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ECONOMY IN HOSPITAL PLANNING
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Economy in building programs, whether they be concerned with private dwellings, commercial structures or buildings designed to meet one or another of the community's civic responsibilities, has been a subject that has captured the imagination of politicians, social scientists, community planners and the like, whenever a society has developed acute social consciousness. However, within the past two decades, interest in this sphere has become intensified immeasurably. Accentuated by the Depression and propelled by present-day governmental philosophies, it is a cautious prediction that agitation for economy will proceed at an ever-accelerated rate.

Certainly, today it is true that tax increases and further demands of our federal, state and local governments to meet world emergencies of aggression, starvation, rehabilitation, and a maintenance of self-preservation are affecting the individual disastrously. Not only is his take-home pay rapidly decreasing, but the privilege of providing for himself more of his individual needs is also being threatened. Surely, a partial explanation for his dilemma is due to inflationary trends by a seemingly never-ending series of chain reactions of tax, commodity and wage increases.

To date, no indication of relief or let-up in increases is apparent, in spite of possible intervention in the way of governmental controls. Although the net results of an individual's pay increases may be a gain on paper, actually his dollars buy less food, clothing, shelter, transportation and health protection.

The latter will become the theme for this discussion.

Much emphasis has and will continue to be placed on public and individual health measures. Many possible solutions have been advanced. One of them, the British plan, probably has been most publicized and advanced by some of our government bureaus. It may justifiably be labeled socialized medicine. As such, it is supposed to solve our individual health problems but would ultimately extract billions in taxes each year. While it is not our purpose to pass judgment on any socialized program, certainly federal or state aid is necessary and should be demanded to care for those people who cannot afford to pay for medical treatment or hospitalization. Nevertheless, a regimentation of the entire population as a unit for medical treatment should certainly be examined most thoroughly before adoption.
Privately owned and operated insurance companies are offering hospitalization insurance policies which cover both in and out-patient treatment. These have gained in popularity and millions of our people are now participating. Group health insurance also cares for many employees of industrial plants and commercial concerns. Large firms have erected their own medical treatment and hospitalization facilities and employ their own staff of doctors, nurses and technicians.

Much can be written concerning our present-day health problems and the existing bureaus and private institutions which participate in both prevention and treatment of diseases. Those in the field of architecture are vitally interested, because whoever provides the means - whether public, private, or a combination of both - will require facilities that must be designed to comply with the peculiar problems that each presents. In one type of establishment, the operation derives its support from an almost unlimited budget, while in the other, there are definite restrictions, because the operation and amortization of the facilities must be met by income from patients. A few are fortunate in having the deficits financed by charitable donors. Regardless of the type of operation, the design must be met with a straightforward, economical solution creating the maximum comfort and treatment facilities for the patient with a minimum effort by a limited staff.

The individual with the decreasing budget has presented a problem to the community. Notwithstanding his contribution to the problem, his sole effort is ineffectual. Even the Architect may perhaps have very little to do in actually solving the individual's plight, but the individual, along with industry and government, has equally created another problem with which the Architect will be confronted - the ever-increasing costs of building construction. Within this realm, the Architect and his associates now become the key figures in solving the problem of constructing an economical building for the sick. The types of plans, equipment, materials and services which are finally selected will certainly reflect the indulgence in fantasies, monuments, or the sound thinking needed to develop the kind of structure that has become a must.

Now, having outlined in a somewhat abbreviated form the social and economic background of the problem, let us proceed to a succinct statement:

To build and maintain a hospital at the lowest
cost, not reducing the highest possible 
standards required for medical and surgi-
cal treatment, and thus create the facili-
ties which will permit our people to re-
ceive aid at a price they can afford.

For the purpose of this paper, the data on individual 
room layouts and functions as revealed in the minimum 
standards furnished by U. S. Public Health Service 
and others, are accepted and enter into the discus-
sion as parts of elements only. However, before accep-
ting the above-mentioned standards in toto, it might 
be well to recall how the Army field hospitals operated. 
With a pyramidal tent for shelter, a gasoline lantern 
as an operating light and very meager sterilizing facil-
ities, the Army Medical Corps has performed and still 
is performing, at this date, some of the most amazing 
operations and life-saving feats known to man. The 
Polaroid Corporation and the Picker X-Ray Company have 
recently combined their efforts to produce x-ray equip-
ment which can process x-ray exposures in one minute 
for Army field operations. At this date, an electron-
ic process is being developed to maintain the fresh-
ness of raw foods for indefinite periods of time with-
out refrigeration. These recent developments will 
undoubtedly revise the aforementioned minimum standards, 
thereby effecting additional economies.

The fact that man can perform effectively under adverse 
conditions for long periods is no indication that he 
should continue to do so, or to carry on in a "horse 
and buggy day" manner, but the mere fact that he has 
might indicate that we have complicated modern-day 
facilities to an opposite extreme. For example, this 
is manifest in the internal combustion engine. The 
continued addition of accessories, weight and extra 
parts to develop more horsepower under varied condi-
tions has created a most complicated means of power. 
The average 100 h.p. automobile engine has less than 
35 h.p. available for the actual motivation of the 
vehicle after overcoming friction in gears and bear-
ings, fans, generators, water and fuel pumps, and 
transmissions, to name a few. Aeronautical engineers 
have found in the jet type engines a solution for a 
more simplified power plant.

Present-day buildings allocate from 30% to 40% of the 
total cubage for the structural frame and installation 
of mechanical services. Time was when ten feet was 
considered the average story height for a multi-story
building, and now twelve to fourteen feet is not uncom-
mon. This means the original frame and chassis have
merely been expanded, an addition here and there to
accommodate an ever-enlarging motor to operate the
building. Of course, this is applicable to all struc-
tures, but even more so to hospitals, due to the com-
plexity of services rendered. However, many of our
present-day structures are reducing construction
costs in reduced cubage by modified structural frames
and mechanical systems, but this thinking has not
necessarily been reflected universally.

The geographic location chosen for this problem is
Houston, Texas. The land is flat with an altitude of
54' above sea level. The average yearly rainfall is
approximately 46". This combination of rainfall and
flat land creates storm drainage and sub-surface con-
struction problems which add greatly to building costs.
Differential levels in ground floor levels create manu-
factured terrain and contours not at all normal for a
predominantly flat geographic location. Basements are
not desirable, as sub-surface structures are costly,
due to waterproofing precautions. Generally, basement
levels are below the elevations of public storm and
sanitary sewers and mechanical summums are necessary
for the operation of plumbing out-fall systems. This
adds another item of continued maintenance. Of
course, lot sizes and other restrictions force the
use of basements to obtain the maximum use of the
land, but an assumption can be made that these cases
are in the minority.

A wide variety of plants grow almost without benefit
of culture. Very beautiful grounds can be land-
scaped and maintained with a minimum of effort and
would most certainly be a "must" for hospital plan-
ning. The skies are generally bright and clear, the
weather being hot and humid with an average yearly
temperature of 70°F. An almost ever-blowing refresh-
ing Gulf breeze is present all seasons. A surface
wind rose is shown on page 27 for examination. South-
ern and eastern exposures are the most desirable.

The type of hospital becomes another consideration.
A general medical and surgical unit will be used, in
that it provides the kind of treatment most required
for our low-paying patient.

A brief description for the total building is as fol-
lows:
GROUND FLOOR: Entrance, concessions, emergency ambulance entrance, services and power plant
MEZZANINE: Laundry and storage
1ST FLOOR: Administration, emergency operation and central supply
2ND FLOOR: Food service
3RD FLOOR: Out-patient department
4TH FLOOR: Maternity floor. 19 beds.
5TH FLOOR: Major operating suite, radiology and laboratory
6TH THROUGH 12TH FLOOR: Typical nursing units - 32 patients per floor with a total of 224 patients

The design is being executed without benefit of a consultation group, which is most important for a well-planned hospital. The actual building program cannot be supplied by an architect. The client, in all cases, is obligated to determine his own policies and requirements. As stated previously, each institution's operational procedures and management are specific to it, and designs created must include these peculiarities. There can easily be as much time and energy spent preparing the hospital program as the actual solution of this problem by the architect. As progress continues through the many elements such as the capacity in beds, bed classification, the clinical branches to be included, to the basic departments of medicine, surgery, obstetrics and pediatrics for a general hospital, and the location of the hospital within the community, it is readily understood why the architect must have a comprehensive program.

Who are the associates to share in the design of the hospital? Certainly no one man can claim credit for an entire project. To name the most important of the planners: the hospital board of directors (or trustees or bureau), hospital administrator, doctors, surgeons, nurses, hospital consultants, mechanical, electrical and structural engineers, and specialists such as x-ray, food service and transportation. By the exclusion of these specialists' knowledge and experience, the most that can be obtained will be mediocrity. Generally, the explorations contained herein may not be too detailed in character or follow a proven medical theory, but perhaps without this influence an economically better basic design can be drafted and have merit.
PART I - THE NURSING UNIT

The basis for a good design should certainly be in planned circulation, both horizontal and vertical. The less interference that can be encountered in transporting both human beings and supplies and services, the more efficient will be the operation and initial construction. Hospitals have a tendency to become horizontal, due to designing rooms on either side of a corridor and continuing this corridor ad infinitum, until a predetermined number of rooms has been gained. To add to this length, two nursing units are usually found on a single floor, with a central vertical transportation shaft to serve both units. This type of planning greatly increases the distances for horizontal circulation. Therefore, a logical answer to foreshortening of horizontal services is contained in a single nursing unit per floor with vertical circulation located in the central portion.

A sub-division of elevators must be considered to provide maximum usage. Certain cars are to give specified service; e.g., hospital out-patients enter and exit to and from treatment areas without crossing other hospital functions; food and kitchen service are important enough to justify separate transportation; and likewise, general hospital services should function separately from doctors, nurses, visitors and patient transportation. These requirements are not new, but merely good plan design. However, the better the integration, the less the confusion, loss of time, and the more efficient the personnel.

Diagram shown in Figure 1 represents the idea of separation and designation of services to be provided by each element of the vertical transportation system.
Plan design should necessarily start with a typical nursing unit. Adjunct facilities, administration, laundry, food service, operating, etc., all play supporting roles in the existence of this element. Their juxtaposition and plans are secondary in order of design only and equal in order of function. The nursing unit circulation has been placed centrally and the number of units per floor is established as one.

Located within this floor area there must be a central control point, the nurse's station. The nurse by visual and physical control supervises the activities of patients, visitors, and attendants, and executes specialized nursing duties. Vision from a nurse's station to all parts of patients' areas is not entirely possible or practical. However, centralized control can be more easily obtained by a location which has the least obstructions and permits partial vision of the majority of all rooms. Visual contact is definitely an aid to better control, and likewise, supervised personnel are generally more efficient. Awareness of watchful attendants certainly has a psychological effect on the patient not to be discounted entirely. Elevators and stairs add to the visual supervision. Visitors are a welcome necessity but require direction and control.

Hospital personnel have restricted duties and also require direction within a nursing unit.

Figure 2 shows, by diagram, the areas that can be viewed from a central nursing station.
Bedrooms receive more attention and present more of a challenge than other elements contained within a hospital. Briefly, present-day designs range from specially shaped rooms featuring a window for each patient, to almost complete toilet facilities built into and near patients' beds, the latter being designed for the patient to remain in bed and help himself. Then, of course, bedrooms are to be "just like home", or perhaps a hotel room. The patient's comfort is most important and every effort to satisfy physical well-being has merit, but more attention is in order for medical treatment - first.

Single and double rooms offer privacy and certainly are desirable for patients requiring quiet and close observation and attention. Contagious or doubtful cases by necessity are isolated. Visitors, perhaps, view a more pleasing and inviting atmosphere. "Hotel-like" service is provided from $12.00 per day to a rest cure for $35.00 per day. Our individual with the decreasing budget cannot afford the expense of an unmolested room with a private bath. His sole desire is the best medical and surgical treatment available, with the hope the fees are not prohibitive. There is no reason to provide second-rate medical care, regardless of the inability of a person to pay high fees.

Reduction of initial construction costs is obtainable by designing more open spaces, such as ward rooms. There is no need to produce cost analysis to prove this type of planning less expensive than single rooms with private baths and toilets. A ward room has definite advantages, other than cost, over other types, but likewise presents some difficulties not conducive to patient comfort. Immediately, supervision and treatment are accomplished with less effort. This means the patient receives more frequent attention, again his sole reason for being hospitalized.

Companionship is gained from fellow patients during the long hours between the restricted periods allowed for visitors. Proper hospital administration can easily group like stages of illness, so patients will not wear on one another's nerves. There is no reason why a patient cannot be moved from one ward to another as he progresses to better health. Tubercular patients are classified by illness and progress from one stage to another - why not other types of patients? For a depressed patient, who needs a boost in morale, why not a move?
Cross ventilation is usually obtainable by ward planning. For non-air-conditioned spaces, this is essential. Bi-lateral lighting also comes with cross-ventilation. Another aid for patient psychology is larger areas. His vision is not restricted to a wall less than twelve feet away. Ambulatory patients have views from other parts of the room.

Modern medical science has definitely placed stretcher patients in the minority. Major surgery no longer requires long periods of inactivity. In fact, within a matter of hours after surgery, patients can move about under their own power. And how does this affect hospital design? Merely that certain facilities can be placed near the patient, so he can be partially self-sufficient. These statements are made in part from the writer's own experience as a patient and also from observation of patients in Army hospitals. As previously stated, medical consultation has been excluded; so an authority concerning the limitations and capacities of patients might very well take exception. Facilities which can be used by patients, once ambulatory, or perhaps with the aid of an attendant, are toilets and baths. A minimum distance of travel is planned by a central location within a ward. Combination water closet and bedpan washing fixtures can likewise be incorporated in the same unit, making sub-utility facilities close at hand. The patient need not leave the ward for anything other than special treatments provided for on other floors. A day area has been included for use by patients and visitors. In emergency, this area provides space for two beds. Figure 3 shows basis for each ward unit.
A nursing unit composed entirely of wards is not flexible enough to care for all patients admitted for treatment. In the absence of contagious hospitals, provision for infectious diseases is a factor in design. This, of course, requires aseptic technique for personnel, service and food handling and requires more planning than shown herein. However, two single isolation rooms are included for each floor. Also, three double rooms for cases requiring special observation and attention are included.

From preliminary studies, the total number of beds per nursing unit is as follows: three 8-bed wards, two single rooms and three double rooms for a total of 32 beds. This perhaps exceeds an ideal number of 25 patients per unit; but assuming a closely designed group with 75% of the beds in ward areas for partial group treatment, an efficiency is maintained permitting an increase of patients per unit. Of course, more effective group treatment is obtained by having a single ward for 25 patients, thereby offering other problems in segregation of patients of opposite sex and race. The latter seems to be somewhat less of a problem today, but does exist and is still a part of our social system requiring special consideration. By a sub-division of areas, a flexible arrangement for segregation of sexes, races and degrees of illness is effected.

Other elements contained within the nursing unit are janitors' facilities, utility room, bedpan sterilizing, linen and general storage, stretcher and wheel chair space, a central soiled linen disposal chute, visitor waiting, and a floor kitchen. Food service is to be discussed under a separate heading.

A summary of the preceding thoughts concerning the typical nursing unit is as follows:

a. Maintain a segregation of vertical transporta-
tion as to type of service.
b. Reduce horizontal circulation and travel by central location of vertical transportation and minimum length corridors.
c. Centrally located nurse's station for effective visual and physical control.
d. Design the major portion of patients' bedrooms as wards of 8-bed capacity.
e. Provide all patient facilities within bedrooms.
f. Design bedrooms for a maximum of cross ventilation and lighting.
The final composite plan incorporating the foregoing ideas is presented on Page 37 for analysis. It is believed all parts have been satisfied with the possible exception of exposures of single isolation rooms and cross ventilation of double rooms.

Further economies are cited by the square foot area per bed for the entire nursing unit in comparison with other types of unit plans. The total area per floor is 7080 square feet with an average area per bed of 221 square feet. The average area of all other hospital nursing units was found to be 290 square feet per bed. Assuming 70 square feet per bed savings, the total theoretical reduction of floor space for 252 beds becomes 17,640 square feet. The economies involved are not gained in reducing the actual required area per bed. Each four-bed bay is dimensioned as 20'x15', which is larger than the required minimum of 19'9"x13'0" for similar alcoves. Single and double rooms follow usual standards.

PART II - FOOD SERVICE

A major function for consideration is food service. Freshly prepared meals served appropriately are a necessity for the successful operation of a hospital. Essentially, the problem becomes one of distribution and not one of actual preparation. Likewise, good distribution and poorly cooked food are not a good combination; but assumptions are made that good food is obtained initially and the importance of distribution a prime factor for the maintenance of quality. Certainly, the kitchen has a logical sequence of operation for receiving and storage, preparation, cooking, baking and special diets, thus requiring proper planning. No matter how well designed the kitchen or how well prepared the food, slow service, extended horizontal travel from kitchen to patients, reheating or remaining too long in high-temperature containers can spoil an otherwise good meal.

Central tray service increases the sizes of main kitchen areas and greatly adds to the responsibilities of the kitchen. Not only must the correct preparation be assumed but also the proper diet for each patient
and meals for hospital employees. This method can be efficient for small compact hospitals where limited horizontal travel is maintained.

Other methods include distribution of bulk food by carts to each patient's floor and served at the patient's bedside. Bulk food may be delivered to floor kitchens and there trays are set up and taken to patients. Regardless of the method, the system must be one for rapid conveyance of food from the kitchen to patients to be effective.

The design may be simplified by definitions of the various functions. Logically, the separations are preparation, distribution and dishwashing.

Preparation has been assumed to be of minor importance in comparison, since this operation can be accomplished within a single space on the same level. Within this function, much effort is required in purchasing quality foods, storage after receiving, and the preparation by expert direction for patient consumption. Specialists are available for consultation in selecting equipment and planning arrangement. Their advice should also be followed for the remainder of the food handling process. Beyond the actual preparation, the central kitchen is responsible for the initial distribution of bulk food. A special diets section is included within this element. As outlined for this problem, there are eight floor pantries, staff dining room and help's cafeteria, making a total of ten points of delivery for bulk food. The kitchen work is greatly simplified by the elimination of the many details that must be considered for each patient.

Distribution now comes into being as the second separation. The help's cafeteria and staff dining room are no problem, as service areas are practically adjacent to the kitchen. Each is provided with steam tables, etc., for the temporary storage of foods while being served. Table service is contemplated for staff and nurses dining. The major concern is service for the patients. Dumbwaiters are provided for quick vertical transportation of bulk foods to each floor. It is also reasonable to expect that a conveyor could be installed to increase the speed. In this manner many more containers could be delivered in less time using automatic take-off for each floor. Either system is faster than loading food carts and then proceeding to each floor via elevator. Food carts
require added space in kitchens and also washing facilities. Upon arrival in the floor pantry, the bulk food is placed in heated or cold temporary storage facilities. Tray set-ups are made immediately and taken to the patient. The floor pantry is located centrally, so horizontal distance has been reduced to a minimum. Dish storage is provided at each floor.

Now that the patient has been fed, soiled dishes become the problem. Upon return to the floor pantry, pre-rinse and garbage disposal takes place. The dishes are then sent to the central dishwashing unit. A central unit was provided here in the belief a more thorough cleansing and sterilizing operation is accomplished than by having eight separate small units. After washing, the dishes are returned to each floor for storage. The dishwashing of patients' dishes will not create an added load for the dumbwaiters, as this operation is not going on at the same time food is being served. Garbage for each floor has not become a problem with the installation of mechanical garbage disposal units connected to the sanitary sewer system, thus eliminating work required in transferring garbage from each floor to the garbage refrigerator for pick-ups.

A diagram is shown for the planned circulation of food service. (Figure 4)
PART III - ADMINISTRATION - DIAGNOSTIC AND OPERATING ELEMENTS

The discussion of administration, out-patient department, operating suite, obstetrics, radiology and laundry is limited to circulation and general relationship of functions to the nursing units. The economies to be gained in these elements are essentially to be made in building construction and an attempt to contain and reduce the floor space to practical limitations. Each of these elements requires considerable planning, by the hospital board, to determine the extent of services necessary to the proper function of the hospital, so each of the elements as designed might very well become controversial planning.

It is assumed that certain departments may be combined and some others may be eliminated, yet not deprive the hospital of medical treatment or diagnostic analysis needed for successful operation.

The administration section, emergency admission and hospital central supply and storage are located on the first floor. Although medical treatment has been stressed, administration is also of equal importance and must share responsibility for efficient and proper function of the hospital. In fact, in this section are found ambulatory patients, hospital staff, and individuals transacting business with the hospital, seeking directions and advice. Jurisdiction over the entire plant is centered in this section; so its relationship to other departments must be one of easy access.

Admitting and business offices receive the most traffic and are located adjacent to the lobby. The admitting office is also in close liaison with the emergency section. This is important, because immediate disposition of emergency patients requires prompt action by this office. Likewise, the admitting office directs for processing ambulatory patients who are to become in-patients.

Special offices are included for the hospital administrator and his assistants. General offices are provided for social service and consultation. The staff lounge is located for easy access from the ground floor to operating suite and out-patient departments. A folding partition is used to create a flexible arrangement for areas such as lounge, library and directors' room. The staff lounge is also adjacent
to medical records for staff research and consultation.

The emergency operating section is located on this floor, for the reasons mentioned, with regard to the admitting office. In addition to emergency treatment, this section will also conduct examination of patients and observation for entry as in-patients.

Autopsy facilities only are provided on this floor. The administration is also interested in this section for pertinent records originating here. Mortuary service is usually available outside the hospital and by the omission here, the institution is relieved of the responsibility of concession space or actual maintenance by the hospital staff.

To avoid increasing traffic in the administration lobby, central supply, central sterilizing, and hospital storage have been located on this floor, other than those elements which might require access by persons not employees of the hospital. Circulation for issue and supply is maintained by the service elevator. Dumbwaiters are provided to service the delivery and operating suites. Central supply, in this case, is essentially-issue, storage and sterilizing.

The out-patient department is situated on the third floor. Clinic operations - other than x-ray and laboratory - may become involved and extensive, depending upon the type of hospital and program instituted by a hospital board. To name a few of the functions performed - venereal diseases, gynecology, obstetrics, eye, ear, nose, throat, physical medicine, pediatrics, tuberculosis, urology, neurology and psychiatry - all might become a part of an out-patient department. A clinic of this magnitude then becomes a separate structure and has no place in a small institution.

Our age of specialists has created the many departments in medical practices. A general practitioner is a receding figure in the present-day medical profession. A simple example is shown by the fact that pre-natal care and delivery of an infant is in the realm of the obstetrician. Immediately upon delivery, the infant becomes the care of the pediatrician. Perhaps the infant arrives with a bone deformity, thus creating a call for an orthopedist. Condemnation of this division of responsibility is not in order, because modern medicine has progressed most rapidly through the intense study and efforts in research by the
specialists. However, by these necessary separations in medical practice, the problem of housing all under a single roof becomes difficult. A compromise solution is to include only general examination and treatment rooms for medicine, surgery, obstetrics and pediatrics, with the thought that other diseases may be treated in the same areas when necessary. A physical medicine department is important in the rehabilitation of body weaknesses and defects which cannot be treated by drugs.

The operating suite, radiographic and laboratory are combined on the fifth floor. Laboratory and x-ray diagnosis precede almost all surgery; so there is an advantage in maintaining these records adjacent to the operating rooms. Occasionally, x-rays are required during surgery.

The economy to be gained in these sections is essentially within the operating rooms. The National Fire Protection Association recommendations redefine the dangers of explosions caused by volatile anesthetics. Research has shown the explosions are usually dangerous to the patient only. The concentration of vapor occurs within the walls of the respiratory tract and the mask of the anesthesia machine, and rarely does a dense accumulation of vapor occur two feet beyond the point of leakage. Static electricity is usually the cause of operating room explosions. Precautions necessary to prevent these explosions must be built into the structure. Therefore, the most important measure is the installation of an electro-conductive floor and conductivity of the floor material must be within certain limits. A material too conductive results in hazards equally dangerous to a floor with no conductive qualities. Acceptable flooring includes properly installed terrazzo containing acetylene black; terrazzo containing magnesium oxychloride; plastic; and conductive rubber, linoleum and asphalt tile.

The seven-foot level for providing explosion-proof permanent electrical installations has been revised to five feet. This reduction no longer requires operating lamps to be explosion-proof, a substantial saving. Likewise, switches and convenience outlets placed above the five-foot level need not be explosion proof. Another saving is gained by the revision of the number of air changes for ventilation. General ventilation requiring twelve air changes per hour
is considered useless. The small area of dangerous concentration of vapor cannot be diminished by general ventilation. Therefore, the number of air changes per hour for operating rooms may be the same as required for other sections of the hospital. Not all local building codes have adopted the new National Fire Protection Association recommendations. However, the National Electrical Code has adopted these recommendations by reference.

Maternity care and obstetrics are located on the fourth floor. The maternity section probably creates more visitor traffic than other patient areas, and for this reason, has been placed on a lower floor. Obstetrics has been isolated from medical and surgical cases by inclusion on this floor.

The maternity floor has been planned about decentralized nurseries. The thought has been advanced that both mothers and babies fare much better when kept in close relationship. Present-day mechanical routines in large centralized nurseries are ill-suited to the needs of the new-born infant. A bassinet is kept in a cubicle adjacent to the mother's room; so the mother can feed and care for her baby according to individual needs. Aside from the fact that the mother is able to help herself somewhat, the nurse's duties are lessened by not having to transport infants long distances from central nurseries to each mother.

In addition to ward rooms, isolation and single rooms are planned to provide for cases that must be isolated. A suspect nursery is also planned for infants requiring isolation.

The laundry is located on the mezzanine floor. A centrally planned linen chute for all floors empties within the laundry area, thus eliminating the carting of soiled linen from each floor down to the laundry. The service elevator also opens directly to this area.
Although this discussion began with the nursing unit contained on an upper floor, each succeeding floor down was not necessarily designed in this order. The nursing unit was planned first as being the most important floor, with the thought that other elements existed as supporting yet equally important functions.

However, floors other than nursing units might have become involved, if the idea of designing a ground floor with the maximum of free or open areas had not been initiated early in the problem. By pursuing this idea, freedom of planning was found in gaining access to and providing services for the lower floors. The division of various kinds of traffic into separate areas was obtained.

Essentially, the ground floor is planned as an ambulatory area for the patients, the public and the hospital personnel. Since the hospital is of the general medical and surgical type, convalescents are few. Mass movement of all patients to an out-of-doors environment is not contemplated. There are many advocates for moving patients outside as much as is practicable; so the theory should not be discounted entirely. However, roof terraces can be maintained at the sixth floor level for those patients who require an outdoor atmosphere and cannot be moved too far. With an increasing number of ambulant patients, it is believed that ground floor terraces, landscaped and partially in the shade, will be used. No doubt, the hospital will have to revise its stock nightshirt to an appropriate type of wearing apparel for the patient to be more in keeping with his surroundings.

The parts of the ground floor which require enclosures are planned with as much glass and open space as possible. The main entrance includes only the elevator lobby and information desk, the latter being for direction of all persons entering the hospital. Adjacent to this area, there is a concession and lounge area. The concession includes a snack bar, newsstand, gift counter and perhaps, a florist’s shop. Men’s and women’s public toilets are located near the lounge.

Loading and unloading space for the public and outpatients is provided under cover. An elevator is near-
by to transport the out-patients to the treatment area. Wheel-chair storage facilities might easily be included in this area for persons requiring aid in moving about. While the current practice of placing out-patient departments on the ground floor is contrary to this theory, nevertheless, this particular plan makes it possible for a patient to take only a few steps from his means of transportation, enter an elevator, and then step directly into the information and direction center of the out-patient department. In so doing, the patient has not crossed other normal traffic lanes of the main hospital functions. Although this is the primary use of this elevator, other personnel may use it to advantage. Doctors desiring to enter or exit via the administration department, and residents and interns going to and from their quarters, have this elevator for transportation.

The ambulance drive and entrance is separated from the public and service entrances to avoid traffic interference which may occur during emergencies. Central control for the ambulance entrance, as well as service entrances, is through an office adjacent to the emergency receiving. All deliveries and shipping for the hospital receive direction from this point.

The power plant, maintenance and repair shops are located above grade adjacent to the main building. All supply and return piping and conduits are to be installed overhead through the covered passage to the main building.

Several thumbnail sketches made early in the problem are submitted. Figure 5 considers the idea that perhaps more than one nursing unit might be planned per floor. Figure 6 represents the next step for a single unit per floor. In the final development wall intersections other than 90 degrees could not be justified. Figures 7, 8, and 9 are sketches of ideas desired for elements of the ground floor.
PART V - STRUCTURAL DESIGN

Presentation of preliminary plans without considering the practicality of structural and mechanical systems would be erroneous and deceiving. Likewise, an attempt to include in preliminaries more than circulation, general sizes of spaces and the relationship of one element tends to initiate problems which should be withheld until plan solutions have been satisfied. Furthermore, many schemes are required before a solution becomes final. For these reasons, and as a matter of convenience, the structural grid system has not been included in the design plans, but is shown on separate drawings.

The design for the structure is reinforced concrete columns supporting flat type concrete floor slabs. Lower floor columns will be composite concrete and steel in order to hold the cross section to a minimum. The upper floors will be all concrete columns. The method of using flat type floor slabs permits minimum floor to floor heights. Typical nursing unit floors are planned to be 10'2", whereas the lower floors such as administration, operating, etc., will be approximately 11'0".

Cross sections 1 and 2, page 22, are typical for beam and slab profiles and dimensions. The sizes are not fixed and represent only desired dimensions which must be changed to conform to an exact structural analysis. Plans shown on pages 22 and 23 are typical for the floors as noted.

By the omission of a basement, the structural system becomes the same throughout, namely, one of columns and slabs. Below grade walls and slabs which require excavation, form work, extensive waterproofing and back filling do not enter into that problem. Under-ground work which can be hindered by excessive rain-fall has also been excluded. The footings may be drilled, or if the soil condition warrants something other than a spread footing, piling may be used. However, pile footings are more expensive construction and are only to be used when necessary.
An attempt is being made to design a structure which does not require 100% mechanical air conditioning. It is believed that an all forced-air system, both for cooling and heating, is neither ideal nor desirable for hospital rooms. A ventilating system is required to furnish an ample supply of chemically pure air, free from objectionable odors. The system creates drafts, which may well provoke differing attitudes on the part of the patients, thereby complicating already existing psychological problems in some cases.

Air systems for all types of buildings require a much larger quantity of air than is necessary or even desirable for good ventilation. Increased duct sizes or uneconomically high velocities are necessary for the distribution of the extra large quantity of air. The problem of installation for duct systems and fan rooms is solved by increased cubage, which adds up to 15% to the size of the structure. The cubage for this building, above the mezzanine floor, is 1,200,000 c.f. By using 15% as an increase in cubage to satisfy the installation of a mechanical duct system, and $1.35 as an average cost per cubic foot, the increased cost of the structure might become $243,000. So for the purpose of this discussion, a paper savings will be realized by the omission of a mechanical system which would require additional cubage beyond architectural design criteria.

The maintenance and operation of a mechanical system must satisfy both hospital personnel and patients. Each person has his own particular idea of comfort which must be recognized. The patient for whom this structure is planned generally exists both at work and at home without benefit of artificial air conditioning. He may perhaps work in conditioned areas, but at least sixteen hours of each day are spent in natural surroundings. A psychological problem develops when this individual suddenly becomes a part of an artificially controlled space, and begins to exist there without the stimulating effect of natural ventilation. A feeling of being restricted is created because the windows are closed and partially covered with blinds or shades, which further reduce vision, natural light, and the everyday noises to which he has become accustomed. Likewise, as an economy measure, the number of windows in totally air-
conditioned spaces is generally reduced to a minimum for refrigeration and heating equipment design.

The continued practice of designing structures about the requirements of mechanical systems, without regard to added initial costs and maintenance operation should be questioned. Certainly, concessions of floor space and cubage must be made for the successful installation of a mechanical system, but there is no economy in a submission to the majority of the present-day mechanical engineering demands. These statements are not intended to cast reflections upon capable and sincere engineers, but rather are offered as a challenge to mechanical engineers to devise a means of creating comfort zones which are desirable and can be economically installed and maintained.

The April 1951 issue of ARCHITECTURAL FORUM introduces a new method of air conditioning, entitled "Panel Cooling". This particular type of system uses continuous cooling coils installed in panels 2'9" in height below window stools and 3'0" in width in the ceiling adjacent to the window heads. Radiant heat, which represents approximately 60% of the heat load, is intercepted and absorbed by the cooling coils. Fresh air make-up and interior spaces are conditioned by small size low pressure ducts. This method, if proven in practice, will solve many present-day problems inherent in 100% duct systems.

Because of its prohibitive cost, a completely air-conditioned system is excluded from this particular project. The following recommendations are considered to be practical means of solving some of the problems which have been discussed:

1. Radiant type heat coils installed in concrete floor slab because:
   a. Added floor space and cubage are not required for installation; and
   b. A uniform heat is possible without drafts.
2. A vertical air duct is installed in each ward room of the building to supply make-up fresh air during winter months and to be reversed during summer months for exhausting warm air.
3. Continuous windows are incorporated to permit the maximum of natural ventilation and light.
4. Exterior walls are to be constructed of a
light metal, terra cotta, or plastic skin
backed with 4" of rigid fireproof insulation.
The insulation material is used to reduce the
coefficient of heat transmission to a figure
very much below the usual 12" masonry wall.
A lighter design dead load is also gained by
the use of this lightweight wall construction.

5. A system of horizontal louvers is provided
at the heads of continuous windows to create as
much shaded wall area as possible and to re-
ject a portion of the solar heat which might
otherwise pass through the windows.
LEGEND
CALMS, INCLUDE ALL WINDS UP TO 3 MPH.
( ) TOTAL OF WINDS IN ONE DIRECTION
WIND VELOCITIES 4 TO 12 MPH.
WIND VELOCITIES 12 MPH AND OVER.

SULTAN WINDROSE
FOR HOUSTON, TEXAS.
WITH OUTLINE OF TYPICAL
BUILDING UNIT PLAN
SUPERIMPOSED.
No extensive list of books in the way of bibliographical material is incorporated for the very reason that this presentation is the result of the author's experience in the field of hospital architecture. The predominant influence was two years' work in the office of Kenneth Franzheim completing the plans for a proposed Veterans Administration Hospital for Houston, Texas (which project has since been cancelled). This project included the plans for 23 buildings with a 1000-bed capacity.

The following publications were used as reference material:

BOOKS:


MAGAZINE ARTICLES:

Architectural Forum: "Explosions in Operating Room". (February, 1950).

"Tomorrow's Hospital Must Be Different", by Robert M. Cunningham, Jr. (February, 1950).


"Panel Cooling". (April, 1951).

In addition to publications mentioned above, Hospital Work Sheets compiled by the author for Architecture 630, The Rice Institute, were used. These Work Sheets are composed of plans for the various departments of a hospital, such as x-ray, dental clinic, etc., and show the minimum room sizes and the basic equipment required for each space.