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ment. Les pavillons F2 à F5 se composent de chambres à l'ouest et à l'est, du hall d'entrée et de deux chambres de visites au nord et du séjour ainsi que de la salle à manger au sud qui est très importante en psychiatrie, où les patients ne sont pas couchés en général. Les cours intérieures permettent une double orientation à la partie jour et un éclairage naturel aux couloirs, où les patients se promènent. Pour un hôpital psychiatrique, la richesse architecturale est importante, puisque les patients restent en moyenne plus de 200 jours.
Le pavillon F1 comprend au 1er et au 2ème niveau l'inscription et les nouveaux patients en traitement et en observation. Comme ils n'y restent que 2 à 3 semaines, on accepte les désavantages d'une zone centrale éclairée et ventilée artificiellement. Au 3ème niveau se trouve la clinique privée avec une cour intérieure servant de toiture-terrasse.
Les sections d'observation avec salles surveillées nuit et jour se composent d'une chambre à 9 lits, de 7 chambres à 1 lit, d'un séjour-salle à manger et de locaux annexes. Le grand nombre de lits est une donnée fonctionnelle.
Le rez-de-chaussée comprend la section de «service médical». A l'ouest on a la pharmacie et les laboratoires, à l'est les consultations et les traitements. Le noyau central, éclairé et ventilé artificiellement, se compose de la radiologie et de la station électrique, le nord est réservé aux petites interventions chirurgicales. A l'exception des parois du noyau central, toutes les cloisons sont amovibles.
Cependant, l'idée de flexibilité détermine le plan de tous les bâtiments d'une trame carrée de 2,65 m, où les cloisons ne sont pas porteuses. La structure porteuse en béton armé est disposée selon une trame de 7,86/7,86 m sauf celle de la salle de gymnastique qui se compose de cadres d'une distance de 5,24 m.
Le directeur du service des constructions cantonales, M. K. Kaufmann, était chargé de la surveillance de la conception d'ensemble ainsi que de l'exécution.

Summary

R. J. Sahl, Düsseldorf
E. Zietzschmann, Hannover

Public hospitals

in Germany and in Switzerland

(Pages 85–114)

Conception of plan – structural design – execution

Introduction:

In a modern hospital the patients ought to be, if possible, given individual care, according to their state of health, with the aid of the latest medical discoveries and those in the fields of pharmacology and technology, and given hospitalization in keeping with the general standard of living.
These conditions ought to be realized economically and without entailing additional work for the staff.
To meet these requirements, there is needed a complete methodical planning system, based on medical-therapeutic, hygienic, sociological, psychological, economic, political, structural, technical formal factors, a system which adapts the organigrammes of an organized plant to the structural layout of a functional building.
The present report, bearing essentially on public hospitals owing to their economic-political importance, sums up structural and formal possibilities regarding plan and organization of hospitals, taking into consideration the maximum number of givens; thus, the study of this file furnishes better information for the architect than any analysis of a single concrete building.

Public health in Germany:

Statistical data:
Annually every 8th inhabitant, i.e. 7.5 million people, are given treatment in 3650 hospitals with a total of 605,000 beds (10.6 beds per 1000 inhabitants: 7.4 for grave cases, 3.2 for long-term illnesses) with 36,000 doctors and 149,000 nurses.
German public health dates from the Middle Ages, buildings from which period still being in use (e.g. Holy Spirit Hospital, Ravensburg), but it underwent a great forward development in 1900 with a slow-down in expansion towards 1930 until after the war. Because of rapid advances in medicine, technology and therapy, German hospitals are going through a very active phase (construction, renovations, extensions, etc.).

Types of hospital:

Ownership:	hospitals	beds
Public authority	1395	336,503
Welfare institutions	1298	221,706
Private	958	46,723

Classification:	number of beds	number of hospitals	% of total number of beds
very small hospitals	max. 50	1113	4.9%
small hospitals	50 to 150	1333	19.4%
ordinary hospitals	150 to 600	1048	47.2%
large hospitals	min. 600	157	28.5%

Division into two types of hospital:
Gen. hospitals: 1865 with 360,437 beds
Spec. hospitals: 1786 with 253,204 beds
(= special treatment, or treatment of special illnesses).
The medical schools and the university clinics are considered to be special hospitals, designed mainly for research and training. End 1962: 77 clinics with 32,253 beds.
A distinction is made between hospitals with a majority of interns (24,270, of which 5642 head doctors) and hospitals with independent external physicians (7546).
In 1962 in Germany, the average length of a hospital stay was 28.7 days. A distinction is made between hospitals for acute illnesses (average: 21.3 days of hospitalization) and hospitals for long-term illnesses.

General classification of types of hospitals adapted by planning systems:
Clinic on minimum scale
Basic clinic (3rd order)
Standard clinic (2nd order)
Central clinic (1st order)
Clinics on maximum scale: universities, medical schools.

Public health in Switzerland:
Supply and demand of beds:
For 1000 inhabitants there are 7.4 beds (general hospitals)
and 3.3 beds (special hospitals)
Requirements (by regions): 5 to 7.5 beds/1000 inhabitants,
most of which is intended for special fields (internal medicine, surgery, gynecology, maternity and pediatrics) which are also the important sections in the general hospitals. The number of hospital beds in supply is high in comparison with the figures for other countries.
However, to draw up the programme of a new hospital, these figures are not sufficient. It is necessary to analyze the past and present equipment, and the requirement for the future, which depend on the regional demographic structure, the number and the type of patients, the length of hospitalization, the staff, population movements, the age pyramid, the social and occupational structure and traffic and residence conditions.

Coordination of hospitals:
The medical and economic givens are essential if we are to get a better regional public health service, the planning of which and implementation ought to be coordinated owing to the actual structure of the given needs (type of illness, difficulties resulting from diagnosis and therapy, etc.). Now then, a special section ought to have at its disposal a certain number of beds which, however, ought not to prevent the head physician from keeping an over-all supervision over the patients, the staff and the facilities (example: 70 to 150 beds for a general hospital). Finally, it is a question of creating a sound relationship between results and efforts (example: number of treatments, of patients, of beds in ratio to staff, available space, arrangement of equipment).
Every system of coordinated public health is based on the equilibrium between the various types of hospitals needed. As the operational optimum differs from case to case, there are also coordinated joint services in a general plan (ex.: laundry serving several hospitals).

Operational planning:
A planning scheme ought above all to be systematic. Operational planning is subdivided into medical-therapeutic planning, capacity planning and execution planning.
According to the number of beds, defined later on, and in accord with other health service schemes, there is defined a general, over-all programme comprising:
type and order of size of the equipment of the various special sections, of therapy, of diagnosis, of rehabilitation, of prophylaxis, of the general services, religious and social, for patients and staff, of training and research;
type and intensity of care, of standard (hospitalization and feeding of patients).
The execution programme is made up of the planning of facilities (machinery, labour, materials), of the planning of projects of time limits and of budget.
Operational planning ought to be expressed in a programme on the basis of which there can be drawn up the over-all organigramme, for the drawing up of a project requires not only the enumeration of facilities but also the definition of the relationship existing among the functions and zones.

Construction planning:
In comparison with operational planning, in which the contractor, the administrators and doctors do not have the suitable training and background and in which intentions, spheres of competence and responsibilities are not clearly defined, construction planning is better organized.
There exists the alternative of a direct order or of a public competition.
The advantages of a competition of architects based on a good programme are evident, for the indispensable teamwork can start even at the preliminary stage.
It is just as harmful for operations as for the architect himself for him to specialize too much in clinical questions, for he must above all contribute to the job with his town-planning, architectural and structural ideas.

Functional and formal composition of a hospital:
A hospital is made up of hospitalization, consultation, technical facilities, training facilities and research, as well as staff residences.
The internal functions are subdivided into specialized sections, departments for treatment of in- and out-patients, group care units, etc.
Now then, to organize a hospital, it is necessary above all to take into account relationships among places of work, facilities and services.
Two principal horizontal and vertical schemes best illustrate the requirements and their main applications.

Basic functional and structural conception:
It is defined by the connections among: hospitalization and technical installations.
1) All the installations and the wards (care units) are situated on one single level.
2) The installations constitute a compact block (one or two levels) and the wards are disposed above or beside in the vertical (ex.: consultations: low building, wards: tower).
3) The installations and the wards (care units) of a specialized section are situated on the same level; these independent complexes are in vertical connection with each other.

Effect of this functional organization on the design and structural aspect:
Vertical type: hospitalization: high building, installations: low building.
Horizontal type: grouping of all the functions of one single section (wards, consultations, installations) on the same level.
The practical applications are generally a mixture of these two extremes.
For modern hospitals, economic criteria require tying in the complex with one single main vertical core.

Architectural design of hospitals:
Pavilions on one or several levels
Low extended volume
Compact volume on several levels, vertical type
Compact volume on several levels, horizontal type.
Owing to the danger of contagion, the pavilion design was very popular at the beginning of the century. Nevertheless, advances in medicine and the growing importance of economic criteria made it impractical, except for special cases (psychiatric clinics).
Compact designs, the only acceptable ones at the present time, can be developed horizontally, which allows for greater freedom of arrangement but applies only to a restricted number of beds, or vertically, either with an I plan or in the shape of a lofty block placed on a broad base housing the consultations rooms.
The horizontal block type on several levels generally has an I plan, composed of a treatment wing and two ward wings.
On the basis of the same functional characteristics, this type offers numerous variants of E, H or U plans, and for larger hospitals, with comb plan, double comb or ladder (old construction).
The I plan is applicable likewise to horizontal type hospitals, and recently there have even been seen plans in L, O, V, X, Y, Z, omega or cruciform.
To get better special connections, plans in T, the traditional type, (with central corridor) have been modified so that the consultation block is disposed in an L or T or in the shape of a bridge. The T design with a single circulation core and a deep volume parallel or perpendicular to the ward block finally prevailed owing to functional and economic advantages, for recent competitions have shown very well the numerous formal possibilities based on the same lay-out.

Structure of plan:
The more intense operational utilization of hospitals is also reflected in the lay-out of the plan, where deep volumes predominate.
There are only rarely found plans with a single corridor in elevation, and even plans with central corridor no longer meet functional requirements.
Thus, both consultation blocks and ward blocks are arranged in depth with one or two interior corridors, lighted and ventilated artificially or by skylights or interior courtyards. For the consultation block, there are even arrangements with several interior corridors completely air-conditioned, not oriented at all toward the face.
For the ward blocks, the technical facilities are situated on the interior and only the sick-rooms remain on the face.
The tendency to organize plans according to interdependent functions and operating processes is leading to spacious arrangements subdivided solely by installations facilities, for consultation blocks and to service corridors for ward blocks, with service rooms housed in alcoves opening into the circulation routes.
As for auxiliary services, there can be observed two trends: either the kitchens, laundries, technical installations, etc. are housed apart, where they function like a little independent industry, or they are accommodated on the basement levels of the hospitals, connected with the same lines and mains as the medical facilities.

System for drawing up a plan and for construction:
Module research:
There is no ideal module, and generally, we work with different modules for the consultation tract and for the ward tract.
With a view to obtaining maximum concentration, interior flexibility and economy, there is indispensable one single module with very large spans and in three dimensions, based on the supporting system, the technical arrangements, etc.

Hospitalization:
The sick-rooms can take any given form: single rooms up to large public wards (Florence Nightingale hospital).
Standard types of rooms: 3 beds in depth (general hospitals, 1, 2, 3, 6 beds) or 2 beds (long-term illnesses, contagious diseases, 1, 2, 4, 8).
To get flexibility, a more human atmosphere and a higher standard, there are being planned standardized rooms with toilet booths with 1, 2, or 3 beds or care units made up of rooms with 1, 2 beds and rooms with 3, 4 beds.
As for the service facilities, there are either specialized facilities or an open corridor with integrated service zones.
The size of a care unit runs from 15 to 80 beds (general hospitals, formerly: 25 to 40 beds, currently: 30 to 35 beds).

The type of care unit depends on the general organization: care by rounds is being replaced by group care systems (12 to 20 patients in a section of 70 to 100 beds) and by the system of progressive care (intensive care, normal, long-term and independent). By way of a general organization, there is a tendency to centralize and to rationalize certain activities (central sterilization, washing, beds, etc.), which are no longer being effected in the ward block, but in a central supply.

Consultations:

The lay-outs of consultations blocks depend a great deal on the type and on the site of the given hospital.
It is subdivided into service facilities, consultations, treatments with apparatus, operations, births, diagnoses and therapy and medical equipment.
Increasing specialization, even in a general hospital, is requiring great flexibility in consultation facilities, and in treatment and services sections, as well as a very complete equipment, which there is a trend to centralize (ex.: anaesthesia).

Types of operating rooms:

Large operating room with two tables or small room, 6.50/6.50 meters hermetically sealed off, lighted and ventilated artificially (always identical conditions) and surrounded by utility rooms, for the equipment in the operating room is reduced to the single needs of one operation at a time, and the operating team changes rooms after each operation.
The delivery rooms ought to be isolated from the sick-rooms and located near the mothers and new-born infants.
The diagnostic institutes comprise laboratories, facilities for endoscopy, pathology, etc. The therapeutic institutes comprise physio- and radiotherapy.
Radiology and radioscopy are difficult to locate because of the necessity to provide radioactivity protection. The diagnostic laboratories ought to be adapted to changes in method and to the duration of the analyses. The installations for physiotherapy and pathology are generally situated on the basement levels, independent of the other treatment facilities.
The medical equipment comprises medicaments, sterilization apparatus (centralized in general), isolated and situated beside the operating room, blood bank and techno-medical installations.

Administration and services:

The absolutely necessary administration is centralized in large office premises, where all the written work is carried out, and where there are located the records, the patients' files, diagnoses, photographs, documents, books, etc.
The services comprise kitchens, laundries, machinery, transformers, switchboards, emergency power unit, workshops, storage. In general, they are arranged in an independent volume around a service court.
The kitchens depend on the production programme (standard meals, special diets) and the general organization.

Systems of distribution:

Heated trolleys, serving out on plates in front of rooms.
Distribution of meals on platters in central kitchens.
Preparation of centralized meals (possibly for several hospitals) independent of meal hours, with deep-freezing and ultra-short-wave preparation, etc.

Laundries and cleaning (beds):

As laundries are not profitable for small and medium-sized hospitals, there are being created central units serving several hospitals with specialized and automatic disinfection services (blankets, mattresses, etc.).
Cleaning (except in the sick-rooms) is effected by specialized teams (2 or 3 persons).
Major communications are concentrated. Postal services are tending to be replaced by mechanical systems (pneumatic tubes, etc.). Other indispensable means of communication: telephones, alarms, signals, dictaphones, etc.

Profitability:

To increase profitability, it is being sought to facilitate the work done, to step up production and to lower costs. The administration and the technical services adapt themselves best to rationalization, centralization and mechanization.
The architectural design ought to provide a good over-all view, minimal communications routes, good connections among the various sections, their services, their equipment, the various units, as well as optimum and logical operations. Volumes and surfaces ought to be in proportion to the number of employees and their location when at work. Spaces that are too small, too large or too subdivided are a disadvantage.

Criteria for judging hospitals:

surfaces in ratio to productivity and number of employees, utility surfaces in ratio to communications cubic meters per sick-bed, comparison between volumes of various sections.
Cost per cubic meter low: ample space
Cost per cubic meter high: great economic and functional concentration.

Investments:

Causes for rising costs:
mounting prices, more space available (150 to 250 cubic meters per bed) improved, equipment, installations and materials.
Cost of cubic meter of hospital volume at present time: twice cost of cu. m. of HLM. The cost of maintenance is also rising; it will attain in 2 or 4 years the amount of the primary investment.
To make a comparison of the costs of hospitals, it is necessary to exclude the purchase of the site and the landscaping.

Distribution of expenses in general:

rough project	25 to 40 %
general interior fittings	20 to 30 %
technical equipment	20 to 25 %
furnishings, etc.	20 to 27.5%

Erkki Helamaa and Veiko Martikainen, Helsinki

Central Hospital in Tampere, Finland

(Pages 115–122)

Awarded a First Prize in a competition in 1955, this plan for a 1000-bed hospital in Tampere is designed for a triangular site with a southerly slope, the steepest parts being situated on the northwest, this calling for accesses on the southwest.
The T-plan is made up of a wing housing polyclinic and consultation rooms, articulated by vertical circulation routes (6 passenger lifts, 7 bed lifts) and the ward block of 12 floors, facing southeast.
A hospitalization unit is composed of 34 beds (3 rooms for 3, 2 rooms for 2).
The consultation block is developed in depth, with two corridors:
ground floor: main entrance hall, waiting-rooms and consultation rooms with overhead lighting, polyclinic and operating rooms.
1st floor: radiology: diagnoses and therapy
2nd floor: general division, operations
South front with 2 floors: administration, staff and a hospitalization unit.
The pediatric division forms an independent wing oriented perpendicularly, with 4 floors, connected to the principal hall by an entryway.
The southwest access at basement level is designed for emergencies, maternity cases and out-patients. Registration, clothing supplies and baths are located beneath the polyclinic.
Underneath the hospitalization block are the laundry, the business office, the kitchens and the dining rooms.
The heating plant is housed independently to the west of the site. The building for contagious cases is planned on the east. To the north there are located the staff residence and adjoining family houses with south gardens.

Distribution of beds in the various divisions:

surgery	272 beds
internal medicine	228
maternity	184
pediatrics	116
ear-nose-throat	36
ophthalmology	36
chronic illnesses and light cases	29
isolated section	64
total	965

William R. Baker, Chicago

Plan of a clinical center in Chicago

(Pages 123–124)

Project carried out in the Department of Architecture of the Illinois Institute of Technology in Chicago, Professor: G. E. Danforth.
The development of large clinical centers in the heart of cities is an interesting phenomenon in recent American town-planning. The growth of applied medicine, of public health and of pharmacology implies a fundamental restructuring of health services. Unfortunately, most hospitals are situated in districts of excessive population density, and therefore they are difficult of access; the largest complex (1.2 million sq. miles), made up of 6 hospitals, belonging to private church organizations or to the public domain, with 1800 employees, is 2 miles west of the Loop.
Without any over-all conception taking into account green zones and shopping centers, the density of this medical center had increased from 25% to 70%, which has become impracticable since the authorization of parking in the narrow streets.
The town-planning scheme for the reorganization of the Chicago center, worked out by Prof. Hilberseimer, earmarks the site of the present study, bounded by Western Avenue, Morgan Street, the new University of Illinois, the Congress Expressway to the north with exit and Roosevelt Road to the south, for a medical center.
The plan consists of 5 ward blocks with free orientation from all rooms owing to staggered dispersion. The complex is sited in a park. On the west and east peripheries there are commercial and industrial districts, residential districts to the east and west of the Institute area, low-silhouette houses and residence towers. Schools and playgrounds also belong here. All the accesses are designed as dead-end streets to reduce noise and unpleasant odours. The main city accesses at basement level lead to underground parking areas, to the entrances and the emergency entrance.

W. Blattner, H. Schenker, Aarau

Psychiatric Hospital at Königsfelden, Aargau

(Pages 125–130)

On the site of the Roman fortification of Vindonissa the Habsburgs had erected a cloister, at Königsfelden, at the beginning of the 14th century. In 1530 the Bernese installed a hospital in the abandoned cloister, which was taken over by the Canton of Aargau in 1803. In 1866 the Canton dispersed the various divisions: general hospital at Aarau, psychiatric hospital at Königsfelden, which was enlarged from 250 beds in 1886/73 and complemented by a horseshoe building in 1895, by pavilions in 1908 and by the sterile block in 1939.
The inadequacy of the over-age buildings and installations is aggravated by alterations and extensions, permitting treatments, consultations and more individualized observations of patients and offering modern technical installations as well as staff residence facilities.
The transformed buildings will comprise 500 beds (instead of 800) and the new buildings will accommodate 360 beds.

First stage:

Nurses' residence facilities:
Plan (competition award) of architects A. Barth, H. Zaugg and H. Schenker, Aarau.
Site: on the periphery of the complex so as not to disturb the extension, short distances to the place of work, Brugg and Windisch.

Lay-out:

Functional triangular plan with two faces parallel to the existing buildings; existing grass plots respected. All rooms face southeast; ideal sunlight, good view, turned away from the roads. To reduce internal noise, vertical circulation and the sanitary facilities, forming a square core, are independent of the rooms. The cellar, accessible via a ramp, houses bicycles, motor-cycles, shelters, transformers, heating plant for water, storage for luggage and skis.
The ground floor with two covered accesses is in direct contact with the gardens. It comprises the nurses' school, transformable into a large hall, the administration and management offices, the entrance hall, and facilities for visitors.
1st to 8th floors are made up of 10 single rooms, a sitting-room, a kitchen, a cleaning room with balcony, a shower and two WCs – on each floor.
The 9th floor comprises 5 large rooms for staff entrusted with important functions.
The roof is divided into a solarium with winter garden, a terrace, sheltered from the wind and covered over in part, with shower and storage space, and an upper level with music room and balcony.
The nurse's room measuring 14 sq. meters is subdivided by a low furniture unit. The entry-way in back comprises a nook with lavatory; the living area is furnished with a studio couch, a low table, an easy-chair and another chair that do not clutter up the space. In front of the window there is a work area and outlets for television, telephone and radio. Multi-purpose lockers and cupboards located on the passageway are a part of each room.

Construction:

Skeleton of reinforced concrete, with untreated brick interspaces, interior walls rendered and covered with wallpaper, floating floors, top of plastic on felt, external glazing of grinatal, outside Venetian blinds.
The building has had residents since July 1964.

Second stage:
New technical block:
Programme:

Heating plant, laundry, workshops, kitchens, staff restaurant.

Third stage of primary importance:
New ward block:

Public competition; result of the study by the architects W. Blattner and H. E. Schenker, Aarau.

Lay-out:

Pavilions, despite the functional disadvantages, because intended for the aged, who thus enjoy direct contact with the gardens located away from the roads and the noise.

Organization principles in plan:

Similar to those of a general hospital, they require minimal circulation routes. The square plan with annexes in the center subdivides the divisions in two hospitalization units with 16 beds maximum. The rooms with 1 or 3 beds (functional in psychiatry), closed at night, comprise toilets, which permits a 2-bed arrangement in depth only.
Pavilions F2 to F5 are made up of rooms to the west and the east, the entrance hall and two visiting rooms on the north and the sitting room as well as the dining room on the south, which is very important in psychiatry, where the patients are not in public wards. The interior courtyards permit two-way orientation in the day area and natural illumination in the corridors, where the patients go walking.
For a psychiatric hospital, architectural variety is important, since the patients remain on the average more than 200 days.
Pavilion F1 comprises on the 1st and on the 2nd level the registration office and new patients in treatment and under observation. As they stay here only 2 or 3 weeks, the disadvantages of a central zone lighted and ventilated artificially are put up with.
On the 3rd level there is located the private clinic with an interior courtyard serving as a roof garden.
The observation divisions with rooms supervised night and day are made up of one room with 9 beds, 7 rooms with 1 bed, on living-dining room and utility rooms. The great number of beds is a functional datum.
The ground floor comprises the medical service division. On the west there is the pharmacy and the laboratories, on the east the consultation rooms and treatment rooms. The central core, lighted and ventilated artificially, is made up of the radiology section and the electric power distribution; the north is reserved for minor surgery. Except for the partitions of the central core, all the partitions are movable.
Nevertheless, the idea of flexibility determines the plan of all the buildings, with a grid unit of 2.62 meters square, where the partitions do not have a supporting function. The supporting structure of reinforced concrete is disposed according to a grid of 7.86/7.86 meters except that of the gymnasium, which is composed of grid intervals of 5.24 meters.