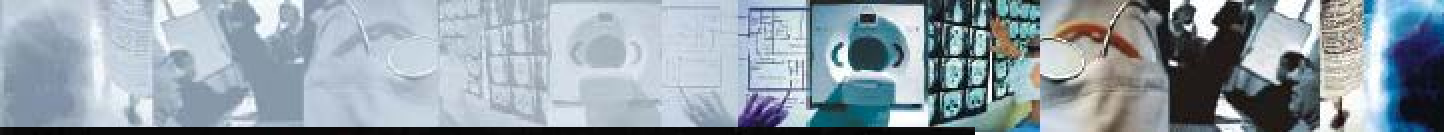
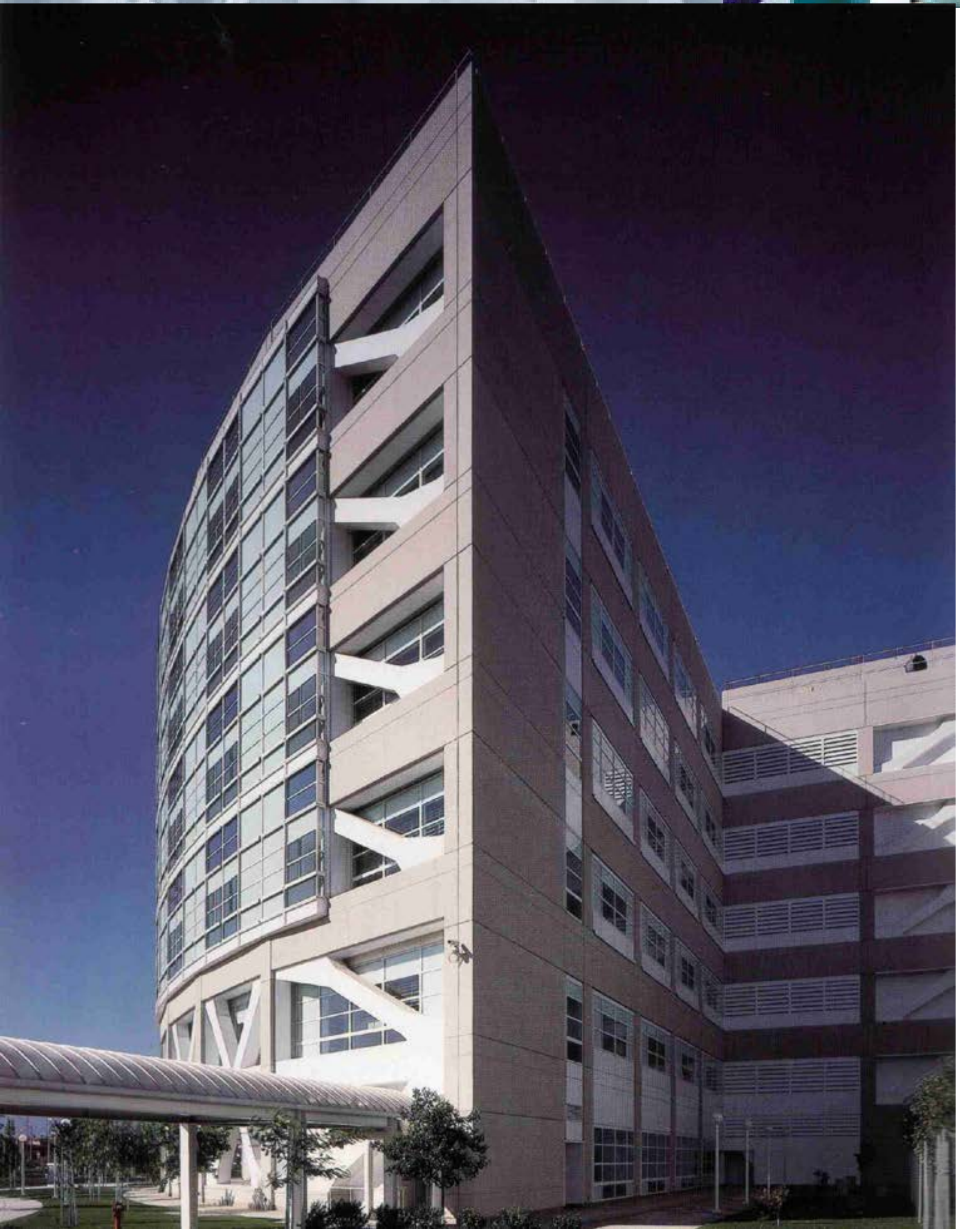


The brief: ‘to create the most efficient nursing unit possible…’

Arrowhead Regional Medical Center





Arrowhead Regional Medical Center, San Bernardino County, California

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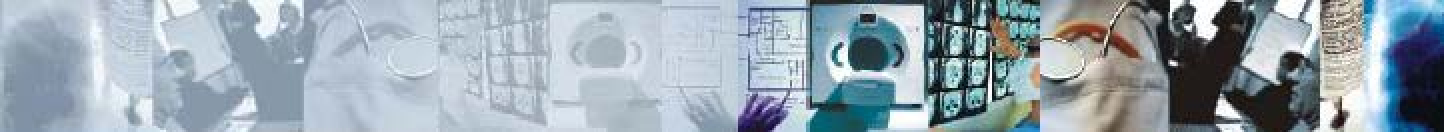

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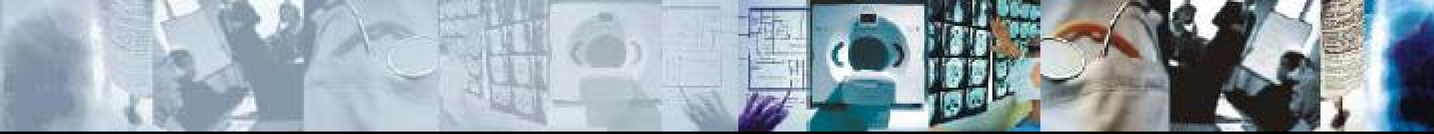
An Introduction to Healthcare Facility Design

Architects Lecture Series 2004 – No. 2

Circulation:

A Critical Issue – Conceptual Clarity, Ease of Wayfinding & Disability Needs



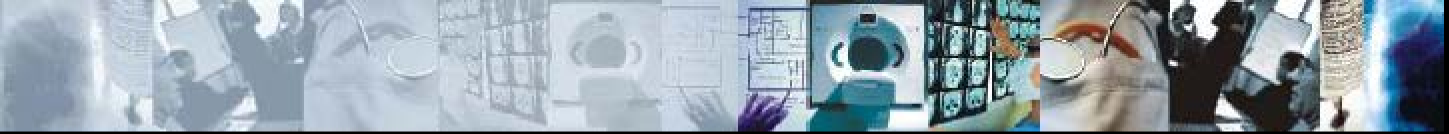
‘Circulation’ is defined as: “orderly movement through a circuit;

‘Orderly’

implies purpose, and purpose implies design.

Hospitals contain main circulation routes often described as “hospital streets”…

Traffic movement and routes taken by mechanical and electrical services are fundamental generators of the plan



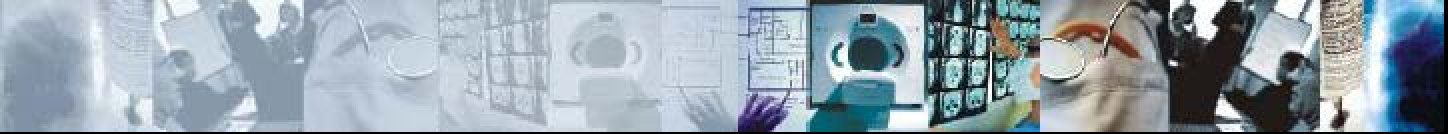
- **In a vertically stacked hospital**

=inpatient areas are placed on the upper floors,

- **The vertical circulation core**

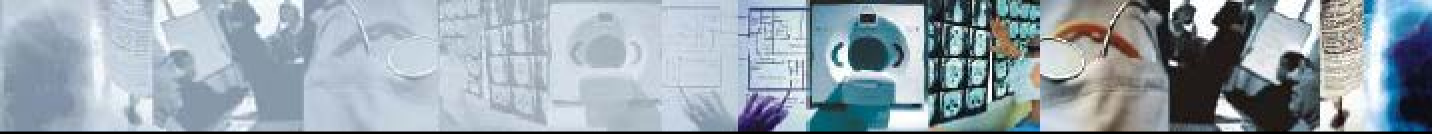
=is located by the layout of the inpatient floors.

The pattern of circulation conceptualized for the hospital under design will be considerably impacted by the location(s) of the vertical circulation core(s).



Patients, visitors and staff should be able to orient themselves by providing windows in corridors to enable them to look out and to allow natural light in.

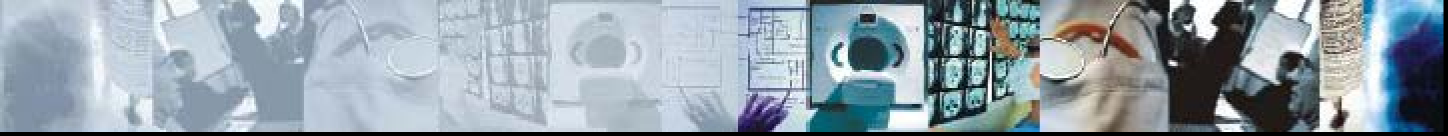
If the site enables them, courtyards are also an excellent means to this end.



- **No easily available prescription for the circulation pattern**
- **The qualities it should possess:**

1. It should have conceptual clarity.

- **It should be designed with purpose**
- **Geometry can be a recourse, junctions should be uniquely treated to avoid confusion over which corner of the hexagon you have reached.**

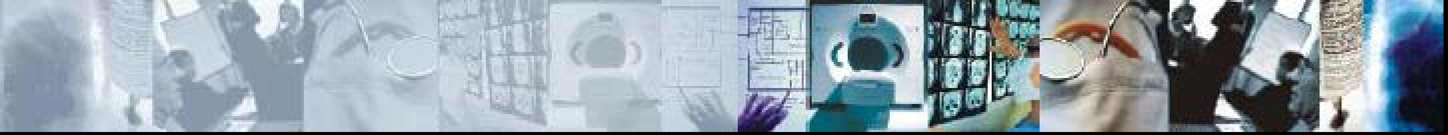


2. It should not be boring.

- Try to make walking from one place to another interesting, modulate those corridors, color them differently, hang artwork along the way.
- Niches, outside views, courtyards, all these will help.

3. It should enable wayfinding.

- With well-designed signage, people should be able to find their way to their destination with ease.
- Color-coding for floors or departments is sometimes used.



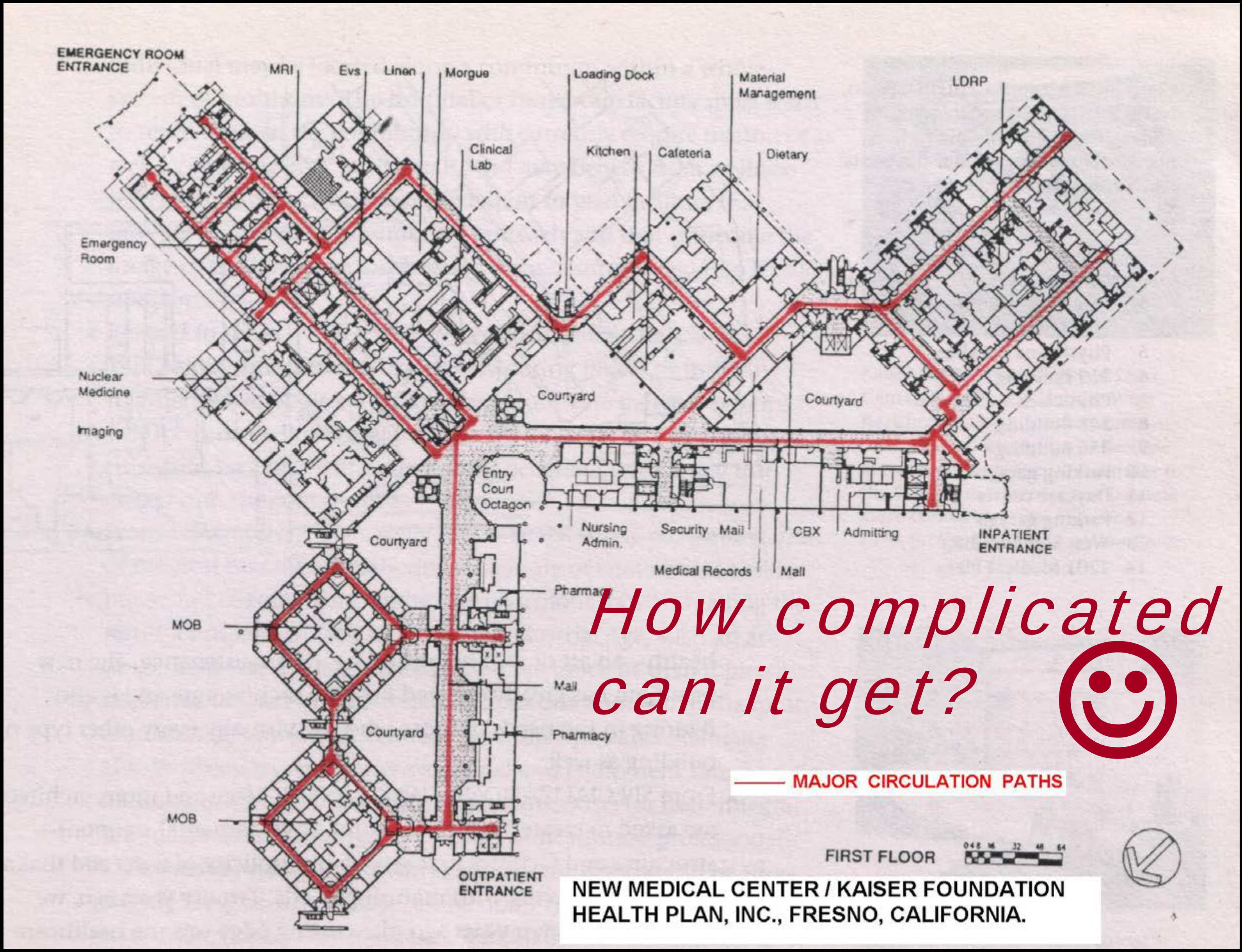
4. **They should be wide enough to handle anticipated traffic.**

- **Stretcher traffic needs 8'-0" width of corridor for easy movement (turning).**
- **Corridors between Operation Theaters make sense even with 10'-0" width.**

5. **They should be indirectly lit.**

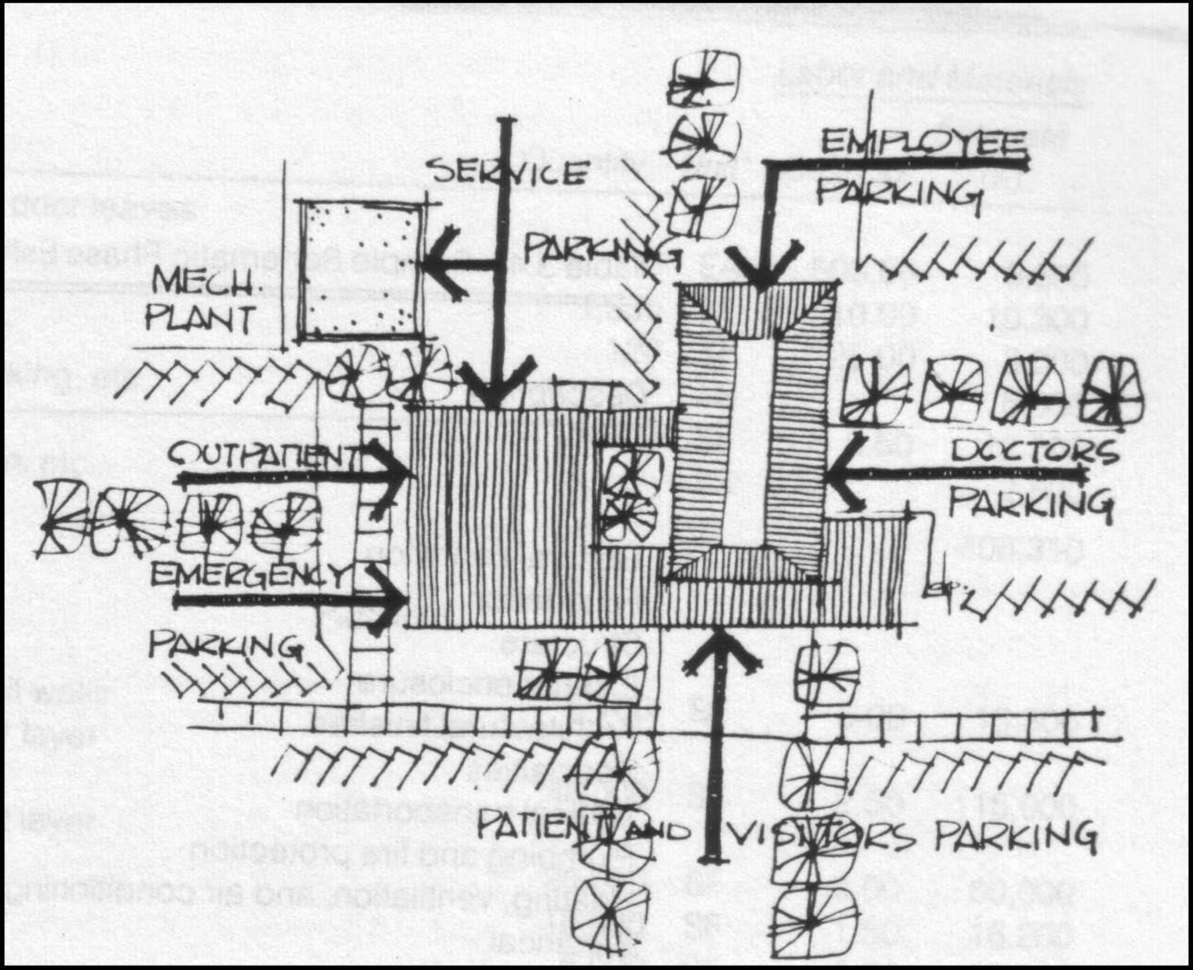
Patients on stretchers get to look at the ceilings. The sign put up by the traffic police at the end of Marine Drive in Mumbai says, "Drive carefully. Hospital ceilings are boring."

While not advocating rash driving, we would advocate making the ceilings interesting.

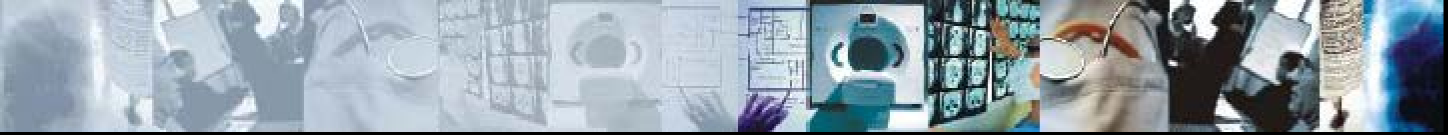


NEW MEDICAL CENTER / KAISER FOUNDATION HEALTH PLAN, INC., FRESNO, CALIFORNIA.

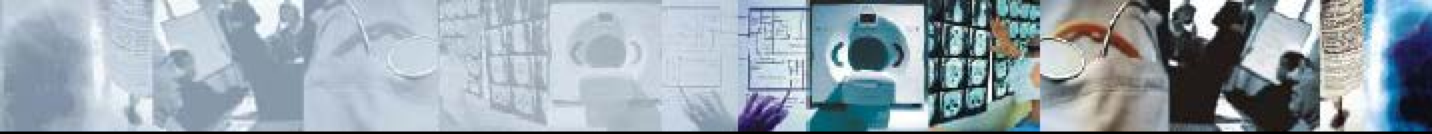
How complicated can it get? ☺



…designing traffic flow around the hospital, and entrances to the hospital – an important part of circulation design…



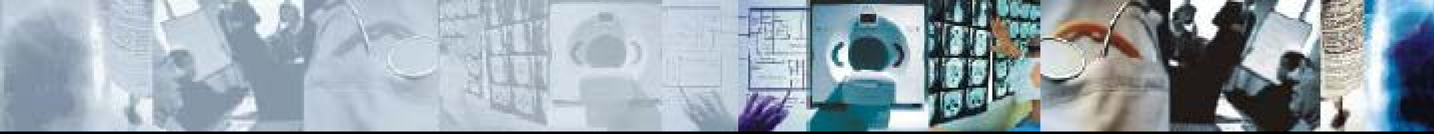
Muthoot example showing entrances



When planning for the area occupied by this circulation space (corridors) in the architectural space plan, it can be provided for as a percentage of the department area (usable, built-up area).

The percentage can vary from 35% for an Operation Theater Suite

to 20 – 25% for the Administration Department.

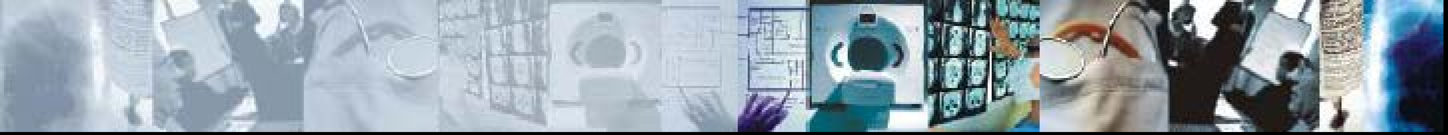


Frequently:

- the major circulation paths through the hospital are laid out even before the tentative space allocation for the hospital departments is done.

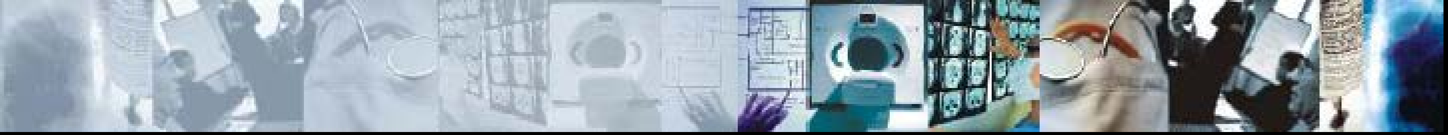
- Conceptualization of the working (and therefore layout) of departments, will determine the circulation pattern through that department, and hence affect the layout of circulation paths in contiguous areas of the hospital.

- you will find that in the areas below the footprint of the inpatient tower in the podium, you end up using the same corridors that you used in the inpatient floors.

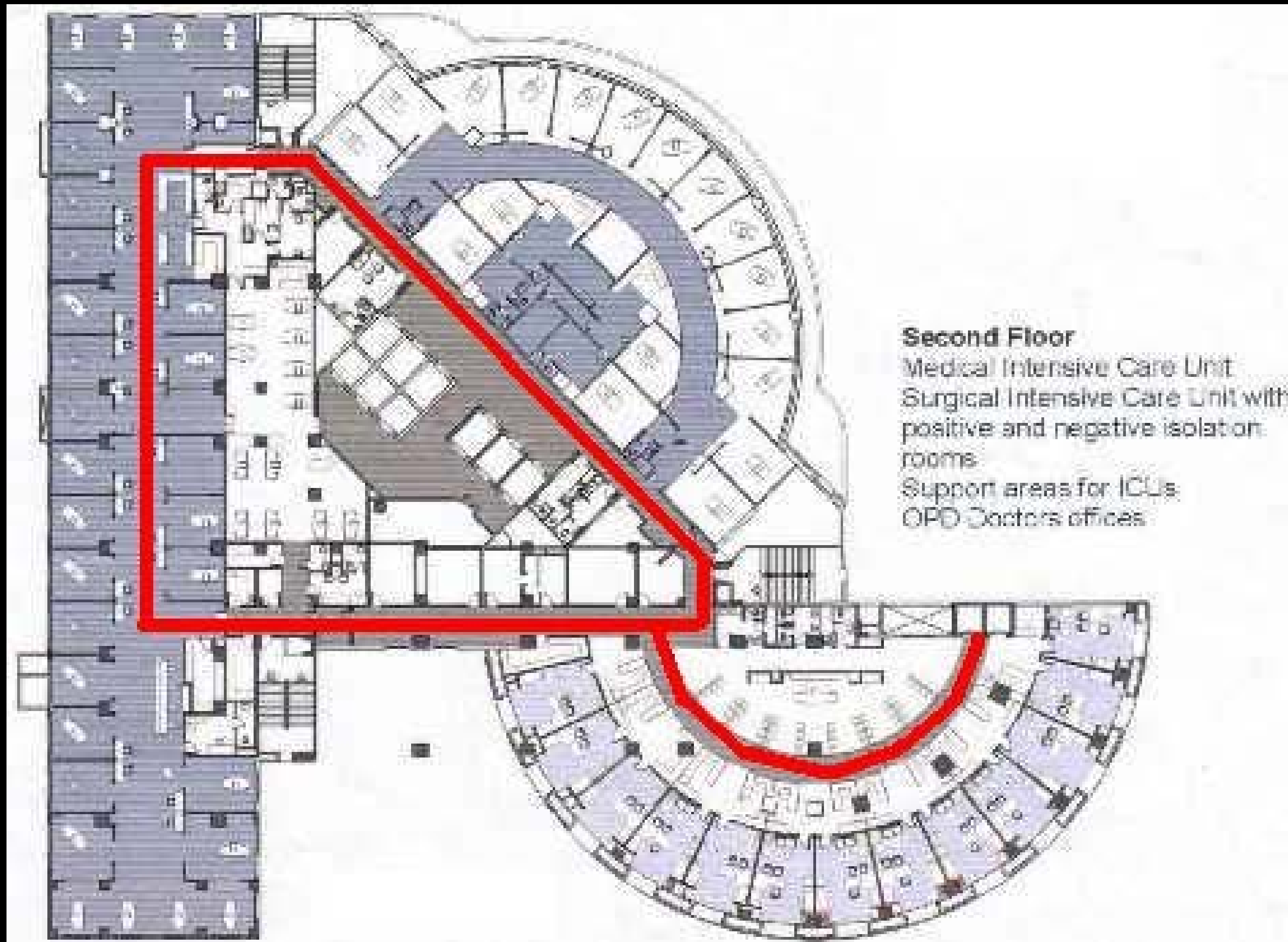


The funda is:

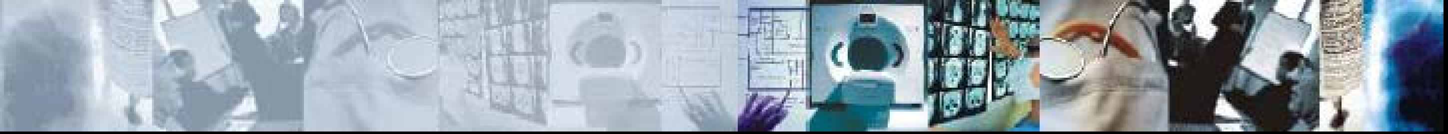
Defining major circulation paths through the proposed and future buildings is a design decision that will considerably impact the form, layout and thus the eventual functioning of the healthcare facility being designed. Do it thoughtfully and with conceptual clarity.

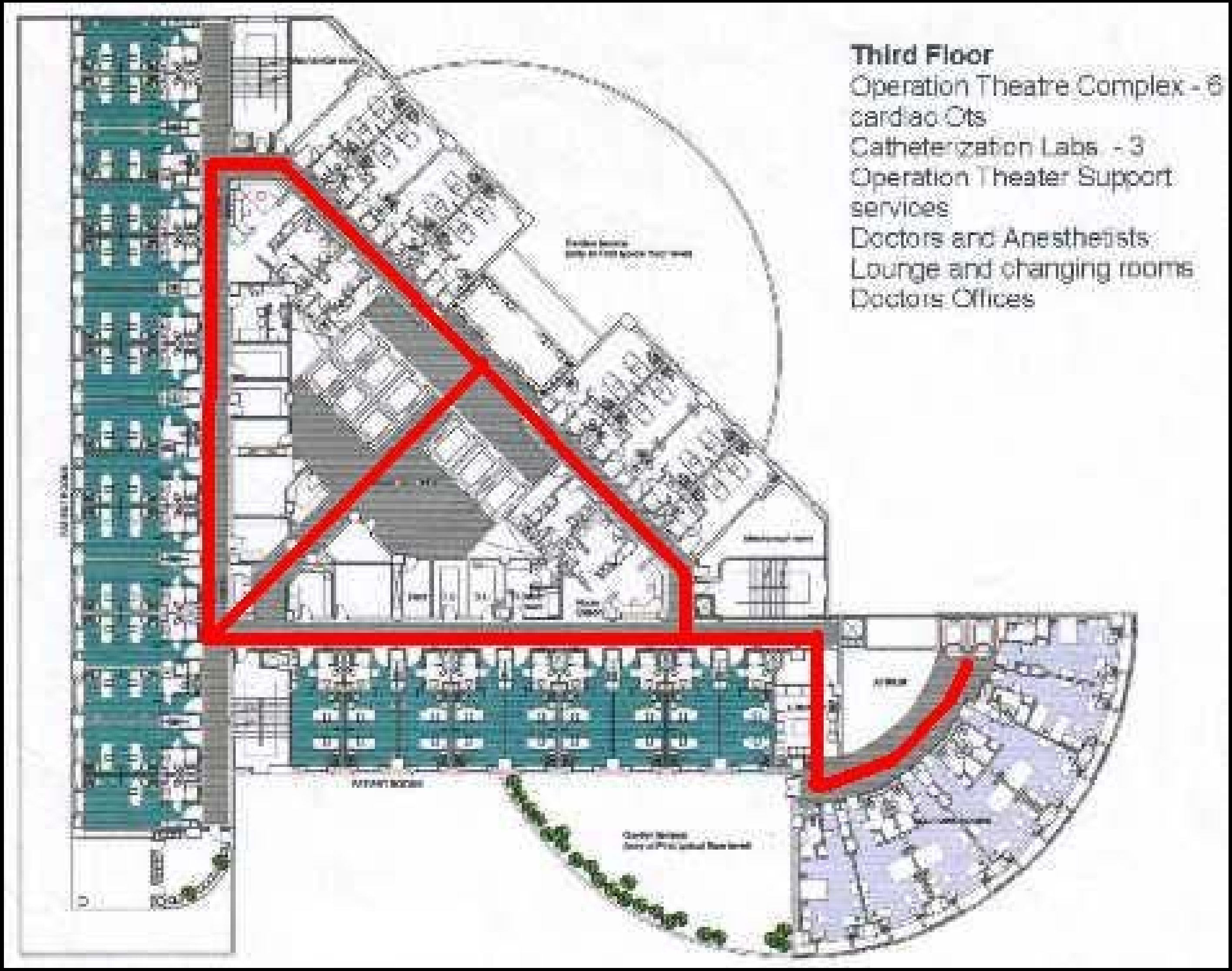


An example of a tight circulation pattern is shown in the next slide in the Asian Heart Institute & Research Center at Bandra-Kurla Complex, Mumbai:

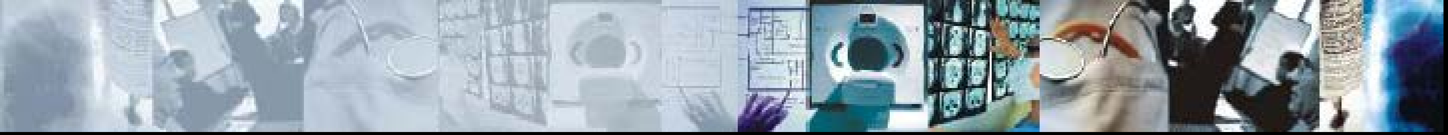


…"looping" is a good way of achieving tight circulation…

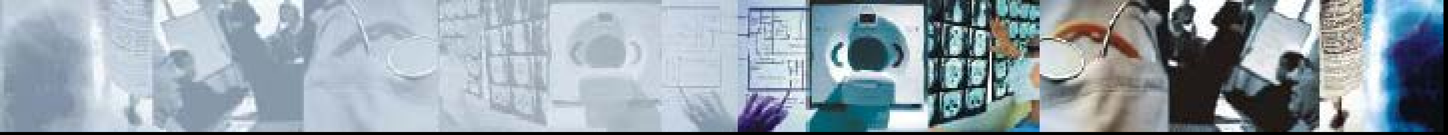




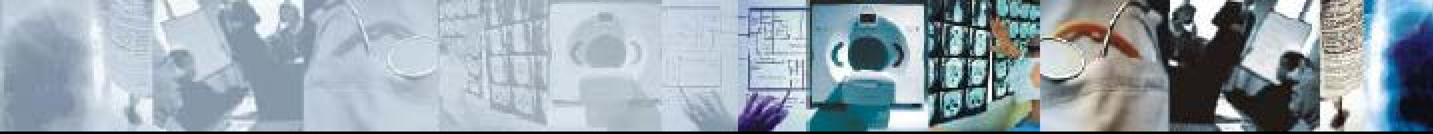
…"Shorting" is even better…



An example of a spread-out circulation pattern is shown in the next slide in the proposed Muthoot Hospital at Dwarka, New Delhi:

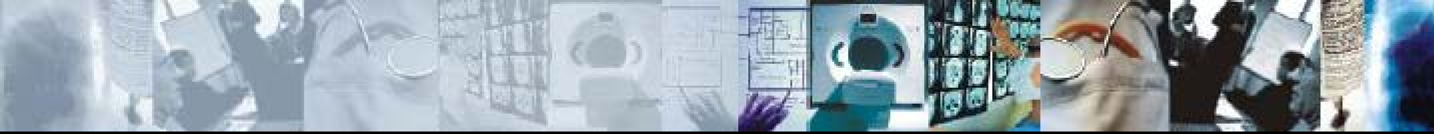


Muthoot example showing circulation routes



Special Considerations for Designing for the Disabled

Identifying and understanding the conditions which constitute barriers to those with a disability is a fundamental requirement for the effective provision of accommodation and facilities to be used by disabled people.

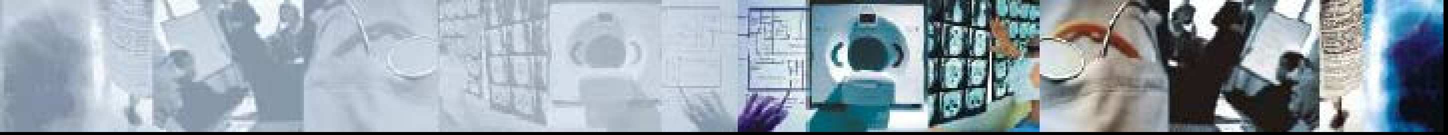


- **Resulting design can make the design easier and safer to use for those with children, those using wheeled equipment and those carrying other items.**

- **The principle of applying critical criteria is used**

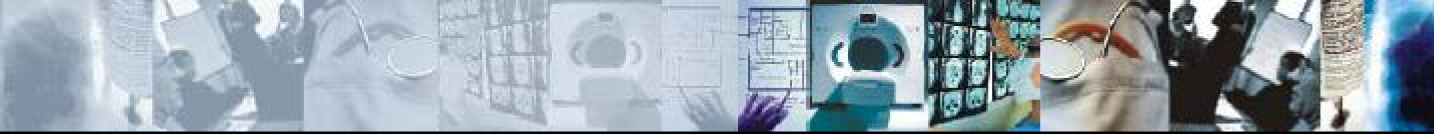
- **Resulting design will help not only people who are ill or disabled but also those who are suffering from shock or stress**

- **Building design that gives consideration to all users will also be easier and safer during an emergency evacuation.**



The best design philosophy is to consider the journey through the healthcare facility from start to finish

Analyzing all the related components of the task (negotiating entrances, corridors, lifts, reception areas, toilets, etc) to ensure that the features, equipment and fittings encountered in completing the journey are suitably designed.



The different categories of disabled people are as follow:

Fully-ambulant

Semi-Ambulant

Non-Ambulant

Manually-impaired

Visually-impaired

Hearing-impaired

The lecture text gives details on each particular kind on disability and specific design requirements for each type. It also enumerates a checklist to be followed during design.

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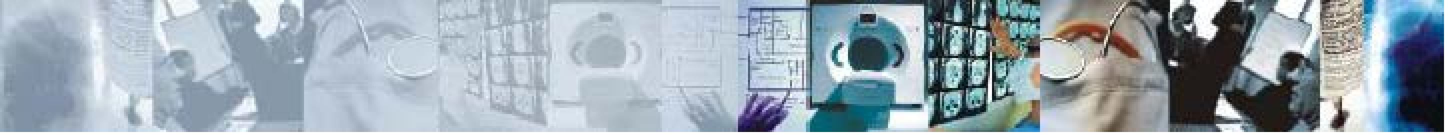

INTEGRATING HEALTHCARE
HOSMAC INDIA PRIVATE LIMITED

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Academy of Architecture, Mumbai

Welcome You To

An Introduction to Healthcare Facility Design

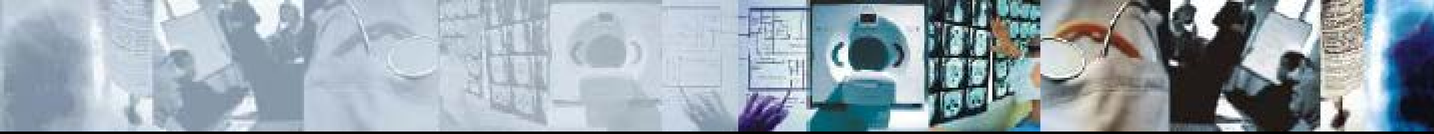
Architects Lecture Series 2004 – No. 3

Designing for Flexibility:

Building In Order & Direction for Growth & Change

‘Flexible’ is defined by Merriam-Webster’s Collegiate Dictionary as: “Characterized by a ready capacity to adapt to new, different or changing requirements.”

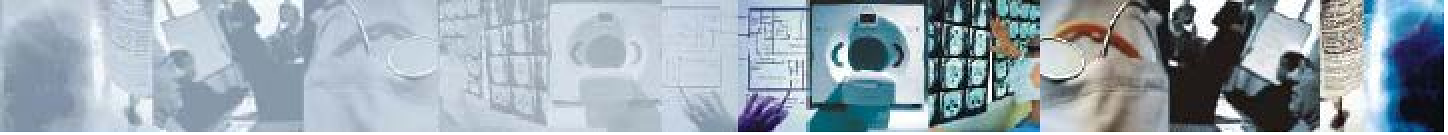
Flexibility, as an architectural principle applied to the design of a hospital, would be the inbuilt capacity of that hospital to adapt itself to “new, different or changing requirements.”

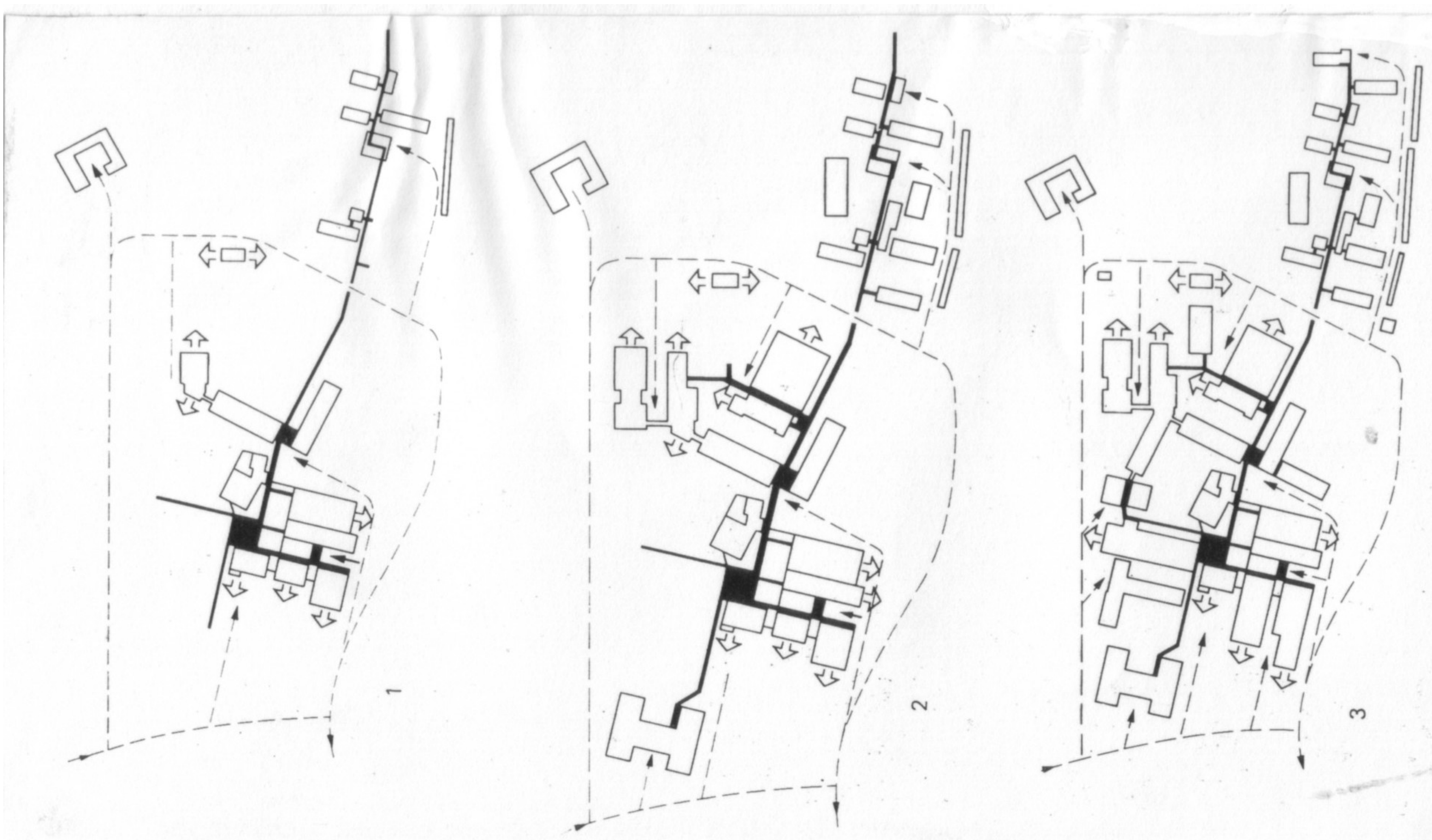


John Weeks, the first architect in Britain to fully grasp the need for this flexibility in the design of hospitals, made the then revolutionary point that ' user studies of function are by themselves not a sound basis for hospital design.

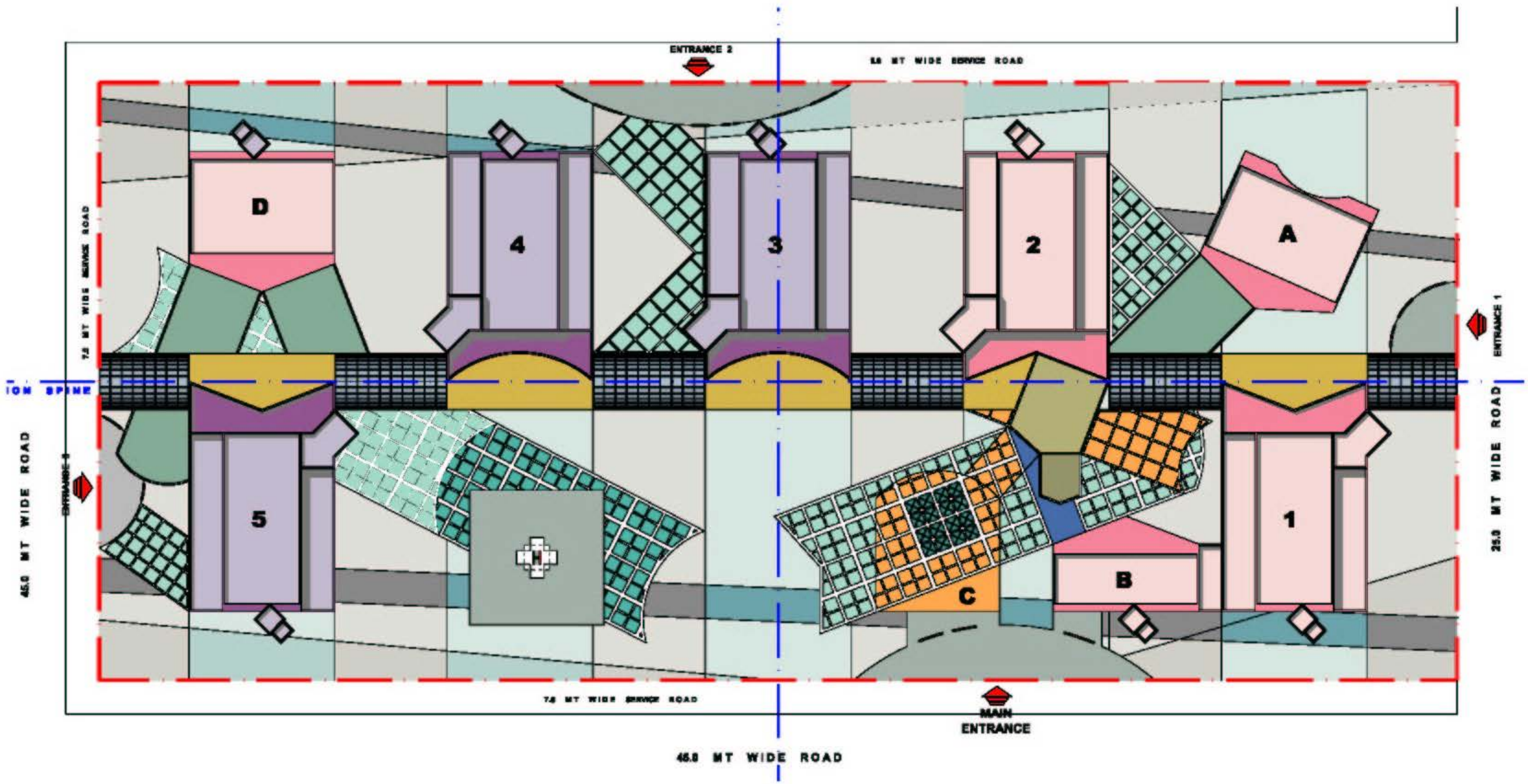
Functions change so rapidly that designers should no longer aim for an optimum fit between building and function.

The real requirement is to design a building that will inhibit change of function least, and not one that will fit specific function best.'

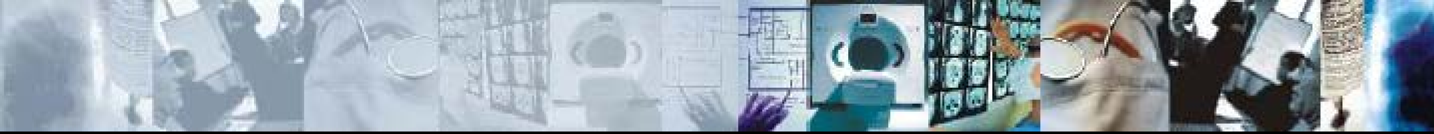




Northwick Park, London… a hospital street



Central circulation spine with planned modular growth

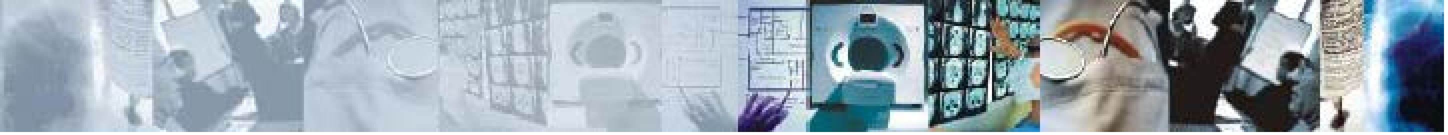


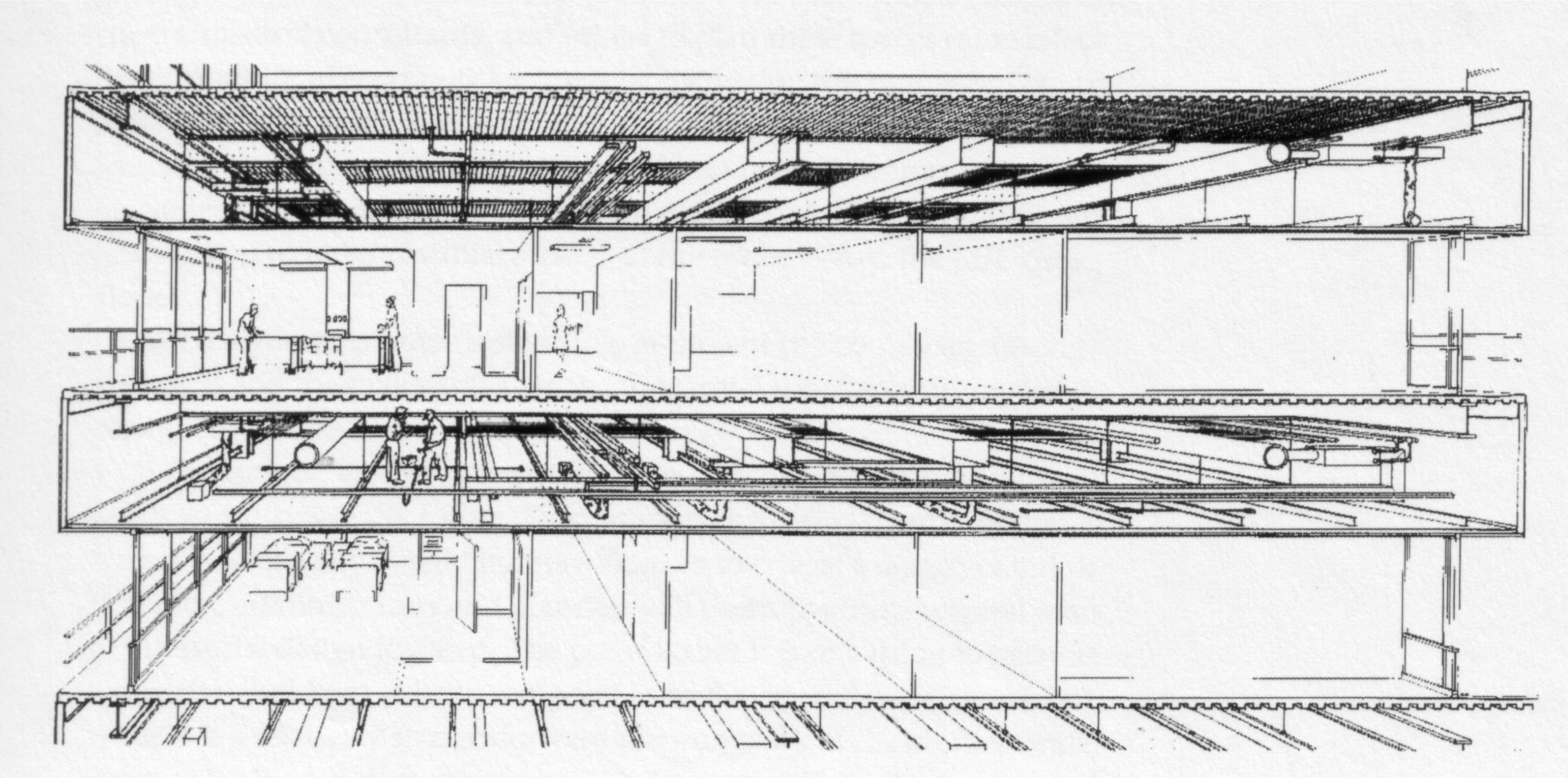
This design concept proved very influential.

However, the hospital sprawled over a great deal of land.

Then what could be done on urban sites where land was at a premium?

An answer to this was the concept of ‘universal space’: that is, a series of structurally uninterrupted floors, to which any services such as electricity, gas, water, could be brought from above, and from which all wastes could be taken from below.

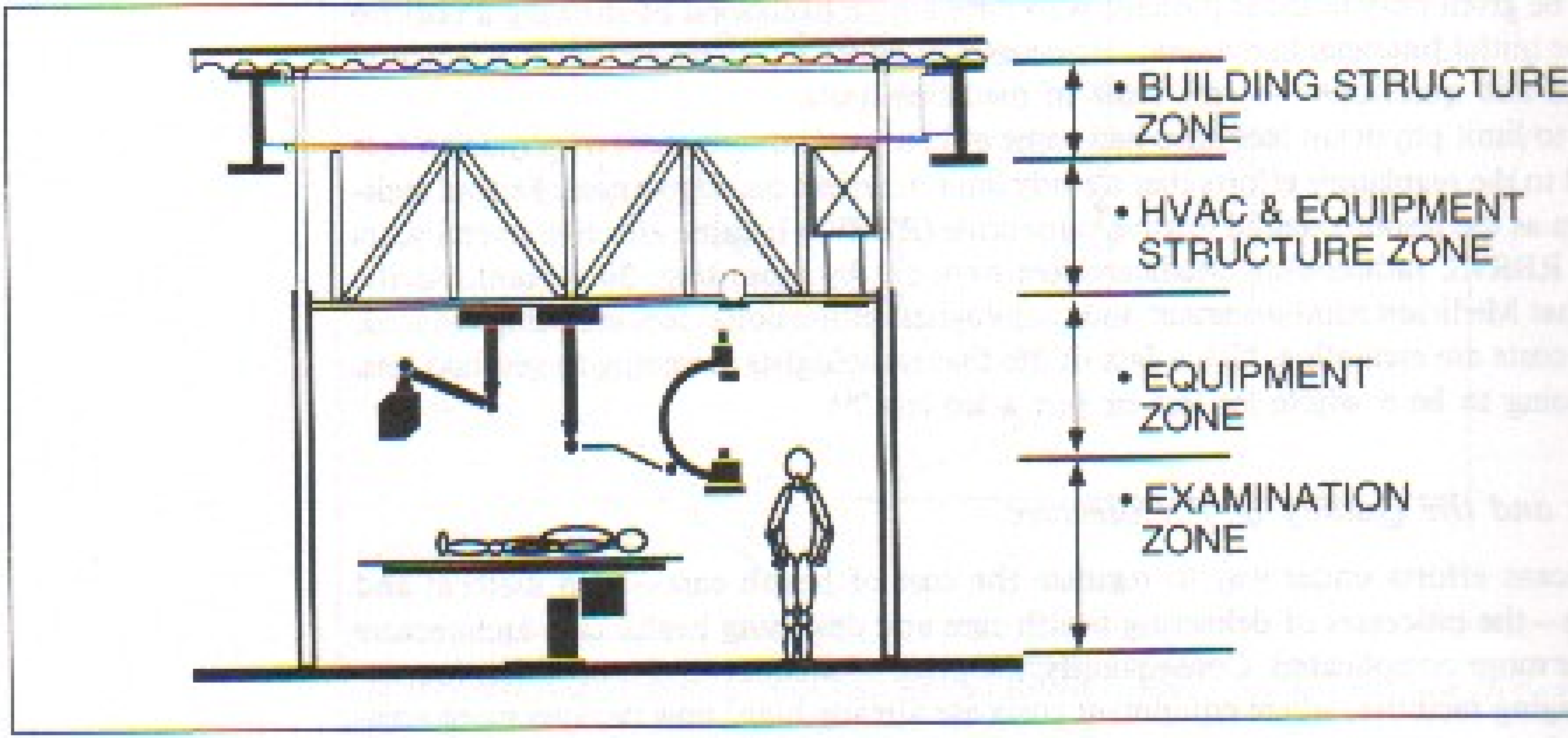


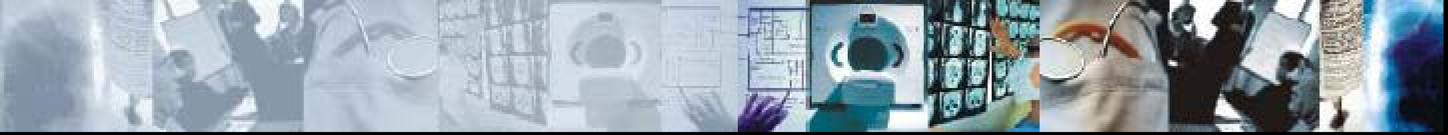


Greenwich Hospital – Section showing 'interstitial spaces'

Section showing various vertical zones

Figure 2-5. Section through an Imaging Room





Integrated Building Systems

The objectives of this system include:

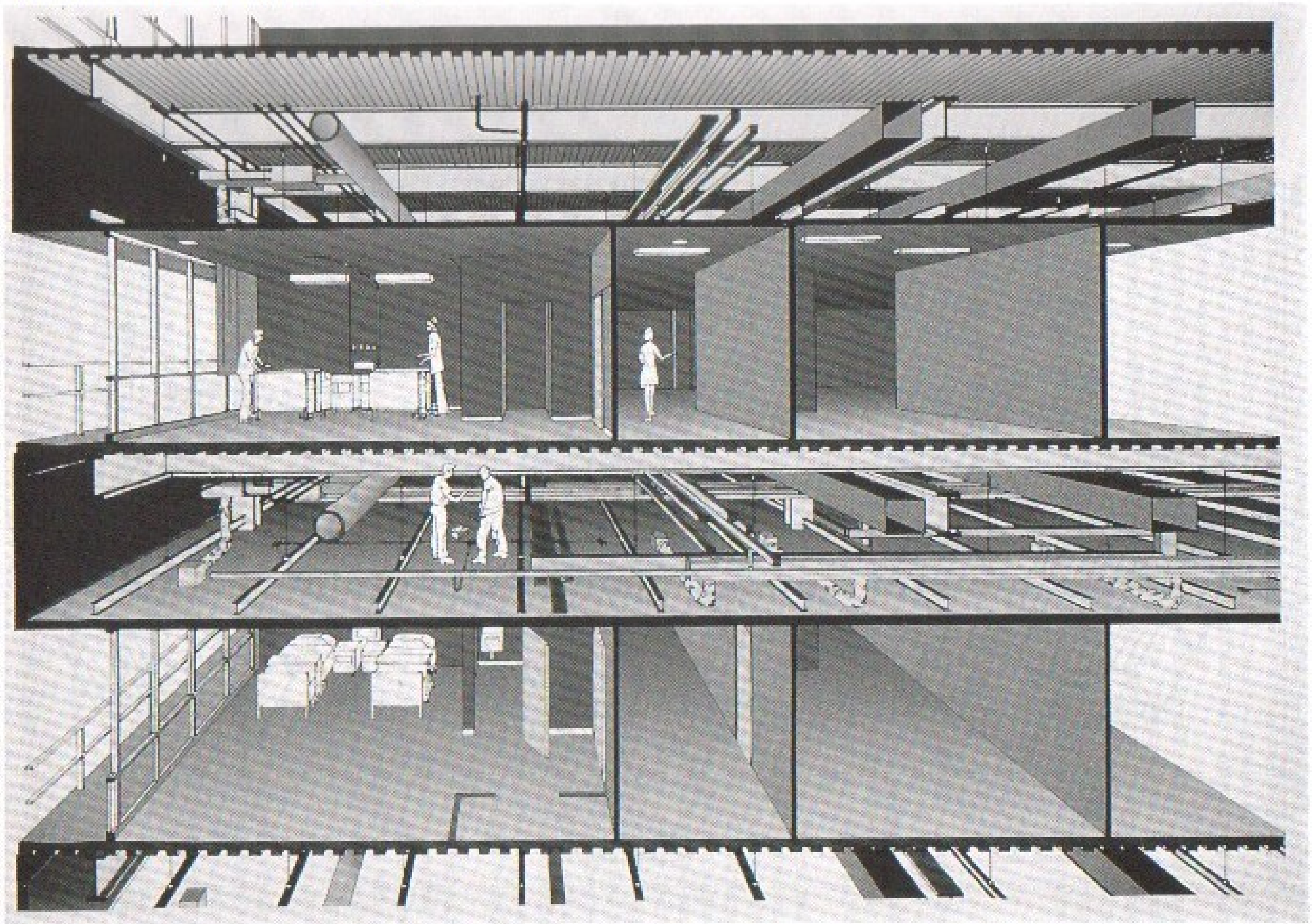
1. Ease of construction
2. Ease of maintenance
3. Ease of facility modification

The concept utilizes a series of three-dimensional modules, where each module is organized into three distinct zones:

1. Functional zone
2. Service zone
3. Service Bay

Section thru' an Integrated Building System facility

Figure 8-13. Section through an IBS Facility



Courtesy of Stone Marraccini Patterson, San Francisco. Used with permission.

Conventional methods in deep truss spaces

Spaces are still congested and disorganized by the structural system-catwalks provide limited access for installation and maintenance

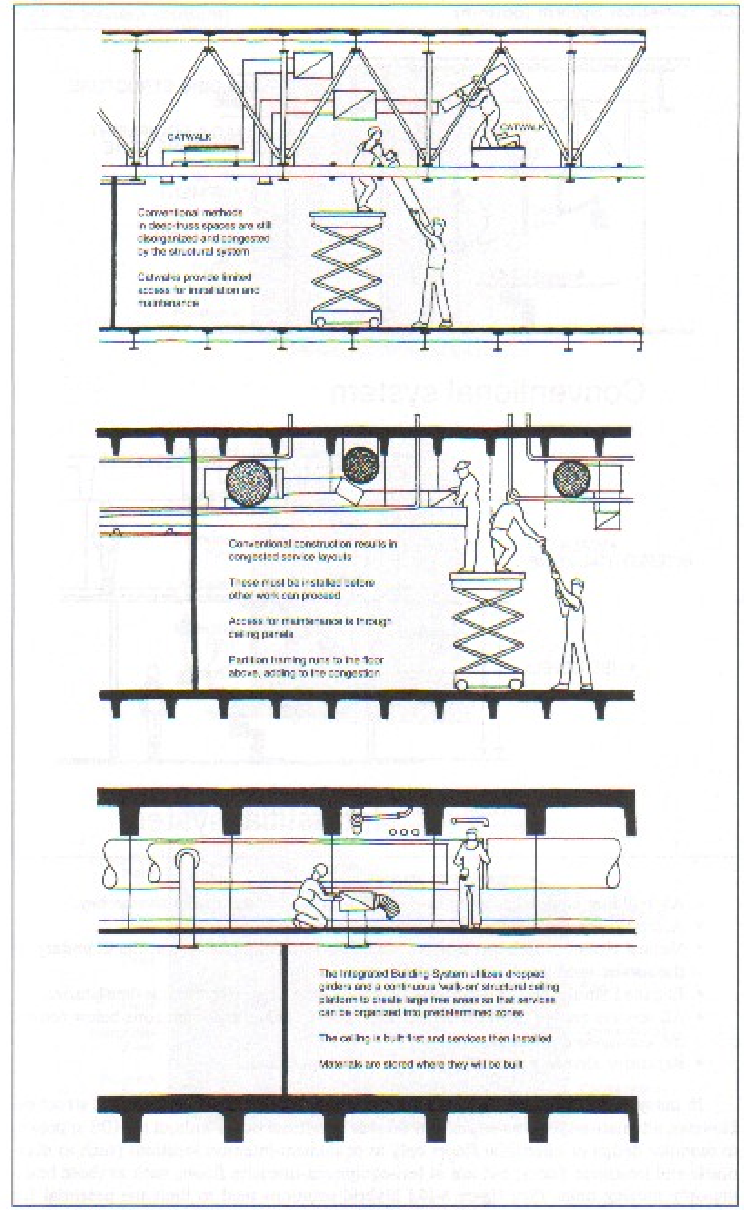
Conventional Construction

Congested service layouts-difficult access for maintenance-partitions run floor to floor-needs early installation

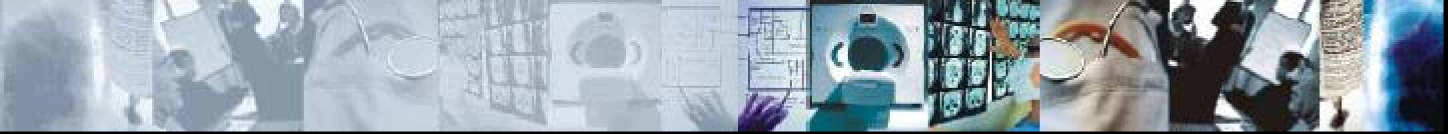
Integrated Building System

Utilizes dropped girders and continuous walk-on structural ceiling platform-ceiling is built, then services installed-materials are stored where they will be built.

Figure 8-14. Section through Interstitial Space Showing Utility Zones



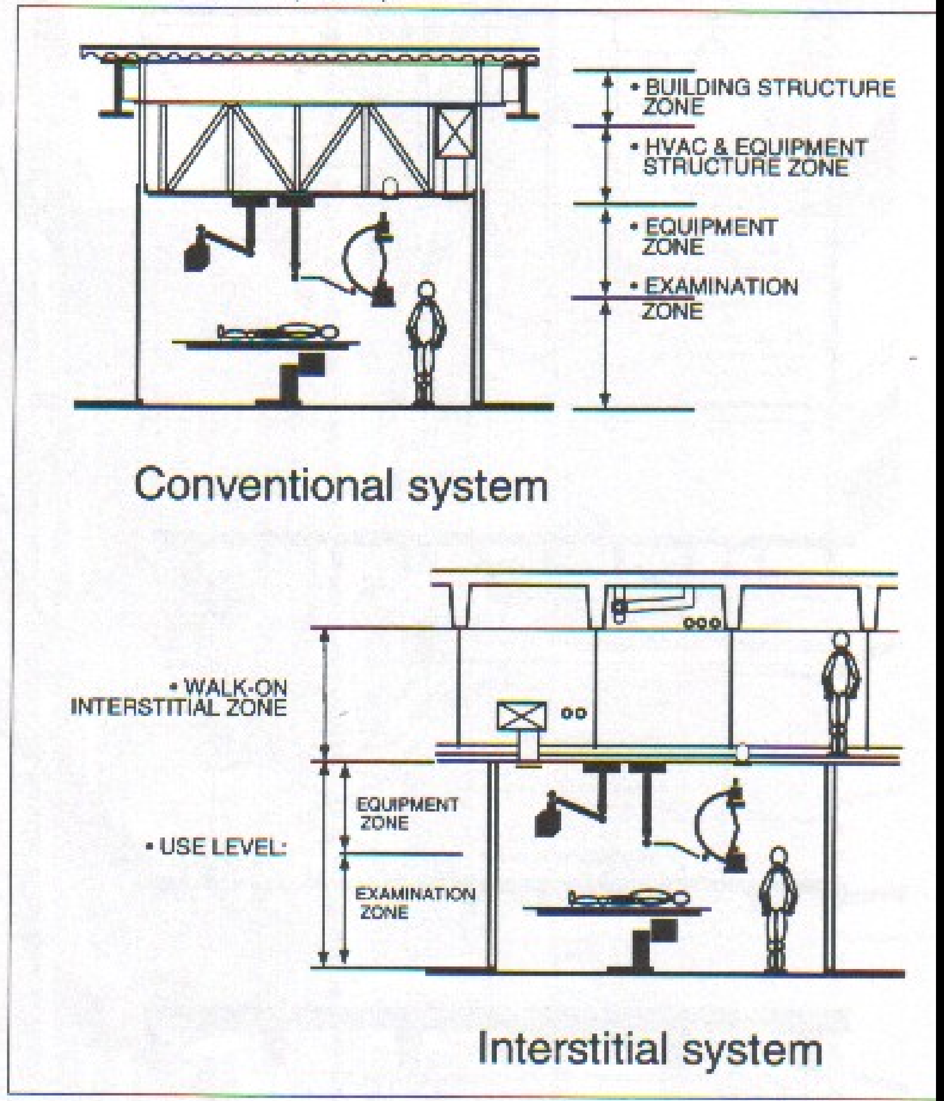
Courtesy of Stone Marraccini Patterson, San Francisco. Used with permission.

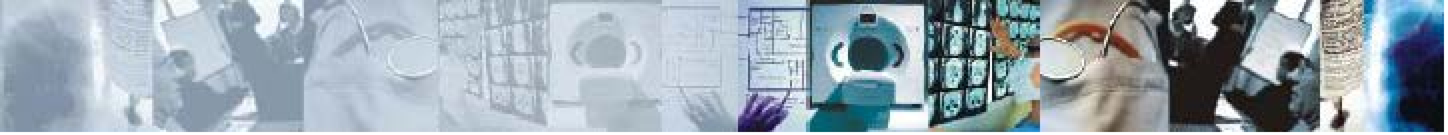


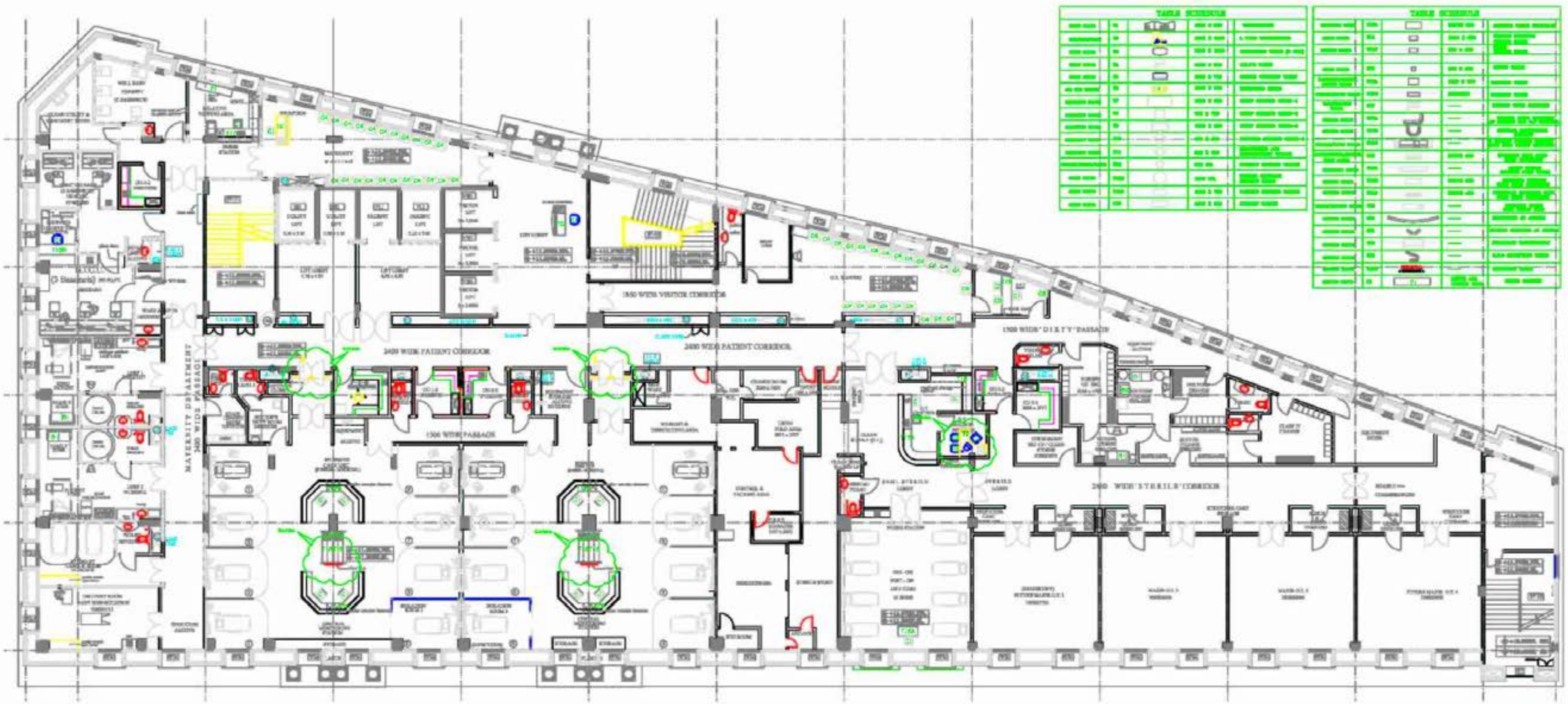
Conventional System

Interstitial System

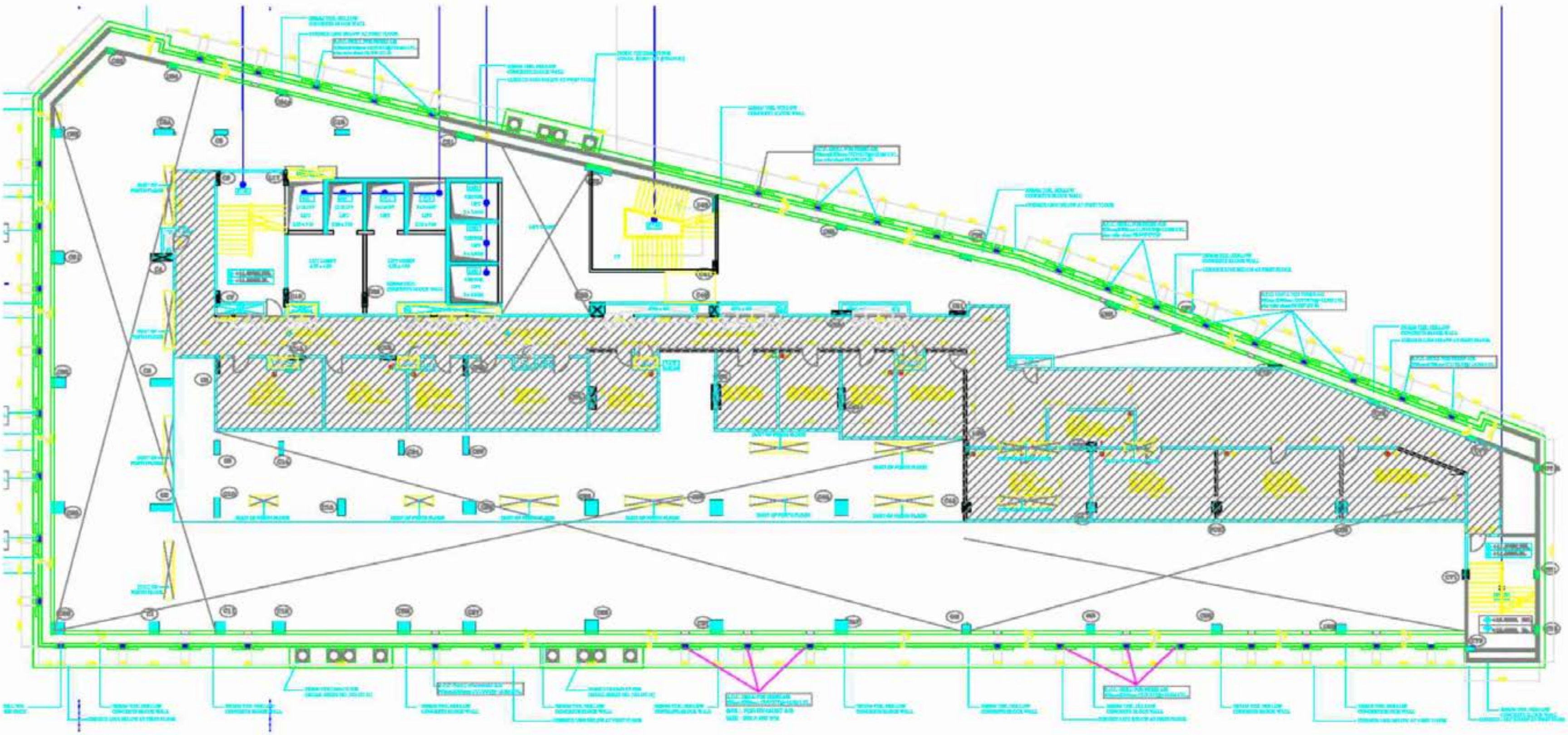
Figure 8-15. Sections through Imaging Rooms: Conventional System (top) and Interstitial System (bottom)



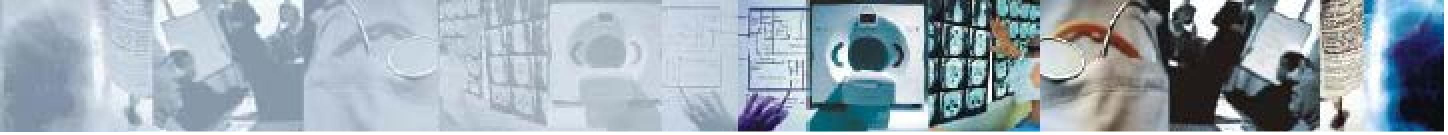


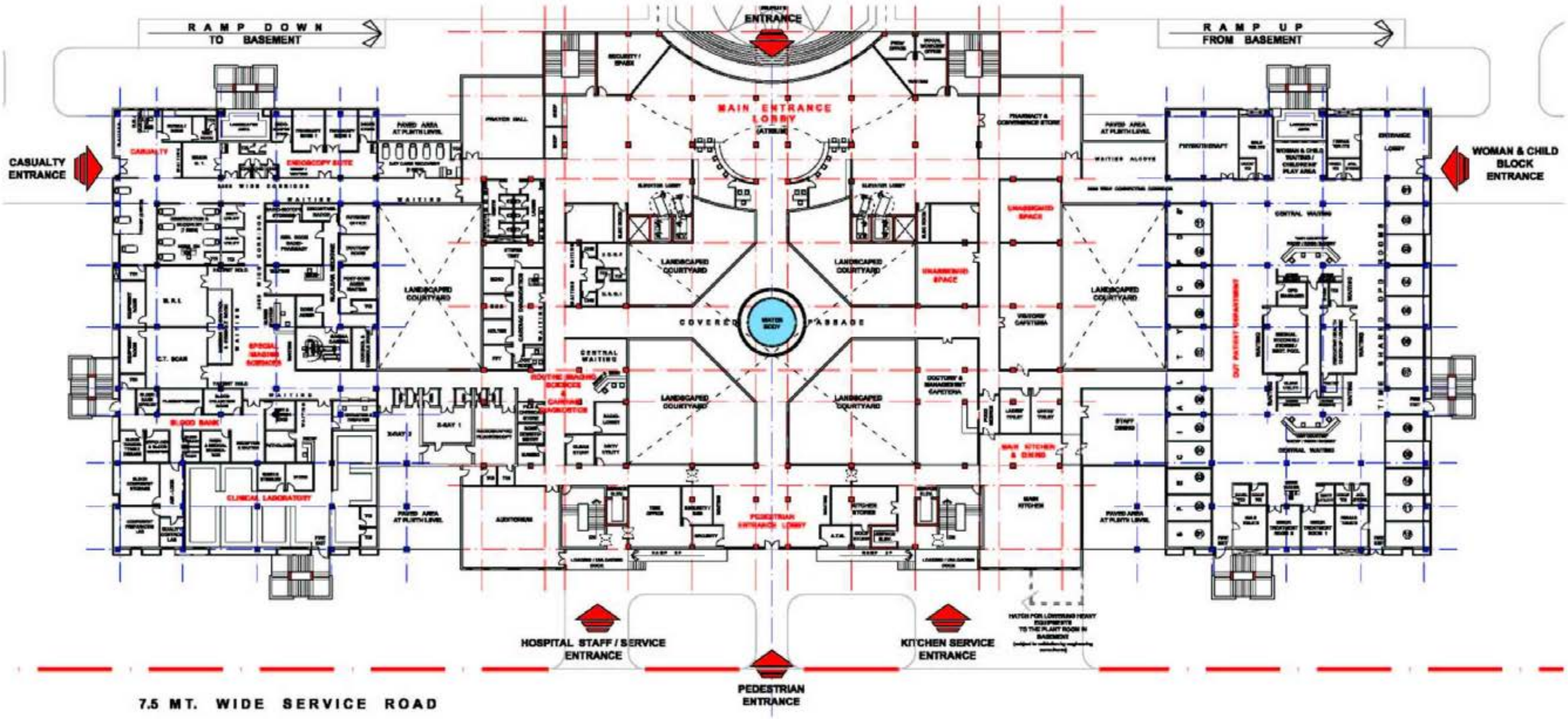


The OT and ICU floor of Hiranandani Hospital…a building services intensive floor.

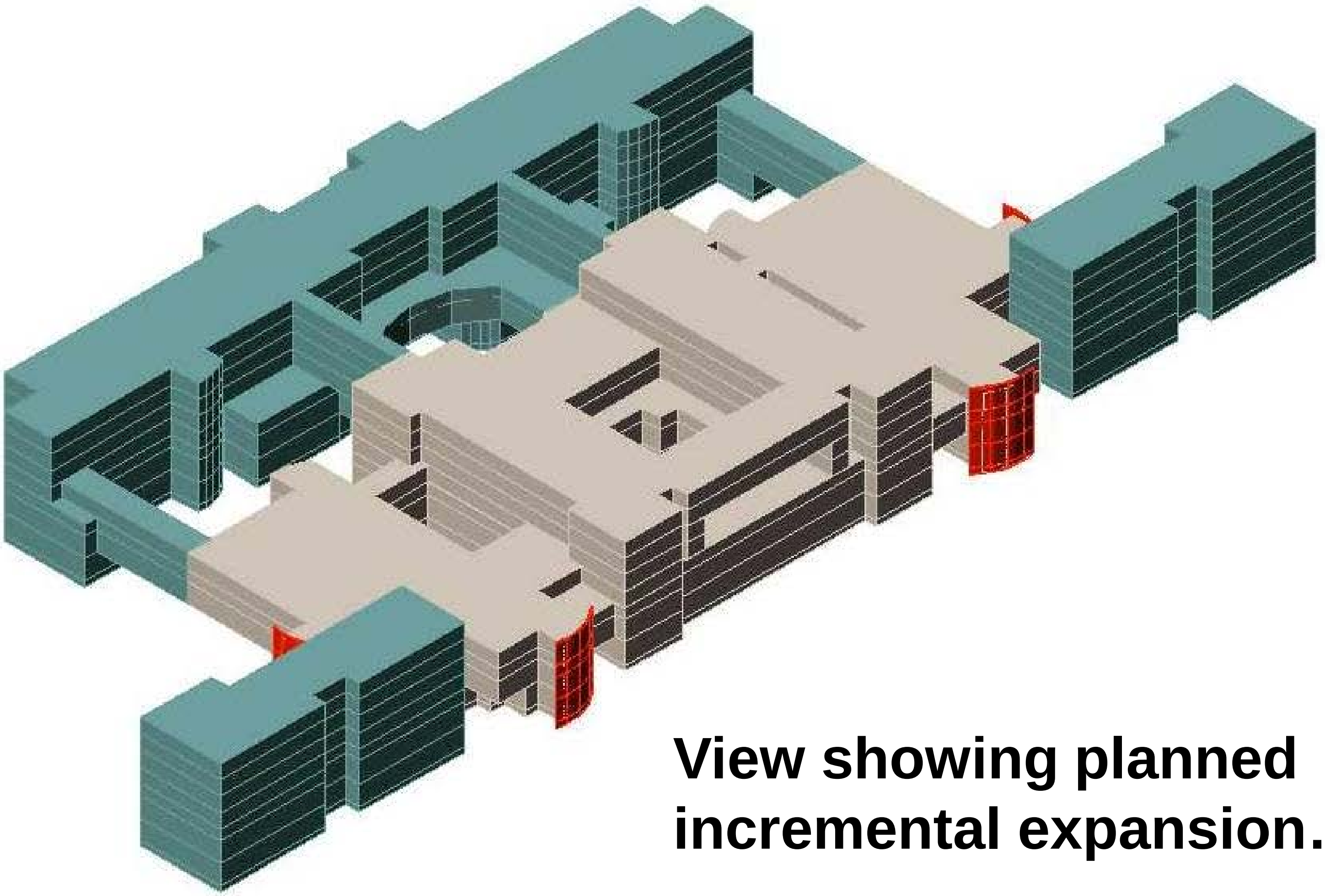


Provision of partial interstitial floors over areas where a lower ceiling height is acceptable…

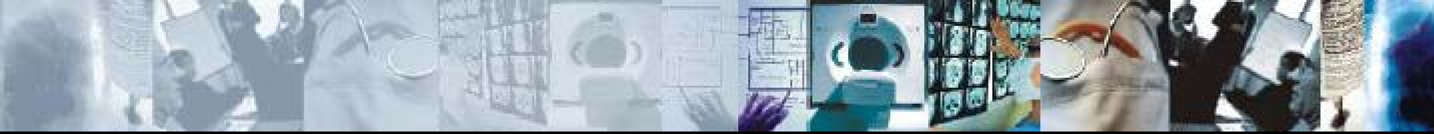




The importance of the planning grid as a design constraint affecting layout and flexibility…



View showing planned incremental expansion…



This approach makes an important point.

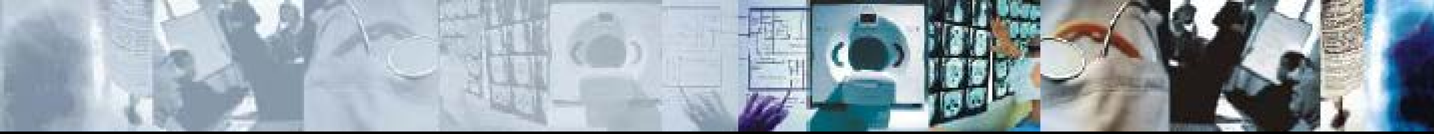
Making a building that is adaptable to changing requirements is

largely an issue of providing the necessary building services

required by the changing requirements at the desired point in the existing building.

In India, with our RCC column and beam method of construction, this need impacts the structural system design for the building in that punctures in the slabs may be necessary during this change of function and thus

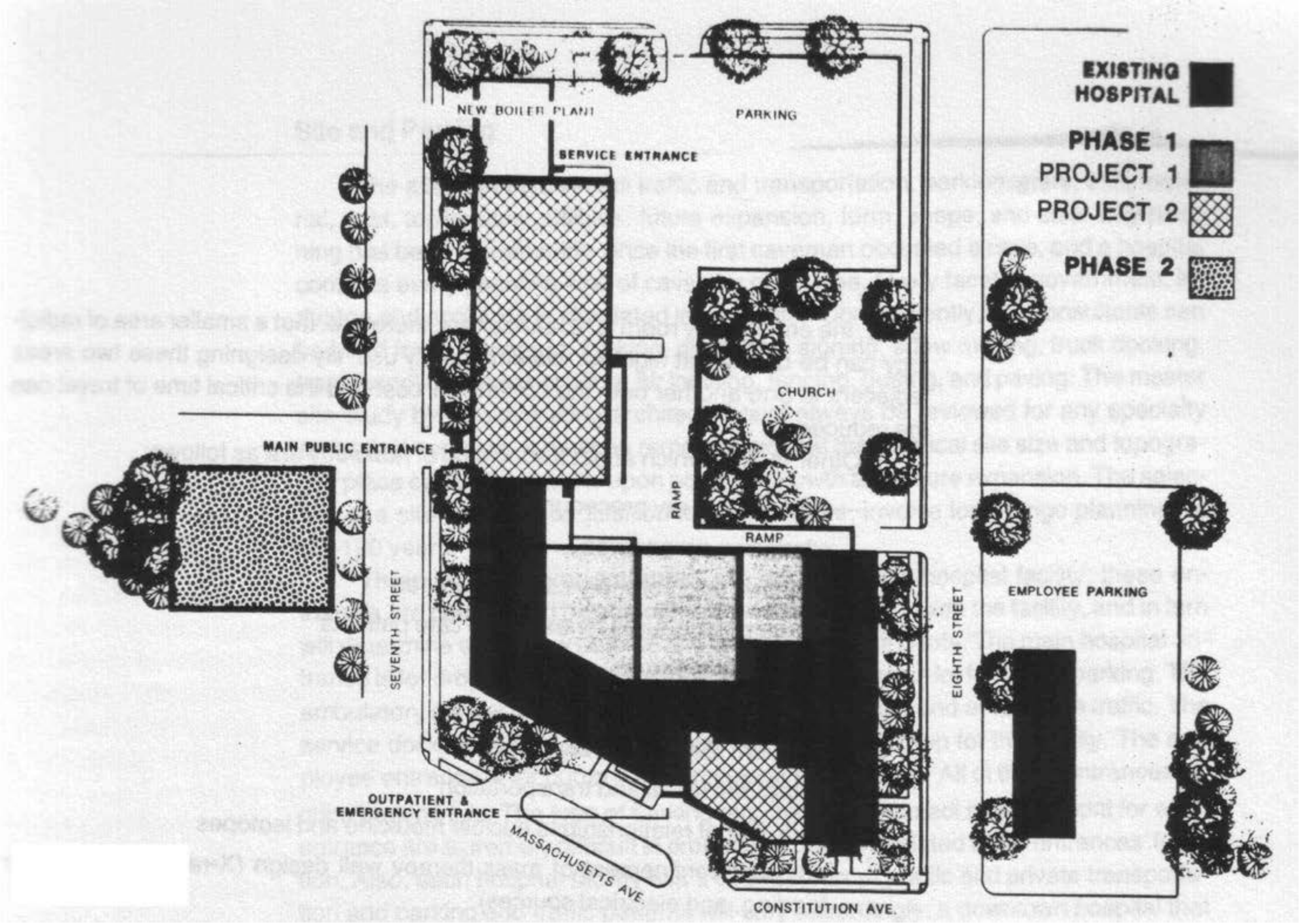
the structural system chosen initially has to cater to that requirement.



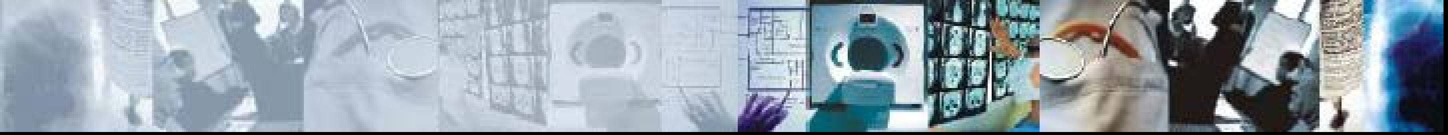
In order to provide for planned expansion it is necessary to develop a master plan that provides for both short - and long - term expansion and change within the hospital and throughout the campus.

The master plan should establish major paths of circulation projected through foreseeable phases of new and renovated buildings.

The design concept should contain within it an overall ordering principle for the entire campus, integrating into the design a building systems framework



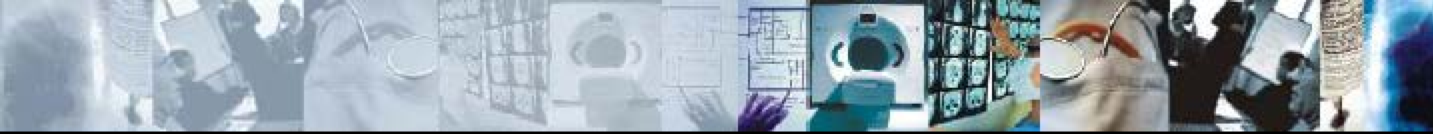
…a master plan that provides for both short and long-term expansion…



- Hospital accreditation by health insurance companies in India being just around the corner
- Changing market demands, new technology replacing the old at an ever-increasing rate of change, advances in the science of medicine and changing patterns of disease
- The fact that many hospitals are built in a number of phases further complicates the problem.

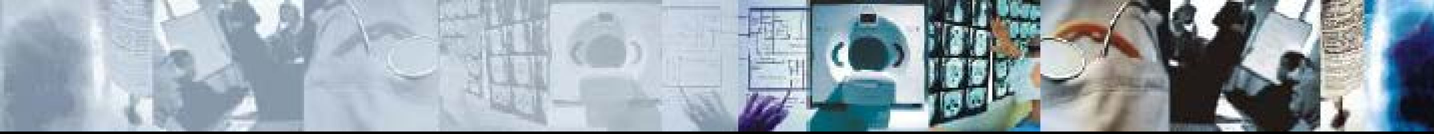
The issue is complex; it involves a multiplicity of design factors that may be making contradictory demands on the designer.

We suggest you consider the various options keeping in mind the needs of future generations to whom you will bequeath your design solution in its built form.



What does this requirement for flexibility augur for the hospitals to be built in the 21st century?

- Buildings will be designed to facilitate the docking of mobile and plug-in modules.
- HVAC systems will be modularized and zoned
- Interstitial concepts may well return as flexibility becomes such a vital consideration that these initial capital costs will become justifiable.
- Other structural strategies that maximize flexibility and adaptability will be used.
- Deliberate specification of “swing” space to allow temporary relocation of departments during renovation
- Some facilities may require the development of “universal floor plans”, which can be adapted – and readapted – to accommodate virtually any need.



The Role of the Architect will itself Change!

The concept of flexibility will extend beyond what the architect designs to the architect him- or herself.

The architect will provide a range of services beyond the traditional architecture and engineering (A & E) tasks, including strategic business planning, evaluation of lease-versus-build options, financial planning, mechanical and electrical systems evaluation, space planning inventories, furniture inventories, long-range planning and master planning.

Once the building has been completed the architect will remain in contact with the owners for the life of the facility, providing a full range of services on a contractual basis.

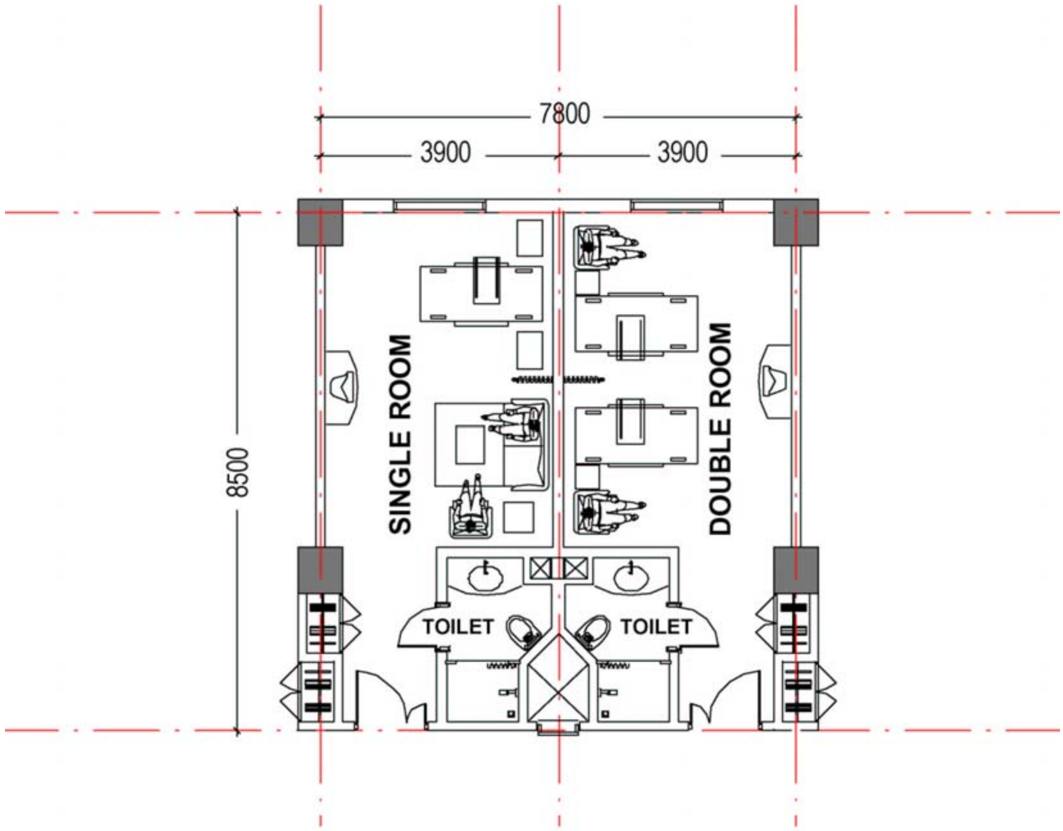
These services will include ongoing evaluation and planning for expansion, contraction and adaptation to changing needs.

A Planning Grid is an overlay of lines usually represented by a 'long dash-dot-long dash-dot' (they need not necessarily be horizontal and vertical, but often are) and is a design tool used by us architects to create some kind of order on what is otherwise a (chaotic) blank white paper when they start to design a building.

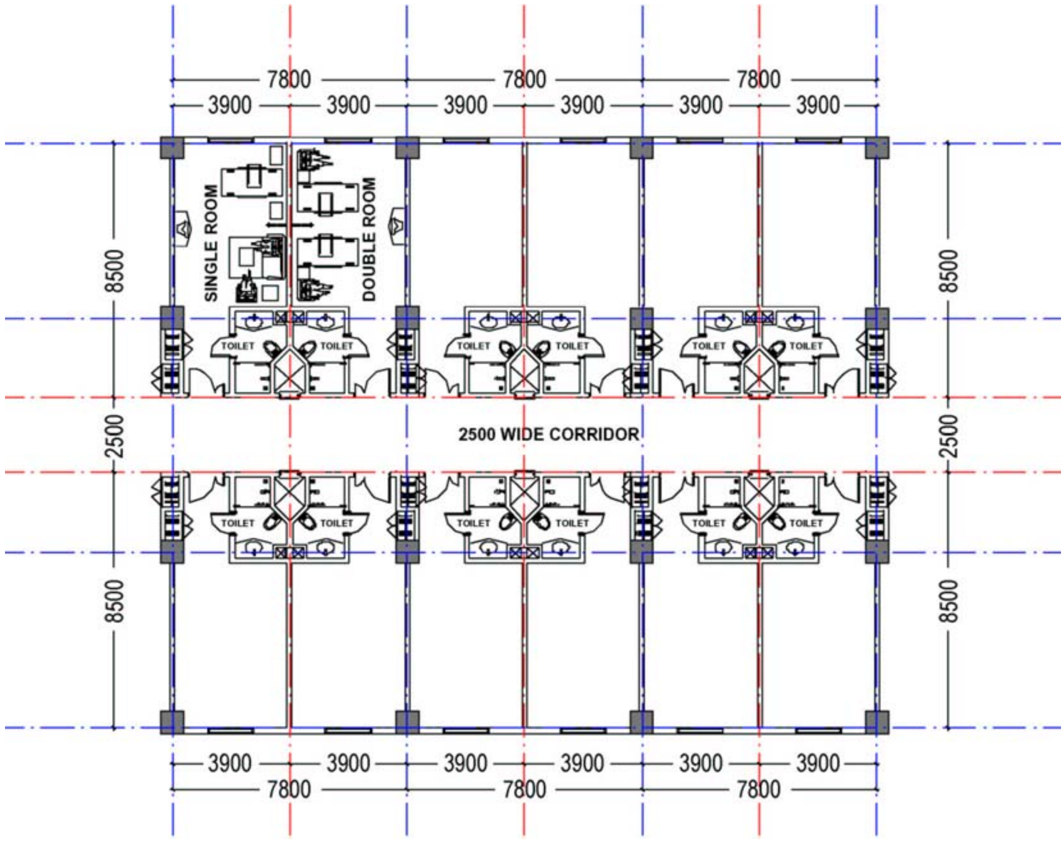
It kind of gives us a handle on which we can hang our hats before rolling up our sleeves, loosening our ties and getting down to some serious work.

Healthcare designers can derive their planning grids in one of the two following ways:

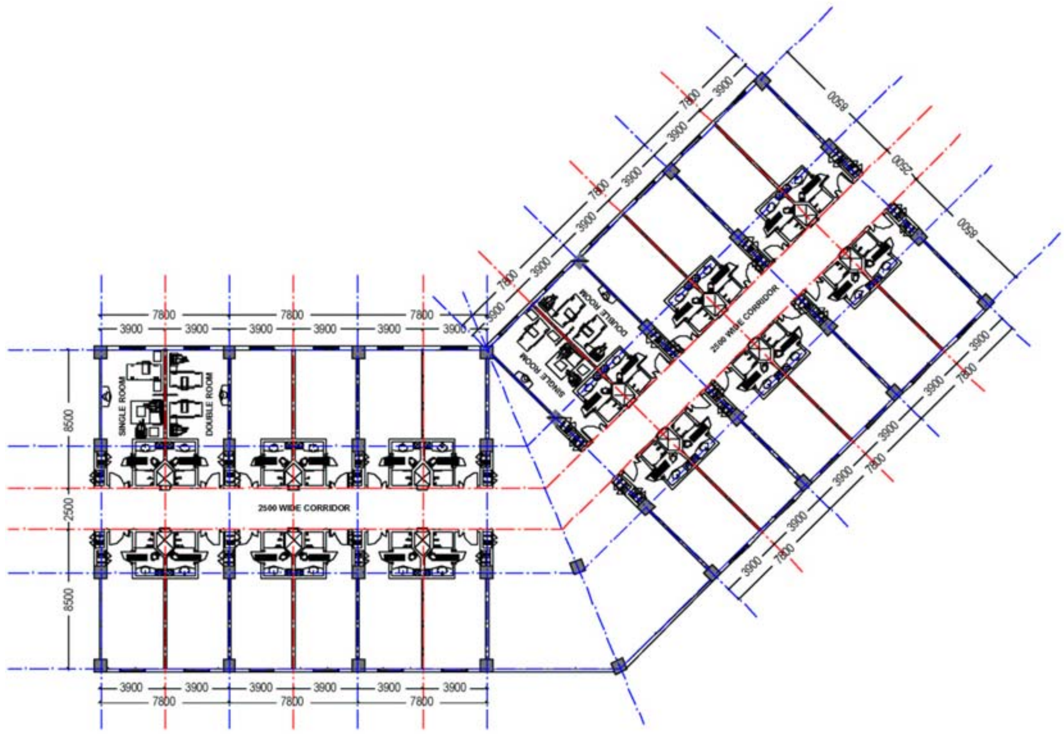
1. In urban situations, where the hospital takes the form of a vertical building comprising of a podium containing diagnostic / therapeutic and interventional services and a tower housing the inpatient facilities, the planning grid is largely determined by the layout of the inpatient tower. The module(s) used to determine the shape and size of this grid is the module(s) used to house the various kinds of inpatient facilities (rooms + toilets) conceptualized by the designer. In the example given below you can see how the planning grid modules (in red) of 3.90 M x 8.50 M is determined by the accommodation desired for a single bed patient room, a double bed patient room and their toilets.



Expanding on this with the addition of the access corridor and stringing the rooms out in a line, as in the plan below, we see how the planning grid starts taking form. Looking more closely at this plan we can see something important has been determined, namely, the positions of the columns that will support the building. We can thus see how the *structural* grid (in blue), the network of lines defining the location of columns, has been derived from the planning grid. The structural grid need not necessarily be the same as the planning grid, but is usually derived from it.



Coming to the next example, we can see that the designer has decided to twist the entire inpatient tower block at an angle to the horizontal / vertical one. This is just one example of how the planning grid could take almost any conceivable shape depending on what the designer wants to do with it. Having said that, we can still see how this twisted planning grid still serves it's purpose of imposing order on a blank chaos, giving the designer a framework within which to design, even the rest of the hospital.



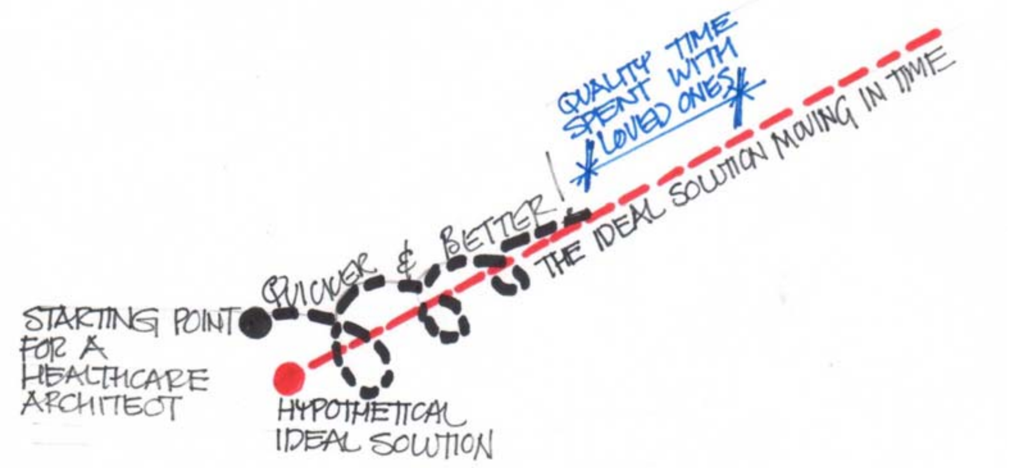
Maybe you don't see that. Well, consider this. The positions of the structural columns determined by this planning grid, twisted or otherwise, will continue downwards through the rest of the hospital, through the lower floors (the podium mentioned above) till their respective foundations, where they will transfer their load to the ground below. Hence the lower floors (the podium), which will contain the Operation Theater Suite, the Radiology and Imaging Sciences Department, the Main Kitchen and the Mechanical Areas in the basement, to name just a few, will all need to be designed within the constraints of these column positions. Extrapolating from here, we can see how the façade of the hospital will need to be designed in harmony with the windows of the inpatient rooms above, which will be designed with the use of the planning grid. Even if the podium extends beyond the footprint of the tower above, it is almost certain that the positions of the additional columns required would be derived from the structural grid used for the tower, which has been derived from the planning grid determined by inpatient facility design.

In vertically organized healthcare facilities, we design from the top (inpatient tower) down (the diagnostic/therapeutic/interventional podium).

Not really. Actually we design in a kind of collapsing spiral with a time dimension. What I mean by this is illustrated in the sketch below.

The design process can be conceptualized as a process that begins at a point in time and space and endeavors to find for its particular problem definition and in its particular circumstances (real world time and money constraints) an (of course, illusory) ideal solution. In the sketch above, let us imagine that the red dot is this "ideal" solution and the black dot is the point in time and space that we begin our search for this solution. The blue dashed line represents our design path in the third 'time' dimension, and the red dashed line represents the movement of the ideal solution in this time dimension. We can see how the designer so to speak 'circles' the ideal solution, thinking about it in its entirety, always coming closer, but fated, however, never to reach that elusive ideal.

I hear the cry from my audience, "There are many correct solutions to any design problem! What is this talk of ideal solutions? Design blasphemy!" To this valid criticism I reply can we not imagine a cluster or range of "good" or even "acceptable" solutions grouped around this" ideal" one. The diagram still describes how we search for them (or should, at least!) Let me give you an example. Let us assume the design search is on for a healthcare facility, and the above diagram represents the way you would search for it before you have participated in this workshop. Let's draw another diagram, as below, to describe the path you would take after this workshop. Can we see how you have started your search closer to the solution you are looking for and take less time to zero in on it? If we can see this by means of these two diagrams then they are surely representative of some aspects of the design process. I invite you to invent your own diagrams to illustrate other aspects and share them with us.



Getting back to the business of planning grids in healthcare facility design, below we have the second way in which we can determine these planning grids.

2. In semi-urban or rural situations, where the land available is very likely to be larger with respect to the built-up area desired, determining the planning grid is another ballgame, one with much greater flexibility in the rules.

   In this situation, the planning grid will be determined by what designers call as their ‘concept’ for the hospital. This ‘concept’ is also an ordering tool, and will have been used to determine the form of the hospital in even the previous example of the urban site, but with less freedom. When there is a lot of land available, it gives the architect more elbowroom, and his hand is likely to move with more (hopefully graceful) abandon. This freedom enables many different types of building layout and form. These are discussed in detail in a following lecture titled: Alternative Building Forms and Massing: Pro’s & Con’s – Horizontal or Vertical?

   Referring to the wisdom of Merriam-Webster Collegiate, my dictionary of choice for almost the past 25 years, we find concept defined as: “something conceived in the mind: THOUGHT, NOTION.”

   This is not very helpful to us as architects have a lot of things in their minds and sifting through them will be a long and possibly not very informative experience.

   Another word designer’s use for ‘concept’ is ‘parti’. The closest Merriam-Webster gets to this is ‘parting’ which it defines as: “a place or point where a division or separation occurs.”

   Actually, this definition may be of more use in understanding how ‘concepts’ and therefore our planning grids originate in these situations of design freedom that designers crave but rarely get. The thought process behind design can be described as a process of analysis and synthesis or divergent and convergent thinking. Or as a ‘parting’ followed by a ‘meeting’ of thought within their minds. At the point of separation, the designer throws up a whole lot of different ways in which he could define an ordering principle that he would use to design the hospital. These ‘concepts’ will be discussed in more detail in a following lecture titled: “Design Concepts: Should Form always follow Function? Suffice it to say for now that based on his / her chosen criteria the architect will (converge) select one or a combination of concepts to provide the ordering principle.

The focus of our discussion here, the ‘planning grid’, in this situation gets relegated to an almost incidental design tool, subject to great local variation if the structure is single storied, and might vary substantially even if the hospital is partially high rise and partially low rise, as the two forms of building could have planning grids independent of each other. Façade design might also vary greatly, there being less discipline to be followed.

Different parts of the hospital may have different planning grids derived from the functional planning requirements of the hospital departments they house.

(Now why couldn’t I have told you this right at the beginning? Don’t tell anyone, but I’m just a hack who gets paid by the word!)

Of course, certain spaces in the hospital may be designed without using any geometrical planning grid at all. In practice, however, you will find such spaces are few among the totality of spaces that comprise the hospital, and are usually those in which the activities have little to do with the field of medical technology or do not house patients who are ill. These areas are usually ancillary facilities such as auditoriums, entrance lobbies or spaces in which patients are recuperating after treatment.

Healthcare facilities often present a complex and challenging proposition to designers engaged in other types of architectural design projects. Thus any means of imposing some “order on the problem” or limiting your options in a meaningful way is not to be sneezed at. The key word there was “meaningful”. To impose arbitrary constraints is meaningless, though it will also make life easier for you. That is just avoiding the issue and moving the job along when it may well have stalled in the studio. It is better then to collect all the design sketches, crumple them up and throw them away, send the staff home early, go home and put your feet up, listen to the music that turns you on till midnight, then crash out and get up in the morning to the beauty and awesome potential of the sun rising on a new day. It will be a beautiful day, you just have to live your life to its fullest, and the healthcare design solutions will flow.

But finding good planning grids might help that flow along just a little bit. Don’t knock it until you’ve tried it.

Circulation: A Critical Issue-Conceptual Clarity, Ease of Wayfinding & Disability Needs

Lecture Series 2004

'Circulation' is defined by our now familiar Merriam-Webster's Collegiate dictionary as: "orderly movement through a circuit; *esp:* the movement of blood through the vessels of the body influenced by the pumping action of the heart."

So we have our medical analogy, though a hospital is often compared to a small city, I've never heard or read a comparison to the human body. We do, however speak of the 'pulse' of a city, and it's 'major arteries'. But we are wandering; let us get back on track.

In the above definition, 'orderly movement through a circuit', the word we should pick up and focus on is 'orderly'. It implies purpose, and purpose implies design. We are going to talk about the importance of the design of circulation in a healthcare facility.

Hospitals, like the small cities they are likened to, contain main circulation routes often described as hospital streets. The way in which the different parts of the hospital are assembled, as a coherent whole but with the parts differentiated, make for analogies with urban design; the way in which traffic moves, and the routes that are taken by mechanical and electrical services are fundamental generators of the plan.

In a vertically stacked hospital, which could also be called a functionally stratified hospital, almost always the inpatient areas are placed on the upper floors, to allow for a more pleasant, naturally lit environment. As we read in an earlier lecture (entitled "The Planning Grid"), the planning grid is determined by the layout of these inpatient floors. Another important planning feature, the vertical circulation core, is also to some extent located within the building by the layout of the inpatient floors. We somewhat simplistically claimed in that earlier lecture that in vertically organized hospitals we design "from the top down." What we actually do is during the layout of the inpatient floors, we provisionally decide on a position for the vertical circulation core and other staircases that may be required, many times by the local building codes. This location, however, is to be checked for it's design impact on the lower floors containing the diagnostic / therapeutic / interventional departments. This 'checking' process is described by the diagram of the design process presented in the self-same earlier lecture.

The pattern of circulation conceptualized for the hospital under design will be considerably impacted by the location(s) of the vertical circulation core(s).

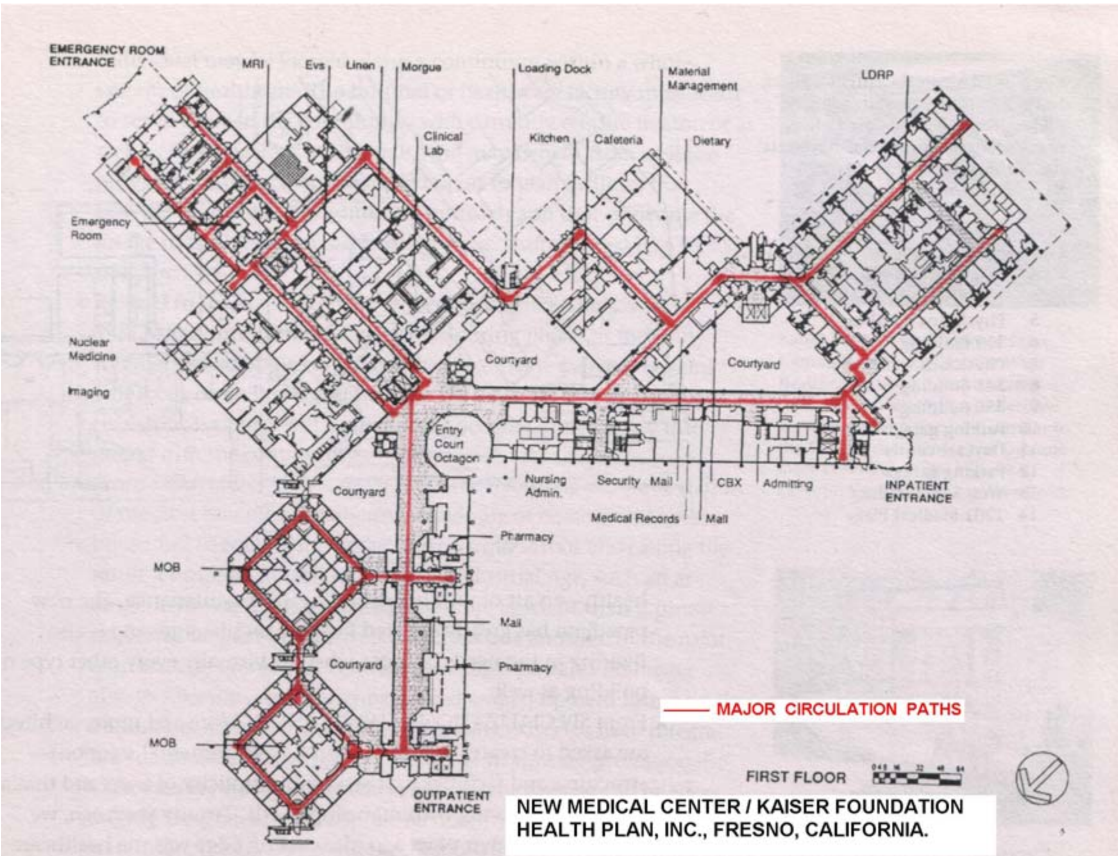
It's something like all roads leading to Rome(s). The vertical circulation core is the center, the focus of all the major circulation paths of the hospital. An attempt can be made through design to minimize vertical transportation by siting (for example) all surgical beds, operating theatres and the intensive care unit on the same floor. This design approach may be used as a justification to reduce the number of elevators, or the width of the staircases, but in no way does this mean that the core can be located more casually by the designer.

Avoidance of dependence on lifts is particularly important in places where maintenance and availability of spare parts is unreliable; long waits for lifts are a major cause of inefficiency and frustration to hospital users – more of a problem the taller the building is.

It is important that patients, visitors and staff be able to orient themselves while moving through the hospital by providing windows in corridors to enable them to look out and to allow natural light in, important in alleviating the tedium of long corridors. If the site enables them, courtyards are also an excellent means to this end.

As such there is no easily available prescription for the way the circulation pattern for a healthcare facility should be. The qualities it should possess, however, I will try to enumerate:

1. It should have conceptual clarity. By this I mean it should be designed with purpose, and should not be leftover space or squeezed into the gaps between other areas. Geometry can be a recourse, but it should work with other planning imperatives, and junctions should be uniquely treated to avoid confusion over which corner of the hexagon (for example) you have reached.
2. It should not be boring. Try to make walking from one place to another interesting, modulate those corridors, color them differently, hang artwork along the way. Niches, outside views, courtyards, all these will help.
3. It should enable wayfinding. In combination with well-designed signage and maybe supergraphics, people should be able to find their way to their destination with ease. Color-coding for floors or departments is sometimes used.
4. They should be wide enough to handle anticipated traffic. Stretcher traffic needs 8'-0" width of corridor for easy movement (turning). 7'-0" will work, but use 8'-0" if you can. Corridors between Operation Theaters make sense even with 10'-0" width. There may be a lot of stuff parked along the sides, despite instructions to OT staff to the contrary.
5. They should be indirectly lit. Patients on stretchers get to look at the ceilings. The sign put up by the traffic police at the end of Marine Drive in Mumbai says, "Drive carefully. Hospital ceilings are boring." While not advocating rash driving, we would advocate making the ceilings interesting.



NEW MEDICAL CENTER / KAISER FOUNDATION HEALTH PLAN, INC., FRESNO, CALIFORNIA.

Some of the hospitals currently existing in India have been provided with ramps in addition to the usual elevators and stairs. Power cuts are realities that have to be considered. But consider putting some (two) of the elevators on a generator, if this helps in avoiding the ramp, which is wasteful of space and difficult to use, as the gradient is often excessive. (With an acceptable gradient, the length becomes excessive, considering that the lower floors of hospitals are considerably higher than those of the usual non-hospital building.)

When planning for the area occupied by this circulation space (corridors) in the architectural space plan, it can be provided for as a percentage of the department area (usable, built-up area). This percentage will vary depending on the department and may also vary if the architect has any special feature in mind for that department which is not explicitly provided for in the room-by-room area statement (such as semi-covered, landscaped waiting). The percentage can vary from 35% for an Operation Theater Suite (with 8'-0" corridors) to 20 – 25% for the Administration Department.

On the Inpatient floors or even in the Outpatient Department, these corridors can be modulated by recessing pairs of doors that occur at regular intervals, and using an accent color in the niche so created. This helps relieve the boredom of walking through long, uninteresting corridors.

Very frequently the major circulation paths through the hospital are laid out even before the tentative space allocation for the hospital departments is done. Thus, the importance of conceptualizing these paths in a way that they contribute to the concept and functional layout of the hospital is not to be underestimated, the exercise should not be done casually.

Frequently the manner in which the healthcare architect conceptualizes the working (and therefore layout) of certain hospital departments, notably the Operation Theater Suite and the Radiology & Imaging Sciences Department (as described in a later lecture titled "The Architecture of Imaging") will determine the circulation pattern through that department, and hence affect the layout of circulation paths in contiguous areas of the hospital.

Frequently you will find that in the areas below the footprint of the inpatient tower in the podium, you end up using the same corridors that you used in the inpatient floors. (At least I find myself doing this quite often. There must be a good reason for this, I hope there is! Beats me if I can think of it though. Maybe you can think of one.) (Taking the easy way out? Aaaaahh…lets keep it within the profession!)

The funda is:

Defining major circulation paths through the proposed and future buildings is a design decision that will considerably impact the form, layout and thus the eventual functioning of the healthcare facility being designed. Do it thoughtfully and with conceptual clarity.

Special Considerations for Designing for the Disabled

Identifying and understanding the conditions which constitute barriers to those with a disability (this category includes, besides the wheelchair bound, those who for any reason have difficulty in walking, and also those with a sensory – that is, visual or hearing – impairment) is a fundamental requirement for the effective provision of accommodation and facilities to be used by disabled people.

If the needs of people who have temporary or permanent disabilities are taken into consideration, the resulting design can make the design easier and safer to use for those with children, those using wheeled equipment and those carrying other items. The principle of applying critical criteria should be used – for example, where space is a consideration, wheelchairs or other larger wheeled items need to be considered; for vertical fixtures or fittings, the shorter person and wheelchair user must be considered; and for wayfinding those with visual and hearing impairments must be considered. The resulting design will help not only people who are ill or disabled but also those who are suffering from shock or stress, as many users of health buildings are. Building design that gives consideration to all users will also be easier and safer during an emergency evacuation.

The best design philosophy is to consider the journey through the healthcare facility from start to finish, analyzing all the related components of the task (negotiating entrances, corridors, lifts, reception areas, toilets, etc) to ensure that the features, equipment and fittings encountered in completing the journey are suitably designed so that the overall task can be completed easily and conveniently, bearing in mind the different requirements of staff, patients and visitors with varying degrees of functional mobility. In this way building users will be more independent (less reliant upon staff) and consequently less stressed, anxious and frustrated.

People with disabilities can be defined as those who, as a consequence of an impairment, may be restricted or inconvenienced in their access to, and use of, buildings because of the physical barriers – such as doors that are too narrow, flights of steps, or unsuitable facilities (for example inadequate lighting, or lack of handrails on staircases or grabrails in toilets.) Some people will be temporarily disabled as a result of their need for hospital treatment.

The following categories of building user are generally recognized:

1. **Fully-ambulant**: persons who are fully physically capable of carrying out all activities necessary to their role or function.

2. **Semi-ambulant**: persons who walk with difficulty or are otherwise insecure, as a result of a temporary or permanent impairment of the lower limbs. They may walk with or without a walking stick (sticks, crutches, walking-frames, etc) and/or require the assistance of another ambulant person. Some people in this category will, in addition, have reduced strength and dexterity in the upper body and/or a sensory impairment. Semi-ambulant people find it difficult to cover long distances (even 50 M may be too far). Specific design requirements include: short distances; provision of handrails and suitable spaces for taking a rest; and even non-slippery surfaces without any changes in level;

3. **Non-ambulant:** persons who temporarily or permanently require to use a wheelchair for mobility. They may propel themselves, or be pushed and maneuvered by an assistant who may or may not be needed to assist with other tasks. Some people will be using a wheelchair for the first time due to being in hospital and will be unfamiliar with maneuvering it. Some people who use wheelchairs will, in addition, have reduced strength and dexterity in the upper body and/or may also have sensory impairment. Some will be able to stand on their feet whilst transferring to and from a wheelchair or to and from other facilities (such as a toilet, chair, or bed); others will require assistance to do so (in some cases the use of a hoist). Specific design requirements include the provision of sufficient space for passing and turning; even surfaces without changes in level; and ensuring that any counters, signs, handles, etc are within the user's range of vision and grasp.

4. **Manually-impaired**: persons who have a temporary or permanent lack of strength and/or dexterity in the shoulders, arms and/or hands. They may also be semi-ambulant and/or have a sensory impairment. Specific design requirements include doors which are not too heavy, suitably designed handrails and controls, etc.

5. **Visually-impaired**: persons who are totally blind or partially sighted. Blind people find their way by noticing changes in the textures of floor or wall surfaces and ambient sounds and smells; some also need the help of a cane for orientation and detecting obstacles. Partially-sighted people need plenty of light and the colors of any fixtures or fittings they are trying to locate (or are on their guard against) must stand out plainly in contrast to the background. It must be remembered that vision deteriorates considerably with age. 40-year-olds need twice as much light and 60-year-olds three times as much light to see the

same object as clearly as a 20-year old. The more strongly an object contrasts with its surroundings, the easier it is to see. However, colors do not have to be garish; subtle changes in color can be aesthetically pleasing, and can fit in with the general décor as well as providing contrast. Different colors in the same tone can appear very similar to people who are color-blind – for example, a strong red and green together can look much the same – and so, contrasting tones, or a combination of tone and color, are very helpful for people with poor sight. Any type of cluttered design should be avoided, for this makes it more difficult for a visually-impaired person to "read" the shape of a space, and consequently impedes their ability to navigate. Good design therefore should not only contribute towards the legibility of a building, but also facilitate easy navigation through it. Specific design requirements include: a simple, well-planned layout even surfaces with tactile indications of direction; no obstructions in walking areas; well-lit areas; signs placed at a convenient height, with space to stand in front to read them.

6. **Hearing-impaired:** persons who are deaf and hard of hearing have the additional problem that their disability cannot be seen and is therefore not noticed by other people. For effective lip-reading, building areas must be well lit in order that the face of the person speaking is illuminated. Specific design requirements include: a simple, well-planned layout with well-lit areas; surfaces which dampen ambient noise, signs placed at a convenient height, with space to stand in front; provision of induction loops at reception areas and in auditoria.

A check-list giving a suggested sequence of activities to be followed in the planning and design of access and facilities for disabled people is given below:

Healthcare Premises: Checklist of Access and Facilities for Disabled People

Parking:

1. Are there parking spaces adjacent to the buildings to minimize the distances to be traveled?
2. Is the parking spaces wide enough to allow a car door to open fully to allow unobstructed transfer into a wheelchair, either unassisted or assisted?
3. Is the location of the disabled parking spaces such that the approach route to the building / facility is not obstructed by other parked cars and away from moving traffic?
4. Are kerbs and other changes of level ramped?
5. Is the parking space and access route under cover?
6. Are there adequate signs to identify the reserved parking spaces and the best routes into the premises?

Approach to Building:

7. Is the approach route smooth, slip resistant (whether wet or dry), free from incidental obstructions or hazards?
8. Are handrails provided on all slopes and resting places provided at intervals where a ramp or approach is long?
9. Are all public entrances to the building / facility accessible?
10. Are access doors wide enough to facilitate wheelchair movement?
11. Are thresholds eliminated or kept to a minimum?
12. Do door characteristics and dimensions of related spaces allow it to be opened (and closed) easily by independent wheelchair users, moving in either direction?
13. What doors can be eliminated?

Internal Circulation:

14. Are lobby sized adequate and safe for both independent and assisted wheelchair use?
15. Are corridor and approach routes satisfactory? Do they allow passing and turning and take adequate account of corridor traffic conditions?

16. Have all obstructions and projections from walls (or ceiling) or similar hazards at floor level – such as changes of level – been avoided? If unavoidable are they clearly discernible?
17. Are internal door widths adequate to allow turning through 90^0 from the corridor or lobby? Should either of both be increased?
18. Have safety handrails been provided on corridors, ramps, and steps or at other points where they are required by persons with impaired mobility? Have they been produced where they can be used as location aids by visually impaired people?
19. Are any large areas of glass close to circulation areas marked or framed so as to be clearly discernible to partially sighted people?
20. Are seats available at intervals to permit an ambulant disabled and elderly person to take a short rest when faced with long corridors to negotiate?

Vertical Circulation:

21. Are staircases safe and optimally comfortable for elderly and disabled people? Are handrail and landing characteristics satisfactory?
22. Are lifts available, conveniently placed, accessible and clearly signed?
23. Are lift controls accessible to the independent wheelchair user? Are the visual and audible signals, alarms and floor designations satisfactory? Are digits embossed and satisfactory for blind or partially sighted persons? Is there a

Toilets:

24. Are there correctly designed unisex toilets, that are where a husband and wife may enter the cubicle together, available in the public areas of the premises?
25. Are there suitable cubicles for wheelchair users in other male and female toilets in the building?
26. Do cubicles for wheelchair users provide adequate manoeuvring space within, or are turning space provided outside? Is the level of privacy afforded satisfactory?
27. Are there cubicles available with appropriate grab rails for the use of ambulant disabled people?
28. Are the WC and washbasin arrangements accessible to independent wheelchair users? Are the grab rails, mirrors, towels, door closing bars and other aids placed satisfactorily?

Outpatient And Treatment Areas:

29. Can ambulance discharge patients under cover within close proximity to the entrance? Are waiting areas protected from draughts as patients move in and out through the entrance doors? Can patients using wheelchairs (their own or hospital chairs) whilst waiting for treatment, sit with other patients without obstructing the corridors or circulation area?
30. Can patients in wheelchairs use the reception desk conveniently and privately?
31. Are all consulting and treatment areas fully accessible?
32. Are there changing cubicles suitable of wheelchair users, with room for assistance to be given if required?
33. Are refreshment areas accessible to disabled people?
34. Are clear, well lit, signs posted to ensure easy circulation within the building?
35. Are telephones and other public mechanisms accessible to wheelchairs users? Are knobs, dials, switches, handles and other controls operable and within convenient reach?

Ward Facilities:

36. Do sanitary facilities offer maximum independence and privacy to disabled patients, both those who will be using wheelchairs and those who have walking difficulties?
37. Is the day room accessible, with a variety of seating heights to help ambulant disabled people? Are all notices easy to see and understand?
38. Are window controls, radio and television and call bells easily reached by disabled patients?
39. Can disabled visitors conduct private conversations with their friends in bed or in the ward?

Other features:

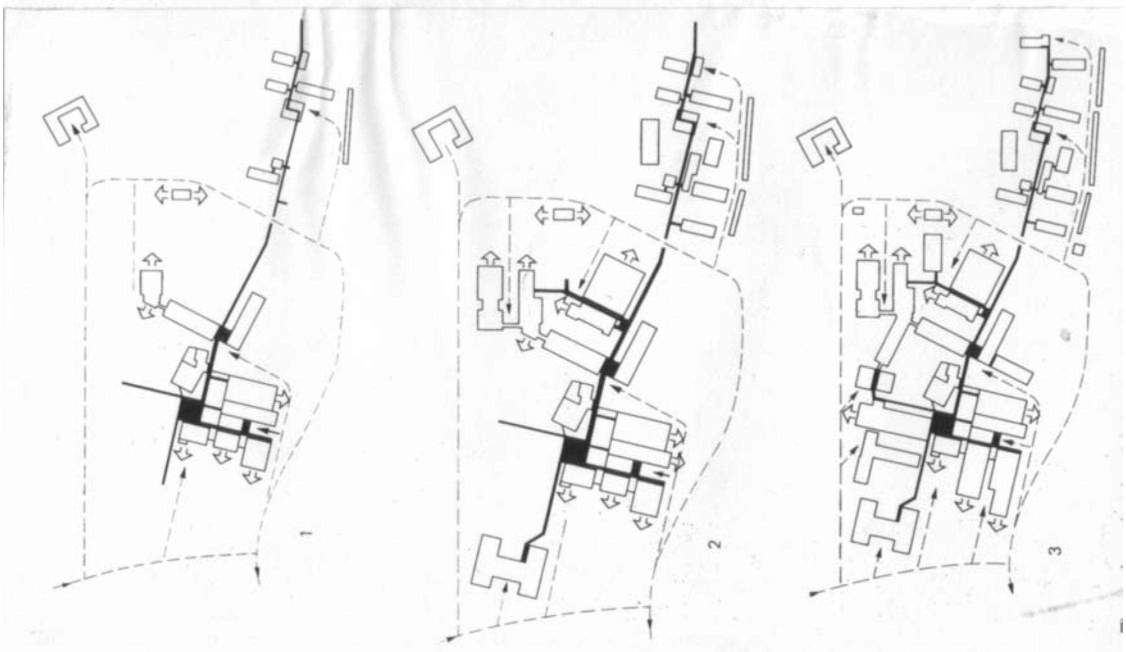
40. Could disabled employees work in the building – with particular reference to offices, laboratories, canteen, rest rooms and toilet facilities?
41. Are emergency evacuation routes and emergency exits satisfactory?
42. Are fire alarms readily accessible to the semi-ambulant and wheelchair disabled? Are emergency call facilities installed to summon assistance to remove locations?
43. Are audiovisual alarm signals provided?

'Flexible' is defined by Merriam-Webster's Collegiate Dictionary as: "Characterized by a ready capacity to adapt to new, different or changing requirements."

Flexibility, as an architectural principle applied to the design of a hospital, would be the inbuilt capacity of that hospital to adapt itself to "new, different or changing requirements."

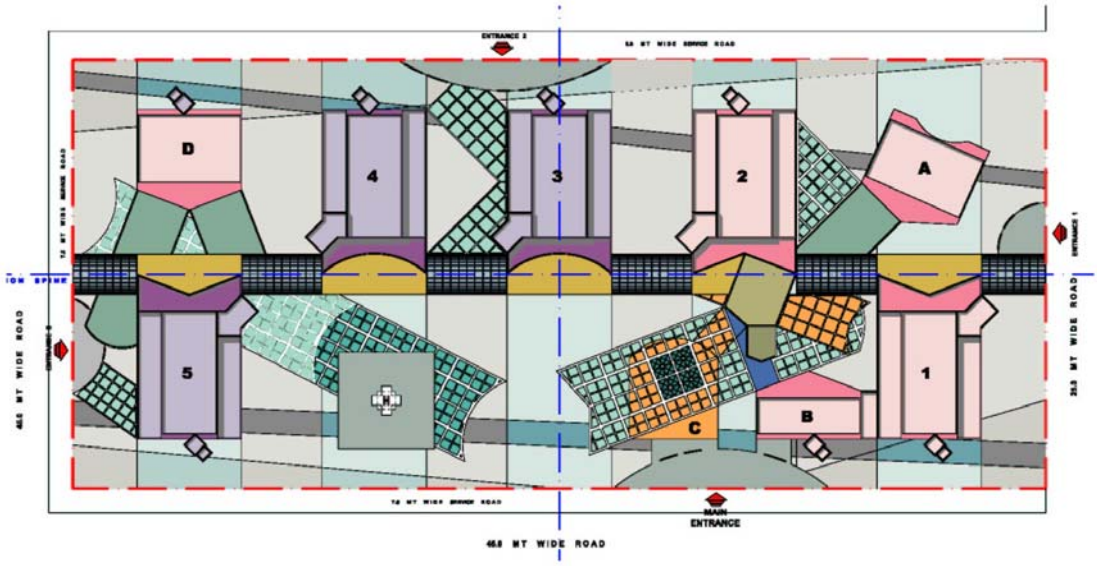
John Weeks, the first architect in Britain to fully grasp the need for this flexibility in the design of hospitals, made the then revolutionary point that ' user studies of function are by themselves not a sound basis for hospital design. Functions change so rapidly that designers should no longer aim for an optimum fit between building and function. The real requirement is to design a building that will inhibit change of function least, and not one that will fit specific function best.'

At Northwick Park Hospital, London, he designed a 'hospital street' along which were placed blocks of buildings that could expand at right angles. Both the blocks and the street were open ended. The plans of the hospital below illustrate this.



Shown above are three plans showing the development method at Northwick Park Hospital and Clinical Research Center. A linear hospital street forms the backbone to which ribs can be attached with relative freedom. It is the earliest example of deliberate indeterminacy in post-war hospital planning. The hospital and research departments can be constructed and later altered or expanded, independently of one another. Construction was carried out in phases over a period of nine years and during this time extensions and alterations to the original brief were made without disturbing the basic design. Architects: Llewelyn-Davies Weeks.

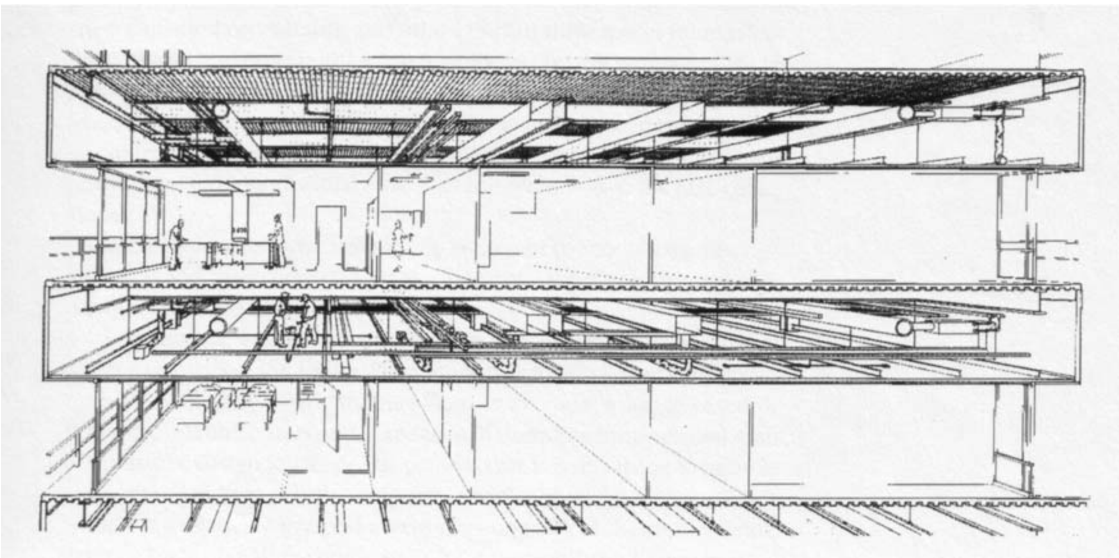
An adaptation of this concept for a project for a project on the outskirts of New Delhi is illustrated in the plan shown below. On a site of 9 acres this is a proposal for a 200-Bed hospital in Phase – 1, growing to 500-Beds in its final phase. The concept of a "central circulation spine" in the place of the "hospital street" described above can be clearly identified. The modular, planned expansion occurs along this spine, as in Northwick Park. Architects: Hosmac India Private Limited.



This design concept proved very influential. However, the hospital sprawled over a great deal of land. Then what could be done on urban sites where land was at a premium?

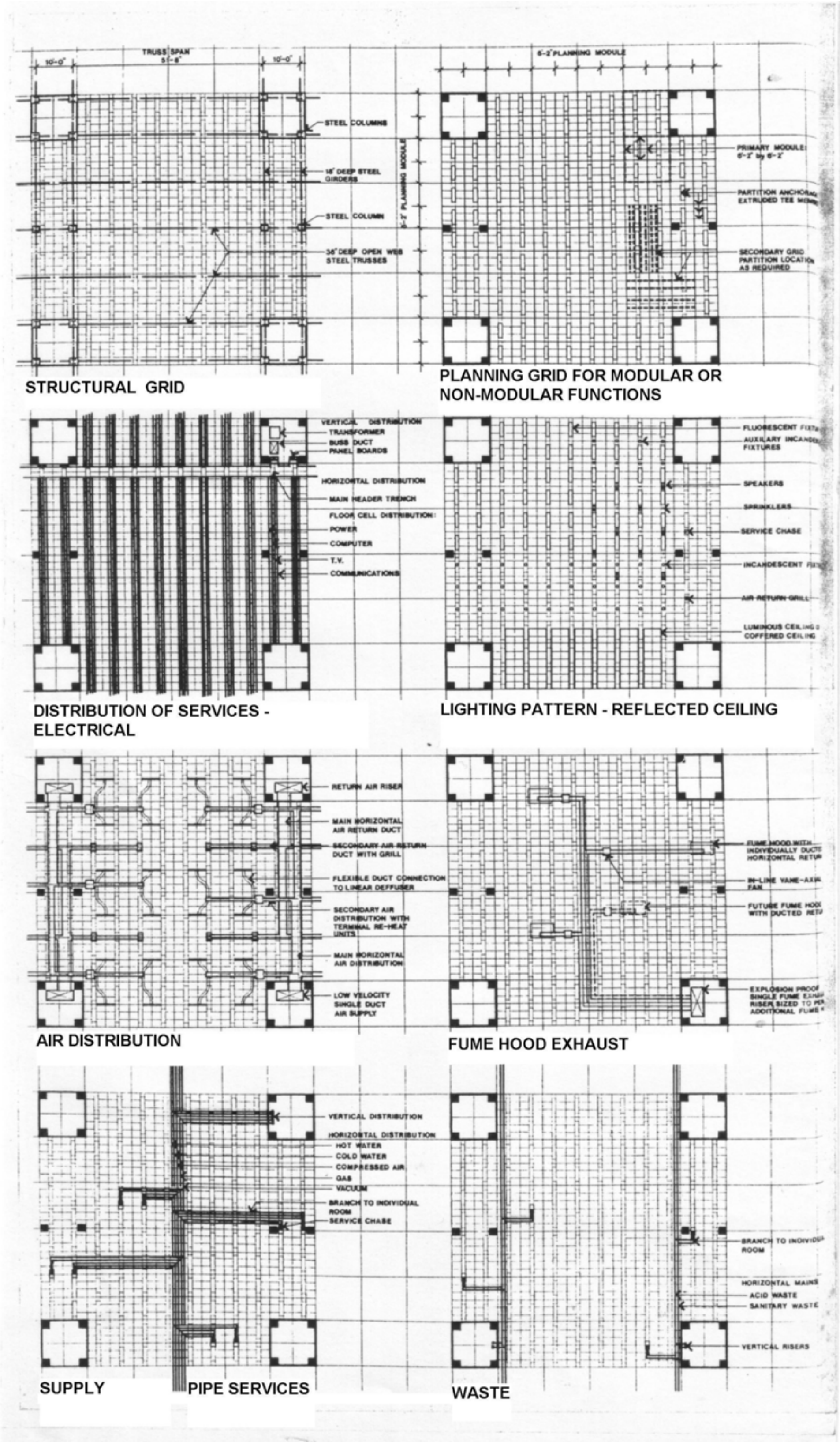
An answer to this was the concept of ‘universal space’: that is, a series of structurally uninterrupted floors, to which any services such as electricity, gas, water, could be brought from above, and from which all wastes could be taken from below.

The Greenwich Hospital, UK was the first hospital to have ‘interstitial’ spaces or services sub-floors between each hospital floor. This solution is most strongly justified in hospitals where the climate makes air-conditioning – or mechanical ventilation – necessary throughout. The dedicated space for air-conditioning ducts, pipes and wiring means a greater overall building volume, but the ability to service them without entering the hospital areas they are sandwiched between is an advantage; full benefits are only reaped if three-dimensional zoning is maintained, by “reserved rights of ways” for the various services. Shown below is a section showing ‘interstitial’ spaces or services sub-floors.



This approach makes an important point. Making a building that is adaptable to changing requirements is largely an issue of providing the necessary building services required by the changing requirements at the desired point in the existing building. In India, with our RCC column and beam method of construction, this need impacts the structural system design for the building in that punctures in the slabs may be necessary during this change of function and thus the structural system chosen initially has to cater to that requirement.

In order to provide for planned expansion it is necessary to develop a master plan that provides for both short - and long - term expansion and change within the hospital and throughout the campus. The master plan should establish major paths of circulation projected through foreseeable phases of new and renovated buildings. The design concept should contain within it an overall ordering principle for the entire campus, integrating into the design a building systems framework (See: Illustration below).



Source: Hospitals and Healthcare Facilities by Redstone

With hospital accreditation by health insurance companies in India being just around the corner, old hospitals that are too tightly tailored to the needs of initial users will become obsolete due to the changing standards demanded by these companies, who are likely to emerge as the new drivers of the healthcare industry.

Changing market demands, new technology replacing the old at an ever-increasing rate of change, advances in the science of medicine and changing patterns of disease all underline the need to design healthcare buildings for flexibility. The functional, technical and hence financial success of hospitals thus depends on the ease with which they can grow and change, and this dependence increases with time. The aesthetic implications in designing buildings that will expand and change over time also become an issue. An urban design approach is necessary; an initial building whose form is symmetrical will tend to look skewed when expansion takes place. The higher the buildings are, the greater the aesthetic, technical and functional difficulties in making a workable addition.

The fact that many hospitals are built in a number of phases further complicates the problem. There may be a series of replacements of older buildings on an existing site or limits to the amount of investment possible at any one time. A comprehensive and firmly established Development Control Plan is essential for a hospital built in phases – to specify the strategic direction of following phases, but not their detailed design.

The issue is complex; it involves a multiplicity of design factors that may be making contradictory demands on the designer. We suggest you consider the various options keeping in mind the needs of future generations to whom you will bequeath your design solution in its built form.

What does this requirement for flexibility augur for the hospitals to be built in the 21st century?

1. Buildings will be designed to facilitate the docking of mobile and plug-in modules. It is likely that specialized major diagnostic and diagnostic-surgical equipment will be manufactured in self-contained pre-constructed modules intended for docking at strategic points – “ports” – in the building. Such mountable and demountable components could be readily downloaded to other facilities – for example, an ex-urban satellite of the main hospital.
2. HVAC systems will be modularized and zoned, with vertical circulation, mechanical shafts and transport systems moved from the core of the building to the perimeter in order to create free fields within the core floor plate that are easily adaptable to different layouts.
3. Interstitial concepts, which seemed promising in the early 1980’s, but were mostly found to be expensive in terms of capital investment, may well return as flexibility becomes such a vital consideration that these initial capital costs will become justifiable.
4. Other structural strategies that maximize flexibility and adaptability will be used. Floor systems will have to allow for multiple penetrations for plumbing and electrical lines, column spacing will need to be optimized so that departmental redesign is not cramped by existing structural constraints.
5. Other strategies for maximizing flexibility will include the deliberate specification of “swing” space to allow temporary relocation of departments during renovation, and to allow greater flexibility in adapting to changes in patient population. Low-tech departments can be zoned in ‘soft” spaces adjacent to “high-tech” spaces.
6. Finally, some facilities may require the development of “universal floor plans”, which can be adapted – and readapted – to accommodate virtually any need.

The concept of flexibility will extend beyond what the architect designs to the architect him- or herself. The architect will provide a range of services beyond the traditional architecture and engineering (A & E) tasks, including strategic business planning, evaluation of lease-versus-build options, financial planning, mechanical and electrical systems evaluation, space planning inventories, furniture inventories, long-range planning and master planning. Once the building has been completed the architect will remain in contact with the owners for the life of the facility, providing a full range of services on a contractual basis. These services will include ongoing evaluation and planning for expansion, contraction and adaptation to changing needs.