Accelerated building programs for West German universities

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There have been over 20 different university building systems developed since the mid-1950's within the Federal Republic of Germany. Most have now at least one prototype in use. The greatest percentage has been designed and implemented by the individual university's own architectural and building offices, each State or *Land* having educational autonomy with little co-ordination at the federal level. This autonomy has had advantages in supporting innovative ideas both in the organization and building of universities, while allowing the teams in the different *Länder* to exchange experiences and erradicate technical flaws.

The first major federal effort at co-ordination was promoted in the inaugural address of Chancellor Brandt in the fall of 1969. He suggested an "Accelerated Building Program" (ABP) through rationalization of building projects in order that university buildings could be erected and ready for use within an average of twelve to eighteen months. This program was to be initiated immediately to overcome the lack of capacity in higher education facilities throughout West Germany. The Accelerated Building Program was illusionary in its time dimension, but it did start a wave of activity which was only possible because of the already developed building systems at hand.

All eleven *Länder* received support from the Federal purse and promises of more money to come (Table 1). A newly set up Federal Planning Committee for University Building passed approximately $94.9 million for 92 projects in January 1970, of which just less than 50% would be available within that year. This was to cover half of the total costs, the rest being furnished by the *Länder*.

Originally, the ABP was to be finished with its actual implementation by January 1972. However, at the close of 1972, all was not completed — but very much under way. Most universities have large building sites, as the ABP is not seen as being final, but rather the start of a long-range program to future growth. Open admissions which are becoming more and more a regular practice at German institutions of higher education, have created a highly political internal conflict. In part this is an outcome of the democratization of the decision-making in Universities with subsequent formalized student input.

Examples

In Frankfurt/Main new building has resulted from both State and Federal funding (Fig. 1). The Pre-clinic Lecture Room Building (lower circle on Fig. 1) and the Arts Building (middle circle) are part of the ABP program, whereas the project shown in the upper circle is totally financed by the State of Hesse. The photograph (Fig. 2) shows the almost finished Pre-clinic Medical Building, a prefabricated structure of which the outer shell was finished by May 1971, and October saw it in use.

The physical growth of the Darmstadt Institute of Technology has had to take place 7 kms from the original, but still in use, downtown higher educational complex. The new large development is completely prefabricated in a system which has been developed by the university's architectural office over the last ten years. The four circled buildings on the section of the map come under the ABP (Fig. 3 reading from top to

COMMUNITY SCALE		I	II	III	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EKISTIC UNITS		MAN	ROOM	DWELLING	DWELLING GROUP	SMALL NEIGHBORHOOD	NEIGHBORHOOD	SMALL TOWN	TOWN	LARGE CITY	METROPOLIS	CONURBATION	MEGALOPOLIS	URBAN REGION	URBANIZED CONTINENT	ECUMENOPOLIS
ELEMENTS	NATURE															
	MAN															
	SOCIETY											●				
	SHELLS							●				●				
	NETWORKS															
SYNTHESIS: HUMAN SETTLEMENTS																

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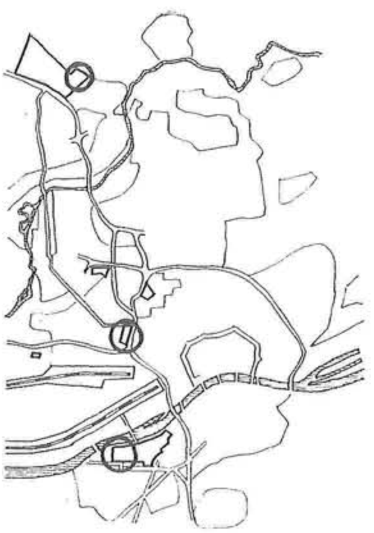


Fig. 1: New building at Frankfurt/Main

Fig. 2: The Pre-Clinic Medical Building in Frankfurt/Main

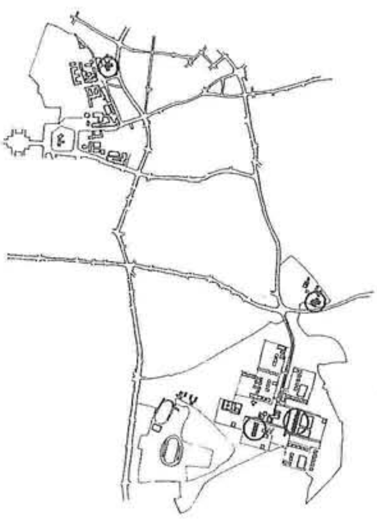


Fig. 3: Darmstadt Institute of Technology site plan

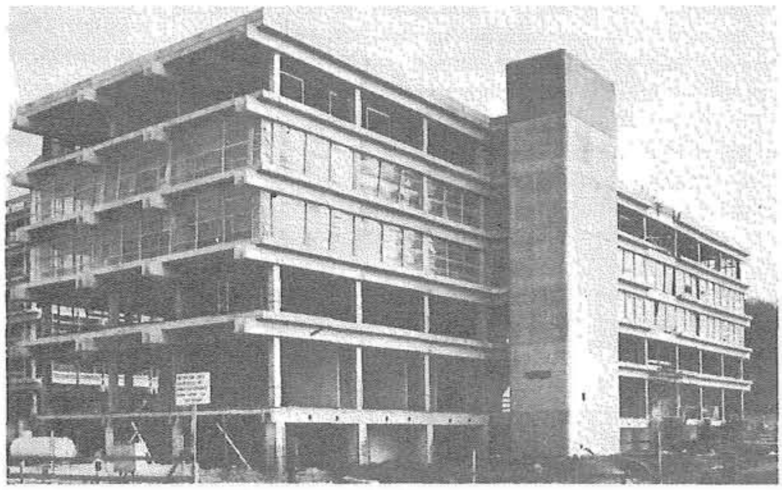


Fig. 4: Partially completed Chemistry Building at Darmstadt

bottom): Maths. & Physics (still at the old location), Botany (within the Botanical Gardens), Mechanical Engineering and Chemistry (at the new site). Construction is a very simple post and double beam arrangement, whereby the floor slabs are lifted into place by a crane. The outside walls are totally glazed, except for the vertical communication and service towers alongside the buildings, allowing a high degree of flexibility in the interior partitioning. The Chemistry Building shows the system in partial completion (Fig. 4). Like so many of the German university building systems, the demand for inner flexibility gives an outer impression of rigid, cool, almost inhuman architecture.

At the University of Münster, the Federal/State ABP financed the General Accommodation Center which was constructed with an "out-of-the-catalogue" commercial building system: Imbau, developed by a firm in Leverkusen. It was finished in June 1971, barely 17

Table 1
ACCELERATED BUILDING PROGRAM, ACCORDING TO PROJECTS IN *LÄNDER*, 1970

Land	Number of projects	Extra usable space m²	Total costs $ mill.
Baden-Württbg.	3	15,800	21.80
Bavaria	11	46,421	40.10
Berlin	9	10,626	7.50
Bremen	2	15,100	11.20
Hamburg	11	10,296	7.50
Hesse	8	34,035	30.80
L. Saxony	12	28,141	16.80
Northrhine-Westphalia	28	60,211	38.80
Rhineland-Palatinate	2	8,535	5.80
Saarland	3	8,150	4.70
Sch.-Holstein	3	5,640	4.80
	92	242,955	189.80

months after the allocation of money through this program. The construction of an almost identical building for the Technical University of Aachen was even quicker (Fig. 5). It was finished on January 15th 1971. Its costs ran at $718.00/m², a very competitive price for multi-purpose buildings of this type, which house the departments of physics, electrical engineering, architecture and geography. Accommodation is supposed to be interchangeable between departments within the 5000 m², but this has its limits in a seven-story building, considering the differing services needed by the different disciplines.

Fig. 5: Multi-purpose building at Technical University of Aachen

The costs of repetition

The further repetition of this drab 'Imbau' building brings to mind the reference in Ian Brown's article to "the box-like envelope." Here we have to ask: How far can this principle go? How often can a building be repeated? Are we not going toward an inhuman, monotonous, repetitive architecture? Does this manifest an inhuman trend in our ed''cation industry?

Monotony and inhuman environments are a misuse of prefabrication principles. They may be the outcome of the site planner's reversion to the easiest solution, the developer's maximization of the use of his crane, or the technical decision maker's and architect's lack of imagination, which can be equally as prevalent in traditional methods of building as in systems-building. If the system has been worked out to encompass the many possible alternatives, and not just to cut down on the necessary number of elements, then there is no reason why it cannot answer human needs as well, or better than a traditional approach. The more primitive the prefabrication efforts are, the more monotonous the finished product will be. Sophistication comes in developing the complexity into a co-ordinated system, which allows many possible answers to the building problem within the system.

The previous examples, the massing of the new Philosophy Faculty Building at the Würzburg University and the differentiation in design, height and expression of a similar Philosophy Building at the University of Saarbrücken (Fig. 6), illustrate the lack of creativity. But the potential of industrialization and creative use of a system is found in the design of the University of Marburg.

Basic principles

In developing this potential, the designers rethought and articulated the basic assumptions in building construction.

Position of elements: If the position of elements, e.g. a wall, is fixed within a linear grid, then the influence

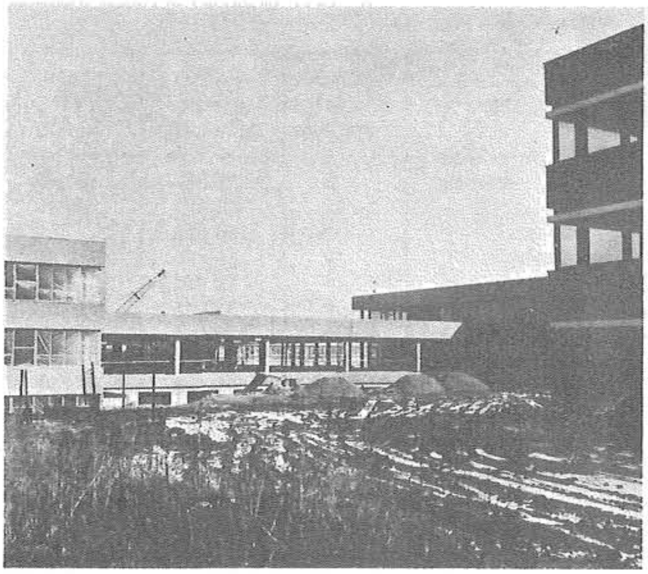


Fig. 6: Faculties of Philosophy at Universities of Würzburg (left) and Saarbrücken (below)

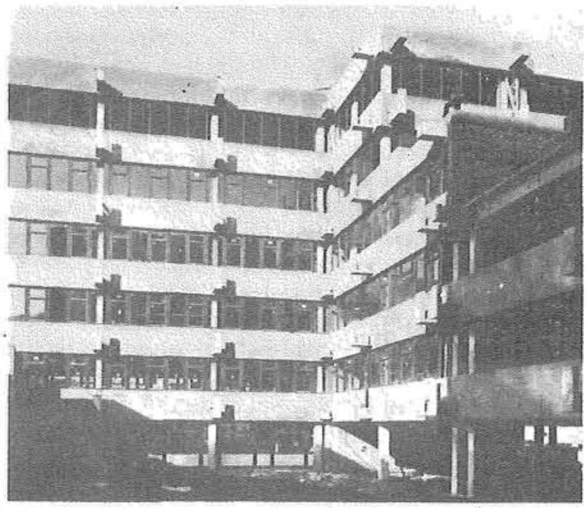


Fig. 7

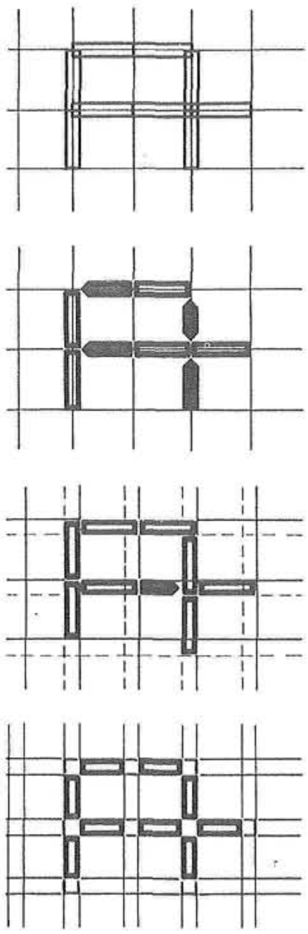


Fig. 9

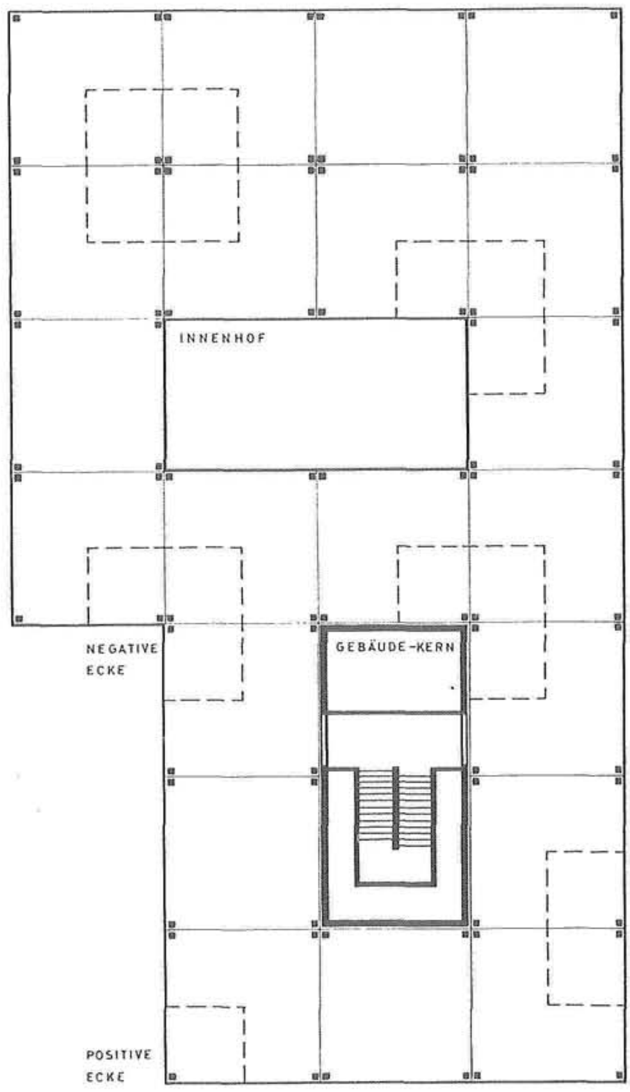
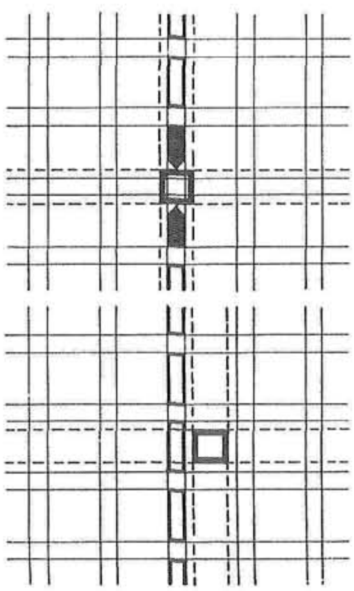


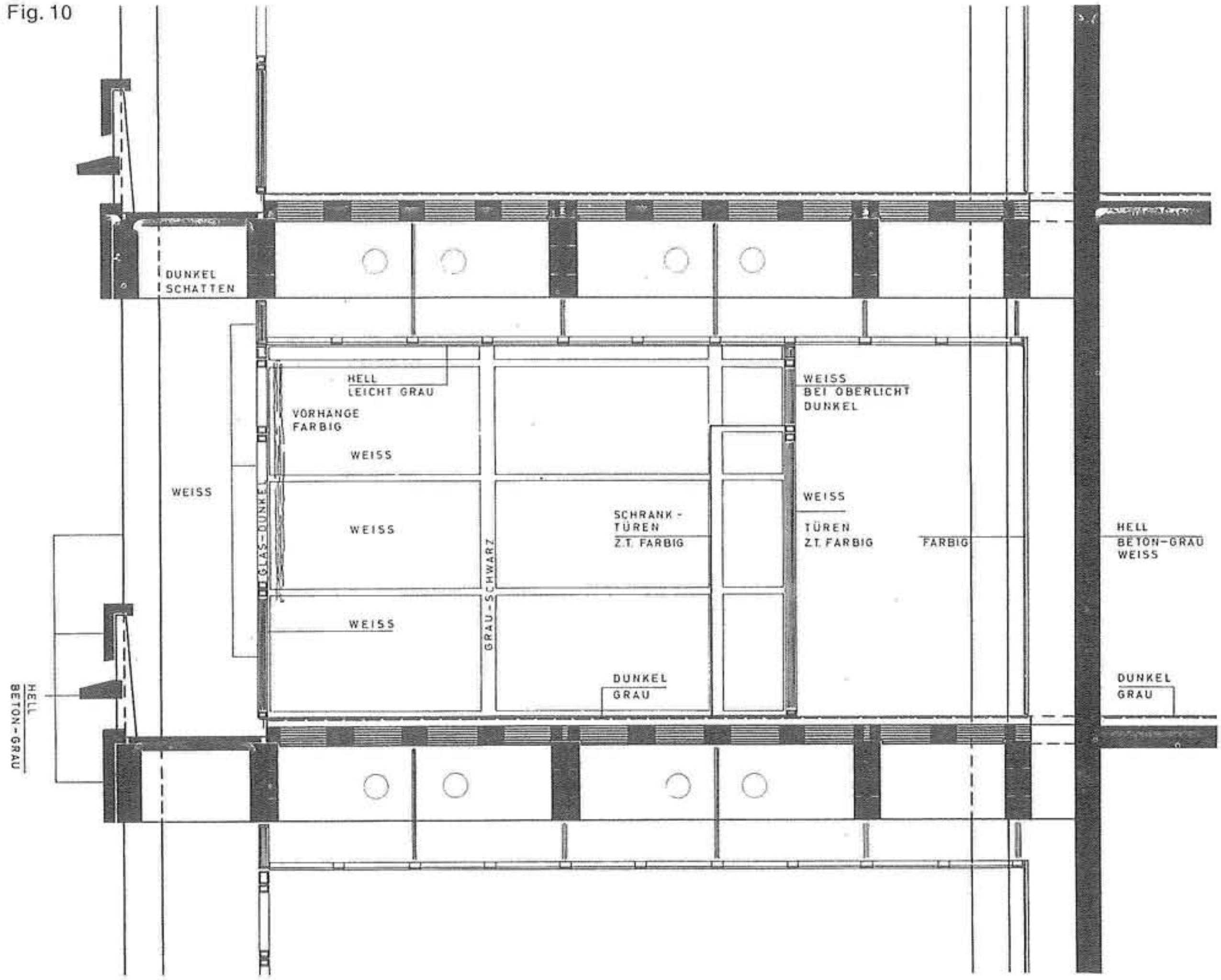
Fig. 8



on all other elements at the connections leads to a shortening of the normal element (Fig. 7). This does not change, even if the grid-axis lies on or alongside the material-axis. The result is that the material must have its own area within the grid, which leads to a tartan grid. Squares surrounded by crossing bands are created. The overlapping areas provide the nodal points for the wall elements.

Supporting framework: Once the absolute separation of the supporting structure from the climate screen has been decided upon, the framework type of supporting construction becomes unimportant and the basis for planning reverts to the space-dividing, non-supporting elements. The tartan grid then becomes the primary grid; the constructional grid must be separated, otherwise once again the wall elements would have to be shortened. The columns are, therefore, set within the square rather than the band (Fig. 8).

Fig. 10



Interchangeability of walls: Interior and exterior walls must be developed together so that they are interchangeable. They will of course have different material properties: the outer is needed for weather protection, the inner more for noise protection between rooms, but this does not prohibit a co-ordination of the construction principle and the dimensioning.

Three dimensional grid: The three dimensional grid is similar in its unit to a table: four legs and a top. This results in doubling and quadrupling of columns in certain situations. At first glance, the clustered columns seem superficial, but in point of fact they make engineering sense, and allow for wall elements to be built in between, for expansion joints where necessary on longer buildings and for addition and subtraction of built areas, which is the wit behind this system (Fig. 9). The tables are stackable, connectable in any direction. They can be left out to accommodate vertical circulation space or interior courts, as each unit is structurally complete in itself.

The continuous concrete balustrade can be attached to the outermost columns of a building and is easily dismounted in the case of necessary extensions (Fig. 10). The separate system of outer walls is set back from the columns, creating a narrow balcony or walk-around on each floor. This gives shade from the strong sun in the summer, but also doubles up as a fire-escape, thereby saving additional interior and exterior staircases.

With this system, the site arrangements can be much more interesting than the usual outcome of parallel blocks for other systems (Fig. 11). Better interrelationships between buildings are possible and indents, interior courts, L-turns, etc. make a higher concentration with sufficient daylighting and privacy feasible (Fig. 12). Further advantages include better use of available land, shorter pedestrian ways between departments, integration of indoor and outdoor space, and indeed a more human environment than has been achieved in the German university building systems to date.

The Marburg system was developed out of an architectural competition, held in Germany between September 1962 and March 1963. The test building

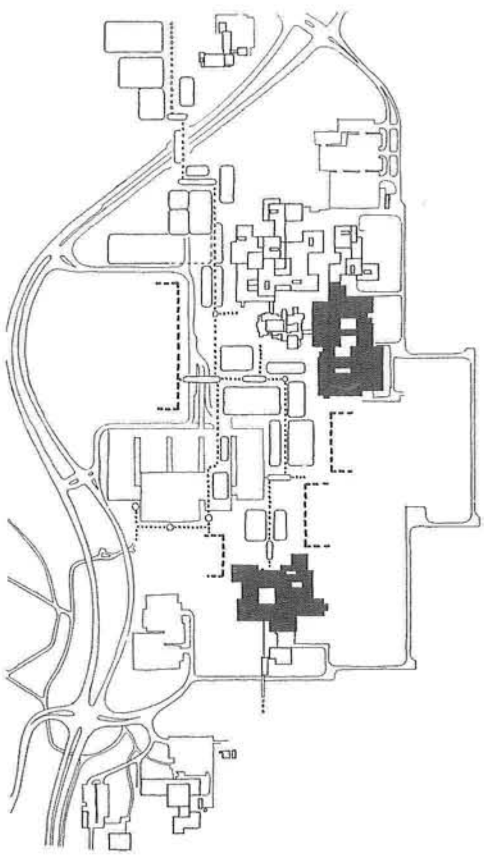


Fig. 11: University of Marburg site plan

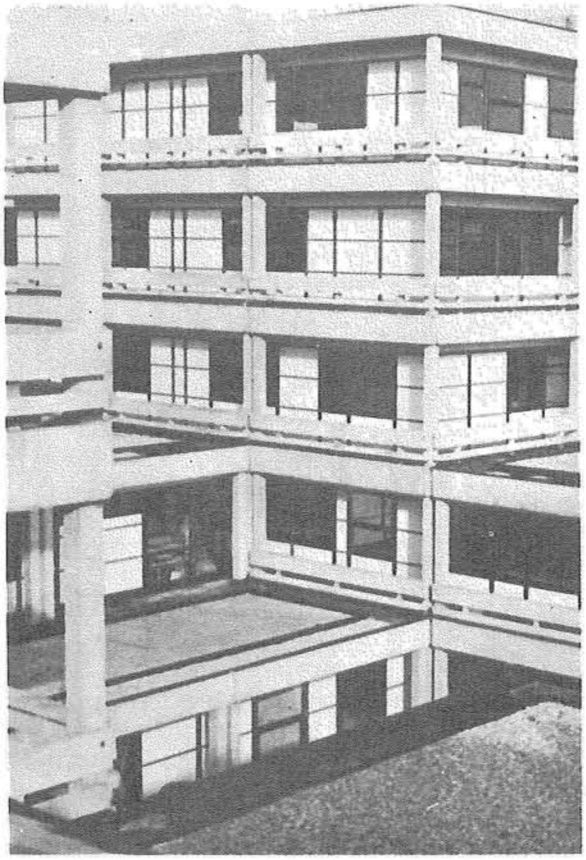


Fig. 12: Part of Natural Sciences Building at Marburg

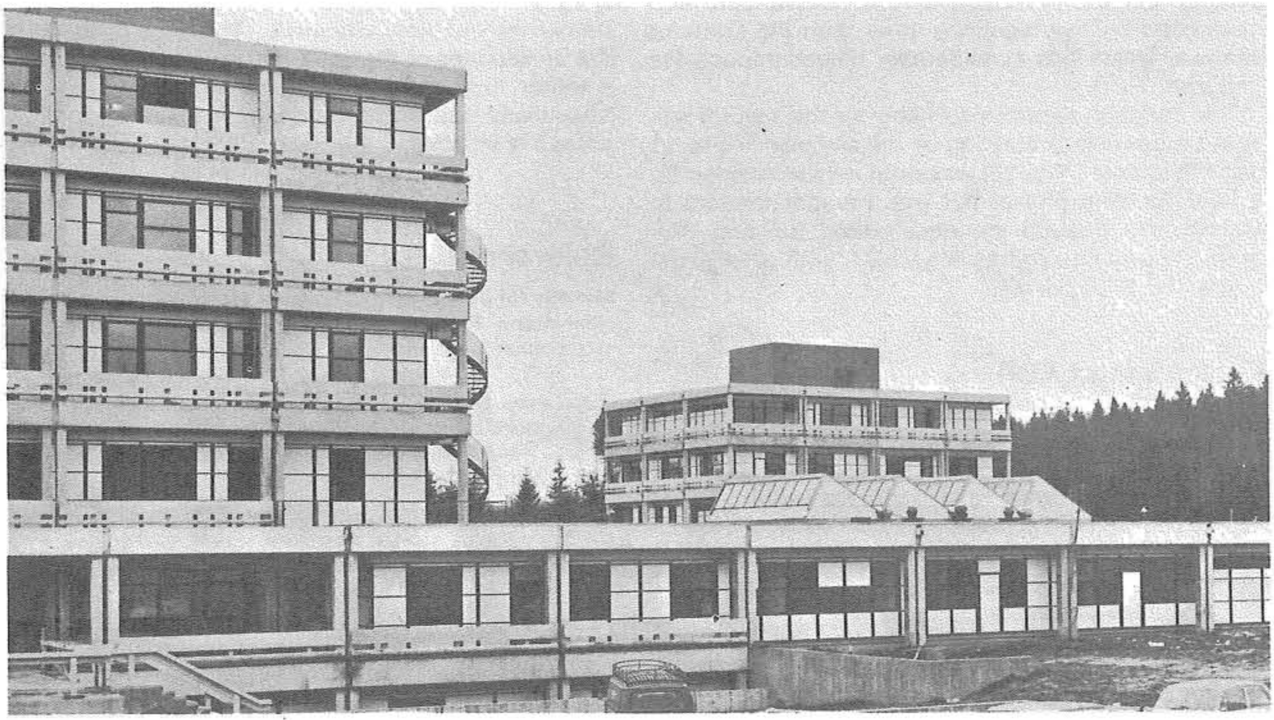


Fig. 13: Marburg University

Table 2
ACCELERATED BUILDING PROJECTS,
ACCORDING TO UNIVERSITY DEPARTMENTS, 1970, WITH AVERAGE UNIT COSTS PER M^2 & PER WORK SPACE

Number of Projects		Department	Additional m^2 area	Space work spaces	Total costs $ mill. approx.	$/$m^2$	$/w.s.
30	1	Maths. & Natural Sciences	96,610	10,745	73.9	717.83	6454.13
4	2	Engineering Sciences	12,490	850	11.9	896.77	13166.73
10	3	Medicine & Pharmacy	20,267	2,212	25.0	1158.12	10611.58
2	4	Veterinary Surgery	5,900	196	3.0	476.69	14349.49
31	5	Arts & Sciences	59,713	11,027	35.9	563.63	3052.17
6	6	Law, Economics & Social Sciences	17,716	2,794	8.9	468.85	2972.89
1	7	Agriculture, Forestry & Ecology	1,056	40	1.2	1035.75	27343.75
8	8	Common/Central Facilities	29,203	4,550	30.0	964.63	6191.24
1		8.1 Computer Centers	6,500	1,500	12.7	1826.92	7916.67
1		8.2 Canteen	600	—	0.4	726.56	
5		8.3 Multipurpose Buildings	22,103	2,700	16.1	683.02	5591.38
1		8.4 Other	—	350	0.8		2178.57
92		Total	242,955	32,414	189.8	732.86	5493.10

was started in November 1963, and the first prototype was ready for use in 1964. Since then, the basic system has not changed, but has been refined over the years. The development of the system was done under the supervision of the design office of the Marburg university architectural and building team (all civil servants). However, after the first few buildings had been erected the construction firm MAN took over the overall production and put the Marburg system on the general market. Schools, offices, workshops, etc. have been built in locations other than the Marburg campus, which has considerably helped reduce the unit cost.

The common facilities building for the natural sciences (upper black building on the site plan — Fig. 11 and photo detail Fig. 12) was originally scheduled for a later building phase, but was brought forward to March 1970 through the Accelerated Building Program. It was finished by May 1971, with a unit cost figure of c. $540 per m^2.

Evaluation of ABP

One disadvantage to the quick decision and allocation within the ABP is the one-sidedness of the program towards 'teaching' facilities. Research and Administration buildings are played down and the latter is conspicuous by its absence in Table 2. Another disadvantage is that although the Federal 50% seems high (for countries where universities are not all publicly owned), the States or *Länder* must bear the costs of land acquisition, infrastructure and maintenance costs. With the preparation of funding possibilities and the erection of the building, all is not accomplished. Landscaping, integration into the community, and programming learning for new environments need to be carried out simultaneously. The main problem for the universities of the Federal Republic of Germany is whether they can keep abreast of the students, academically and organizationally, as well as their increase in number.

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