Summary

Criticism of Architecture
Teachers' Training Institute and Official Athletics School of Ludwigsburg

(Pages 412–427)

This complex of buildings is situated on a difficult but attractive piece of ground. To the east there is a park; to the west the triangular site is bounded by a railway line. In the centre of the site there is a hill on which the architect has set the main buildings, which thus dominate the other tracts.
The main building comprises a classroom tract, the dining-hall and the gymnasium as well as another classroom wing not originally envisaged but constituting an extension which soon turned out to be indispensable. All these buildings are located around a square forum. To the west, a mountain, the Asperg, commands the landscape, while towards the south extends the town of Ludwigsburg. With regard to the placement of the buildings and their interrelations, the site has been most carefully utilized.
The accessory buildings as well as the main buildings and the heating plant, the whole group being unified, are located on the north side of the site but separated from the centre.
As regards the gymnasium, it has to be recognized that it is well sited in respect of the acoustic factor. On the other hand, it is hard to reach, for visitors have to go all around it in order to get to the entrance.
The forum is monumental in its effect. Its expanse is broken solely by a pool, some concrete beams and a statue. Taken as a whole, this square lacks charm. As for the gymnasium, it would have been better not to jam it into the southwest corner of the forum. Towards the north, the forum adjoins the large building designed for classrooms. The general impression made by it demonstrates very well the principle underlying the layout: the creation of large-scale shapes that can serve different functions. It can be said that this principle rests on the modern architecture developed by Mies van der Rohe.
The plan of the large classroom building is symmetrical. The groups containing the various rooms are of various dimensions. The small rooms, such as those for seminars, teachers' rooms, etc., are disposed around large auditoriums and the lecture hall, all of which, for their part, are located in the centre of the complex. The auditoriums occupy the entire height of the building and constitute a well enclosed block.
Particular attention has been devoted to the actual construction of the buildings. Thanks to a fine spirit of teamwork, the specialists of the different disciplines have here created a work that is certainly exemplary. This project represents an enormous advance in the industrialization of construction methods. For the realization of this assignment, a prefab elements factory was erected in advance on the very site, and all the face elements were produced here.
Among the characteristics emerging from the methods applied here, we can point out the extraordinary precision of the prefab elements. It has also to be added that the luxury prevailing in the buildings is certainly incomparable.
As for the handling of the construction itself and the materials, there has been applied the following principle: each construction element indicates its proper function and the building material remains visible in the finished stage.
In the construction style and in its relation to the designs, there are recognizable 2 principles:
In the classroom buildings, of several stories, the structure is recessed back of the façade line. The prefab elements cover the whole like a curtain wall.
On the other hand, in the gymnasium, the construction appears in all its detailing as a visible design element.
Both design principles have been applied with the most scrupulous care.

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School Construction Employing Prefabricated Elements

(Pages 428–433)

Considerations arising in connection with low-cost school construction and examination of various possibilities
We must not expect, in the near future, that the demand for school buildings is going to fall off. On the contrary, from now on, it will be necessary to erect even more schools. This increase in demand is due to the following causes:
1) introduction of the 9th school year,
2) expansion of the main schools,
3) replacement of old schools by new ones,
4) rise in the birth rate.

Not only is demand growing, costs are rising also. Therefore it is quite natural for all the possibilities of coping with the problem to be examined with a view to cutting costs.
When building by means of prefab elements, we rationalize processes and lower costs. Nevertheless, the advantages of rationalization depend on the organization of transport, the flow of production and the assembly of uniform elements. A sizeable number of communities and production plants have attempted experiments in the field of rationalization. As for small-dimension jobs, the effects of this rationalization are achieved solely by means of a system of "open element construction". What is involved then is a list of elements which are to be developed for the erection of school buildings of different designs and sizes. The application of a system of open element construction" calls for minutious and patient research.
Enumeration of the criteria that are valid at the present time and in the future for school buildings in general:
1. Classrooms
a) Analysis of the functions of rooms.
b) Establishment of the plans of these rooms.
2. School building complexes
a) Analysis of the relations and dependencies among the rooms.
b) Creation of school complexes of different designs and dimensions.

Knowledge of these criteria is a sine qua non for the development of an adequate construction system. Moreover, this knowledge permits an objective judgment of the existing construction systems.
Two factors have a decisive importance:
1. Character of the classrooms.
2. Possibilities of transformation of the classrooms.

The plans and the construction system of the given school ought to allow for probable growth. At the time of the construction of a school, the plan ought to lend itself readily to modifications or to expansion. This condition ought to be respected absolutely.
Grid unit
The introduction of a grid unit is an essential condition in order to have a sufficient number of uniform elements. The employment of such a unit ought to eventuate in solutions that are in accord with the given project and that involve low fabrication and maintenance costs.

Construction system employing prefab elements

If we employ an advantageous grid unit and respect the above-mentioned criteria, we can perfectly well elaborate an adequate construction system.
Enumeration of the assignments
The system thus applied ought to permit the construction of school buildings whose designs, dimensions and siting are different.
The buildings should always be constructed in such a way that an extension is always feasible, either by the erection of annexes or by the extension upwards of the building by one or more floors.
This construction procedure permits flexibility in the face of varying climatic conditions and a short-term construction period. These are two advantages not offered by the traditional construction method.

Method of analysis
It is necessary first of all to classify the known and possible solutions to the given problem. Then, we must examine the possibilities of a quantitative comparison between the respective inherent financial advantages and drawbacks. This calls for a breakdown of the total problem into its constituent problems.
Geometry
Capacity of combination of elements / number of basic shapes.
Productivity
Utilization of construction materials / stability / expenditures.
Insulation
Acoustic and thermal insulation / watertightness / fireproofing.
Production
Expenditure for coffering, reinforcing and concrete.
Transport
Influence of dimensions, weight and fragility.
Assembly
Precision of adjustment, stabilization of assembly, cost of connections.
Maintenance
Mechanical wear and chemical decomposition.
Valuation directives
To lower costs, it is necessary to aim at simplicity of construction, the following principles being adhered to: to select a construction type whose designs can serve several functions at once.
Stabilization
It is effected by means of plates on the partitions and ceilings. All the elements constituting the detached ceiling are assembled so as to form a plate. At the present time there is a preference for solid ceilings of heavy or light concrete. The resistance of the elements making up the partitions ought to be above the ordinary norm, on account of the acoustic insulation. As in the ceilings, the thermal insulation necessary is applied later on to the partitions. This operations is effected by means of façade elements suspended by clamps. The thermal protection is attached to the interior of these elements. Running parallel are ventilation ducts to permit the evaporation of possible humidity.
Protection against direct sunlight
In the premises located on the east and west sides vertical sunbreaks are attached in front of the windows. Horizontal shields are installed on the rooms on the south side. These sunbreaks are assembled cold, and are made up of special elements.
Installations
The installations are in general laid on inside the elements.
Heating and sanitary installations
The main distribution system is sited horizontally beneath the ground floor. The appliances are attached to vertical ducts, descending or ascending.
Electrical installations
Wells serve the main distribution system. Thence a horizontal distribution system. Thence a horizontal distribution system branches out floor by floor via ducts located underneath the ceilings, which are at any time accessible.
Type plans
The elaboration of a system with »open element construction« ought to narrow down the relation between the special problem and the over-all assignment. It must be possible at all times to estimate the limitations and the possibilities of the system.
The place comprising the main school building opens on to a large recreation hall. The classrooms are designed for the teacher-facing-pupils method of instruction. Other classrooms, differently arranged, are available.
This project implies a new conception of teaching which could be more widely applied.

Planning and supervision of the project: Günter Behnisch, Horst Bidlingmaier, Stuttgart
Elaboration of the project: Wolfgang Riessner, Manfred Sabatke, Stuttgart
Statics: Ernst Jetter, Stuttgart
Construction period: 1964–66

Elementary School at Neckarweihingen

(Pages 434–439)

1. Construction stage:
Building volume: 13,900 m³
Net construction cost: DM 2,000,000
Gross construction cost: DM 3,200,000
Preliminary remarks
Building employing industrially prefabricated elements is still not very popular in small localities. The firms have trouble recognizing the fact that the same needs call for the same types of units and that the technical construction methods can be applied indifferently to all sorts of school buildings, in the country as well as in the city.
For the construction firm working on the project dealt with here, the decision to employ prefab elements was in all likelihood determined by the reduction of the building period required.
For the architects' firm, it was a project necessary for the perfecting of a construction system employed already on many occasions. Finally, what was involved mainly was a simplification of the system with a view to applying it increasingly to different plans.
Site
The project opened to competition was supposed to be built on the outskirts of the locality and to comprise: the main school, a kindergarten, a church and a shopping center.
Program
The main school building had to comprise two parts:
The first includes 10 standard classrooms as well as 5 group rooms, 2 hobby rooms, a music room, a natural science room, a manual training room, a classroom for religious instruction, a domestic science kitchen with dining room, storage space for supplies, the principal's office, the teachers' room and accessory rooms.
The second part is envisaged for 10 standard classrooms, a group room, an art room and accessory rooms.
Lay-out
The slopes towards the west. The building comprises two floors on the valley side and one floor on the other side. The tracts accessible to the public are located not far from the main entrance. These are the concert hall, the administration offices, the principal's office and the teachers' room.
The teaching tract proper of the first construction stage is concentrated around an interior square courtyard.
A wide passageway has been laid out between the classrooms and the courtyard.
The route leading from the main entrance to the other part of the school (second stage) planned for 300 children seems long and also narrow in places. Moreover the stairway running to the recess yard betrays a spirit of excessive parsimony.
The classrooms face south, west and north. The different lighting and air-conditioning set-ups are supposed to be compensated by similar venetian blinds in front of the south and west windows.
The classrooms (which are square) are 3.20 meters high. A special bilateral illumination system has been applied. The windows facing out have very low parapets (55 cm); on the side opposite to the windows, skylights have been installed in the roof.
Construction
The assembly of the prefabricated elements took from June 1, 1965 to August 25, 1965. The entire façade was assembled on the supporting part of the structure: railings and mural panels of reinforced concrete, with built-in thermal insulation, windows of light metal.
The reinforced concrete prefab elements have not been given any further treatment. Painting has been confined to the ceilings and steel parts.
In the classrooms, radiators have been installed for the hot-water heating system. In the corridors, there is a plaster ceiling, separately suspended, with built-in radiant heat system.
Construction and Design
The interlocking called for by the construction system applied is also apparent on the outside, and no part escapes its effect.
When we examine the faces, we notice at once the function of the different tracts. The group rooms and the corridors are, from the outside, different from the classrooms. The horizontal window accents emphasize the elongated shape of the whole structure.

Even more than on the faces, on the inside the structure becomes an aesthetic principle. The non-supporting partitions are recessed between the struts and disclose the supporting system even to the non-architect. All the parts of this school building testify to a serious endeavour to arrive at a harmonious equilibrium. It has not been forgotten that children are the users of the building, and everything is built on the child's scale.

Architects: Claude Paillard and Peter Leemann, CJP Studios (Cramer, Jaray, Paillard and Leemann), Zurich and Winterthur
Engineers: Widmer and Wädensweiler, Winterthur

Grüzefeld Building Complex, Winterthur

(Pages 440–446)

Construction period: 1965–67
Construction volume: 370 apartments, accessory installations, food shops, business premises, total approx. 135,000 m^3
Decision on competition: 1961
Plan: beginning 1962
Building permit: 1964
Voting of financing credits: February 1965
Commencement of work: March 1965
Probable completion: End of 1967

Preliminary Remarks

A considerable number of enterprises and even of architects' offices are offering different apartment construction systems for one or more stories. In nearly all the cases, it has turned out that there is an advantage in building with prefab elements only in the case of fairly big structures. In many cases, comfort is sacrificed to simplification. Nevertheless, our age has the paradoxical wish to continue with immemorial building principles, in a time of voyages into space.
However, it is not possible to fix the blame clearly on the architects, the enterprises or the building contractors. Architectural research and training have been outpaced by avant-garde technology.
The builders of prefabricated apartment units endeavour to apply their construction system everywhere, and they at times they even go so far as to eliminate certain parts that are included in the plans. Nevertheless, the architect ought not to accept unconditionally the builder's opinions. His task consists too in humanizing the places people are supposed to live in.
It is an undeniable fact that the requirements, the way of life, the social structure and the average age of the family have undergone profound modifications during the last few years. These changes correspond, in the realm of housing, to new needs.
The Grüzefeld project is precisely an attempt to resolve these problems. It is not yet an established fact that the architects, the building engineers and the building firms have achieved the goal set.

Disposition of the buildings

The building site has been divided in such a way as to erect there differently designed blocks with heights varying from 2 to 12 floors. The complete project comprises 4 large blocks and a smaller group of buildings, making a total of 317 apartments, 53 flats for the aged, 1 food shop, business premises and accessory installations. Two underground garages can accommodate 200 cars.

Construction

The realization of this project by means of traditional systems involved financial drawbacks and undeniable technical difficulties.
The staggering of the blocks both horizontally and vertically would have entailed a great excess of façade masonry and complicated scaffolding. That is why an attempt has been made to build an immense exterior wall that is, at the same time, thin and insulating and that is rapidly and handily assembled. The construction system employing heavy concrete elements, and that is the system chosen here, offers all these advantages. It has been erected on a ground floor constructed in the traditional manner. Moreover, this system has been rendered possible thanks to the development of methods of transport which are capable of moving up enormous elements, the weight of which can go up to 9.5 tons. In this way it was possible to transport, in one piece, the seamless room ceilings, measuring 22 sq. meters, the partitions of the rooms, the façade extending across the entire width of the apartment and the height of one floor, i. e., 6 meters by 2.60 meters. Still other advantages should be mentioned: rapid assembly, high degree of precision in dimensions, weather-resistance of the materials.

Economic aspects

In order to arrive at a decision between the traditional system and the prefab system, there was drawn up a cost estimate covering the main parts of the raw construction. This comparison revealed that application of the traditional system would have entailed costs 18% higher than with application of the prefab heavy concrete element system. If that is compared to the total construction costs, this difference would have meant a cost increase of from 5% to 8% of costs. This already constitutes a sizeable sum, if we bear in mind that the project is based on an estimate of 28 million francs. The walls being thinner, there results a notable saving of space (8 to 10 additional flats). The reduction of the construction period obtained by this method is a crucial factor in the building of apartment houses.

Types of housing accommodations

Taken as a whole, the 370 apartments are divided into flats for the aged of 1 or 2 rooms, 2 to $5^1/_2$-room flats and $6^1/_2$-room maisonnette flats. There are 36 different types of flats.
One notable characteristic: the arrangement of the group formed by the sitting-room, the dining-nook, the balcony, the kitchen and the bathroom with WC is everywhere similar.
The $3^1/_2$ and $4^1/_2$-room flats are grouped around the stairwell. The larger flats are situated at the ends of the blocks. The small flats are accessible via porticoes. The complex made up of the sitting-room, the dining-nook, the kitchen and the loggia forms a generously dimensioned tract.

Architect: Franz Füeg, Solothurn
Associate: Dietrich Kruppa
Construction engineers: Emch & Berger, Solothurn and Berne
Heating and air-conditioning engineer: Walter Wirthensohn, Lucerne

Office Buildings and Apartment houses in Solothurn

(Pages 447–449)

The computing centre is established on the ground floor, directly above the air-conditioning rooms. The files, installed in a secluded place, are shielded from the direct rays of the sun. There are located in the entrance hall the following: the reception desk, the telephone central and the post office.
In the office building, on the 4 upper floors, 80% of the surface is utilized and 20% reserved for corridors, utility rooms and installations shafts.
The humid office facilities are grouped with the conduit shafts, including all the ducts and the lifts, in such a way that they constitute an interior core. The 2 lifts are designed to accommodate 5 persons each. During office hours, one of the lifts is accessible for use only with a key. It is employed mainly for the transport of goods.

Framing

Struts and beams: bolted steel constructions.
Ceilings and roof elements: prefab concrete elements placed on strips of synthetic rubber.

Faces

The glazed bays of the office building are set in synthetic rubber frames. The reflecting glass does not hinder the view outside but prevents one from looking in.

Interior construction

The floors are laid dry. A fibreboard layer is placed on 1 to 3 cm of sand. The ceilings, which can be dismantled, are acoustically insulated and fire-proof and are a combination of cement board, semi-hard asbestos and layers of rockwool.
In principle, the same products and materials have been utilized in the apartment building. The rooms are separated from the corridors solely by simple locker elements. Here too the prefab lockers and the doors are interchangeable, and the room partitions are removable. The dividing walls between the apartments are constructed of heavy elements.

Fireproofing

The office buildings (5 floors of steel construction) have not entailed significant fireproofing costs. Certain measures were taken in cooperation with the authorities.
Spiral staircase of reinforced concrete
The conditioned air can be introduced directly into the stairwell. In the event of fire, the main ventilation switch is pulled in the caretaker's station so that the building is cut off from inflow of oxygen.
In the corridor on the first floor, there have been installed windows mounted on pivoting elements which can be operated by remote control, from the caretaker's station.

Günter Behnisch, Stuttgart

Considerations on methods of planning and allocation of work in building with prefab elements

growing out of the plan of the Official Engineering School in Aalen (Wurtt.)

(Pages 450–454)

Construction employing prefab elements is a method which does not exclude efforts to seek out the optimum plan. Nevertheless, this method offers us the opportunity to achieve, advantageously, large-scale projects by means of the resources of modern technology.
The absence of functional and visible structure in the plan of the Engineering School in Aalen could be considered an unfortunate gap, more especially in comparison with plans for other engineering schools in Baden-Württemberg.
The building comprises 2 floors. From the outside, it is not possible to make out where the workshops, the auditoriums, the laboratories, the banquet room and the classrooms are situated. The plan demonstrates that it is impossible to furnish a definition of the functions of each tract. However, a specific organization corresponds to an exact definition. This consideration, far from giving rise to resignation, ought, on the contrary, to encourage research in this sphere.
In the plan of the Engineering School in Aalen it was necessary to take into account possibilities of extension and adaptation in the future, in view of the accelerating changes in methods of execution and in technology.
Each sector in isolation was to be adapted to all assignments, and all departments were to complement one another. Thus, the engineering school is to be understood and utilized as a self-contained unit. It can be presumed that this arrangement extends to the person making use of it the chance to undertake, without any difficulty, still undefined future assignments.
The construction of the engineering school in Aalen called for prefab elements. Moreover, this was the only way of realizing this project in the brief time limit required by the construction firm. What's more, construction with prefab elements offers the chance of drawing up an excellent plan and of carrying out large-scale projects. In the first place, construction with prefab elements is naturally a logical consequence of the planning principle. The requirement is that all the tracts and functions be interchangeable and capable of serving functions that are as yet undetermined. That is why it was necessary to find a functional common denominator thanks to which it was possible to draw up a volume module. This module, which comprises the dimensions of the local unit, includes possibilities of utilization and equipment.
The requirement of a common denominator for the dimensions and the equipment was to eventuate in similar construction elements. It is easy to conceive the prefabrication of this large number of similar elements and to benefit in this way from industrial prefabrication.
Industrial products can be fabricated at lower cost. Construction costs have gone up during the last 10 years, ten-times more than the cost index for total production. In addition to the business boom as such, the rise in wages is responsible for this state of affairs. Thanks to industrial fabrication, or at least partially industrialized fabrication, of construction elements, and thanks also to the decrease of the percentage of labour costs, it would be possible to bring the building trades into line, economically and technically, with the other branches of industry.
Industrial products are proving to be of superior quality.
The industrially fabricated product is designed by the engineer, it is the outcome of several production processes. Production is under steady supervision and is independent of the influence of the weather and of conditions on the construction site.
The utilization of adequate materials and of new production methods eventuates in prefab pieces which answer better to the needs and requirements of modern building procedures. Thus quality is not at all sacrificed to practical necessities. Contrary to the traditional way of building, it is easy to carry out at the last minute a check of the prefab pieces and to eliminate defective parts before installing them in the building. Also, a high degree of precision in dimensions can be insisted on with industrially prefabricated elements.
Moreover, the method of building with prefab elements presents considerable advantages in the planning stage. When one built, employing traditional methods, structures that were technically complicated, those who worked out the plans were obliged to collaborate with a large number of artisans, suppliers and building firms. Thus, it was difficult to arrive at e comprehensive picture of who was responsible. In the case of construction with large-scale prefab elements, this confusion vanishes. At the present time, side by side with the architect we have the engineer, who is an equal partner fully capable of drawing up plans in his own domain. The plans are all brought together in the office, there, those working on the project have the time and the chance to study the best solutions to the problem. The work proper is already finished before construction begins. Construction by means of prefab elements obliges us to follow a method of plan drafting which is generelly desired but rarely realized. Knowledge of manual fabrication is not of great use to the architect involved in building with prefab elements. On the other hand, it ought to be thoroughly familiar with the principles of industrial construction. We intend to make use of the mass-produced products available on the market. Nevertheless, when the piece needed is not offered, it ought to be fabricated. Prefab elements, whose plans are worked out by the engineer and which will be produced on an industrial basis, ought to prove themselves highly precise with regard to dimensioning. Despite this, there do exist dimension tolerances, especially on heavy prefab parts, at the time of fabrication and of assembly. If it is desired to reduce these differences and to approximate them to a norm, very high costs are the result. This can be avoided when the plans are made and at the time of assembly if care is taken that inexact dimensions do not accumulate and if tolerances are compensated.
Elements that are externally similar can easily be affixed end to end. On the other hand, elements that are externally different and complicated can be joined together only at great cost. These difficulties are obviated if the plan for these elements is drawn up indenpendently of the others. This principle is well known in the construction of office premises.
From the economic point of view, it would be advisable to develop the construction of adequate elements whose module corresponded to international norms and which would serve equally well for the construction of office buildings, universities, schools, etc. The elaboration of cost plans is justified only if they are in accord with our given economic and political situation.
The planning procedure is theoretically clear. It is incumbent on the architect, in association with the construction firm, to determine the caracter and the importance of the project to the built. He ought as well to work out all the possibilities that can lead to good solutions. The best solution is studied in common with the consulting engineers, and the project is discussed with them. The prefab elements available on the market are at the basis of every project.