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Profiles are presented of several vocational-technical schools and colleges designed to provide large, flexible, well-equipped, comfortable, efficient, teaching and learning spaces. Each demonstrates a conscious effort to fulfill the following requirements--(1) a logical relationship between classroom instruction areas and shop or laboratory spaces, (2) an overall plan that emphasizes the comprehensive nature of the school and encourages a mixture of students in widely diverse programs, and (3) attention to aesthetic considerations in an effort to create an environment that dignifies occupational education. Schematics and photographs are included with evaluations of the schools in relation to the programs for which they were planned. (FS)

Profiles of significant schools

On the way to work

Five vocationally oriented schools

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On the way to work

Significant currents in the mainstream of social evolution tend to effect change on many levels, altering conservatives as well as liberals, objects as well as attitudes, schools as well as education.

During the last two decades in the United States, one of these major currents—a movement toward greater equality among men—has acted not only as a force for racial justice, but as a kind of ideological nervous system, setting off alarms wherever and whenever an increasingly crowded and technological society felt itself slipping toward dehumanization.

Education, of course, has been a particularly sensitive area. The problems of racial integration could be seen as symptoms or manifestations of a more elemental force that demanded dignity for all students, regardless of aptitude, economic condition, or academic proclivity.

Simultaneously, the trend toward equality began to erode one of society's most solidly entrenched forms of segregation: the separation of academic and vocational education into superior and inferior disciplines.

Vocational education responded enthusiastically to this encouragement. Emerging from its long tradition of impotence, it shed the trappings of second-class citizenship with a spate of creativity and a very practical series of efforts—architectural and otherwise—aimed at preparing its facilities to meet the challenges of the future.

The efforts came none too soon. Our country's economic base has shifted away from a blue-collar orientation. Two-thirds of the labor force are already engaged in the production of services, rather than the manufacture of goods. The demand for trained technicians vastly exceeds the supply. Additional opportunities for unskilled and semi-skilled workers, says the U.S. Labor Department, are almost nonexistent. And education, according to the 1968 report of the President's Advisory Council on Vocational Education, has been slow in meeting the challenge.

About 54 per cent of all high school graduates go on to college. Of the rest, most of whom will be thrust directly onto the labor market, only a fifth will have been equipped by trade and industrial courses to work at a craft or white-collar job.

Even when a high school does offer vocational education, programs are too often limited in scope. Approximately half of the schools scheduling trade and industrial courses offer four programs, or less, and these are usually limited to a single occupation.

Although women constitute a third of the country's labor force, most of the few useful occupational programs available to them are offered only by proprietary schools.

Occupational training does not respond sensitively enough to the forces of supply and demand. We are training students for unimportant, irrelevant, or outdated occupations. Or—just as futilely—we are giving workers narrow skills that cannot be adapted to other demands.

The latter mistake is particularly culpable. We now know that the average wage earner makes six or seven separate job changes in his lifetime. Early in his education, he must develop the basic skills that will enable him to meet the demands of those changes.

Are educators aware of these problems? Exactly what steps are being taken to solve them? What is the status—socially, philosophically, and physically—of vocational education?

To answer these questions and report to the profession, Educational Facilities Laboratories asked educational consultant Jerome Harris to prepare a publication describing several outstanding vocational-technical schools and colleges.

As Mr. Harris' work progressed, it became obvious that some educators were not only aware of the problems, but were answering their challenge with a fertile multitude of plans, innovations, and experiments.

In the spring of 1968, EFL invited a group of educators and architects to a conference that, it was hoped, would bridge the gap between abstract and concrete developments Each of the 10 men who attended the meeting was deeply involved in probing new approaches to occupational education.

William E. Blurock, head of the architectural firm of William E. Blurock & Associates, Corona del Mar, California, was responsible for the design of the new Southern Nevada Vocational-Technical Center, an exclusively vocational school in Las Vegas. Planned to accommodate both secondary and post-secondary students, the school represents a growing, changing educational program housed in a modular structure.

George Champion, director of the Center for Technological Education at San Francisco State College, Daly City, California, was engaged in trial runs of the "Richmond Plan" of preengineering technology in some 40 San Francisco Bay area schools.

Amo De Bernardis, president of Portland, Oregon's, new Portland Community College, was the prime mover in planning that school, a post-secondary institution that offers education in dramatic physical style: open, active, and almost self-contained; a one-stop educational shopping center.

Louis J. Kishkunas, an assistant superintendent in the Pittsburgh, Pennsylvania, school system, was responsible for that city's progressive program of vocational and technical education.

Frank M. Mitchell, the assistant superintendent of secondary schools in the Borough of Etobicoke, Ontario, Canada, had recently opened the Martingrove Collegiate Institute, a conventional but extremely well-organized and truly comprehensive public secondary school near Toronto.

Clinton Mochon, a partner in the architectural firm of Schutte-Mochon, Inc., Milwaukee, Wisconsin, had helped plan the Kenosha Technical Institute, a new two-year post-secondary school in Kenosha, Wisconsin. Internally linked with a well-planned, uncluttered network of television-oriented facilities, the school is the result of a searching reassessment of educational theory, and offers training for many new occupations.

Keith W. Stoehr, director of the Kenosha Technical Institute, had played a vital role in predesign research and in planning the school and its programs.

Robert E. Pruitt, superintendent of public schools in Quincy, Massachusetts, was a principal planner for the Quincy Vocational-Technical School, a vocational "twin" joined to a traditionally academic public high school in that city.

Thomas F. Zuck, director of occupational programing and vocational education research in the Compton Union High School District of Compton, California, a community contiguous to Watts, was working on programs that employed vocational training in social rehabilitation as well as in career-oriented education.

Marvin Feldman, program officer of the Ford Foundation's Public Education Program, was and is deeply concerned with the emergence of occupational education as a significant element in social change

While the educational programs represented at the meeting often differed substantially in style and content, the men who deliberated on them agreed—often strikingly—on objectives and philosophy. This was particularly evident when, toward the end of the meeting, EFL President Harold Gores suggested that each of the men at the conference table predict the shape of occupational education 10 years hence. The following points summarize their sentiments, hopes, warnings, and dreams about the future of vocational education:

□ Children should be introduced at an early age to the realities of wage earning, to ideas about working for a living. Exploration of the various aspects of commerce and industry could provide elementary school students with such an introduction.

By the time they reach junior high school, a more sophisticated prevocational program should expose youngsters to the full range of occupational choices that will eventually be theirs.

Students thus will be able to establish a relationship between education and the adult world Further, they will be equipped to make not a premature commitment but an intelligent choice.

Steps taken toward such an occupational orientation in various schools throughout the country indicate a definite trend away from the traditional insularity of pure academicism. Field trips to local industrial plants, documentary film screenings, model demonstrations, and other coordinated exposures to the practical applications of classroom theory can help expand student comprehension of the workaday world

□ An occupational commitment should be implicit in every student's secondary school program. Toward this end, an increasing number of schools are preparing their students to elect, by the time they reach the 11th grade, one of three occupational alternatives: college entrance, post-secondary training, or a beginning job The decision need not be final.

In fact, the school is obligated to guarantee that no one is locked into an unalterable life-course by a single, irrevocable decision Training programs arranged in career-ladder style, just as many occupations actually are, introduce the student to several related jobs. The hierarchy of training permits him to "spin off" at any level with marketable skills, and perhaps return later to pick up more or refine the ones he has.

□ An interdisciplinary approach to education should be introduced at the secondary level, combining English, mathematics, science, and a vocational shop, and relating practical training to academic subjects.

A developing concept of team teaching, which combines the traditional disciplines around a vocational shop program, the "Richmond Plan" of pre-engineering technology is being used in many schools. Under the plan, a study of the inclined plane would involve an actual model built in the shop, followed by applications of its principles in mathematics and physics classes and writing about it in English courses.

□ All technical-vocational programs should incorporate relevant part-time work experience no later than the 12th grade. In some cases, particularly those involving needy students or potential dropouts, it should be introduced earlier.

What students *do* is more important than what they *earn*. The best work-study situation at the secondary level involves a group of students, accompanied or very closely coordinated by a teacher, working at jobs directly related to their in-school training.

□ School planners should enlist the aid of advisory groups from local industry and labor in developing vocational programs and designing technical facilities. They constitute a vital link to the life and needs of the community.

□ Schools are increasingly obligated, not only to equip a vocational student with marketable skills, but to place him in a job. The situation is directly comparable to a school's responsibility for assisting students seeking admission to college or other post-secondary schools. Follow-up is of critical importance in assessing the school's programs, as well as in determining student progress and problems

□ Conventional scheduling practices cannot cope with occupational education's demand for nearly continuous utilization of staff and facilities. More and more, the customary school day and year are being discarded in favor of systems for allocating time according to student needs. This is particularly appropriate in part-time programs or programs leading directly into full-time employment. The school must be organized as a service operation in which the conventional term, and even diploma, become irrelevant, subordinated to other needs.

□ The comprehensive high school should offer broad options for progress toward occupational objectives. These objectives may be realized at the secondary level or deferred until post-secondary school or college. In this context, schools are discovering that individual guidance, rather than pigeonholing, is essential to avoid sharp separation of academic and vocational programs.

In rejecting such mutual exclusivity, it is not to be assumed that all pupils will take a basically academic sequence of courses. The correct approach becomes a matter of emphasis.

□ When high schools and junior colleges serve the same community, they should be closely articulated. Artificial distinctions between secondary and post-secondary occupational offerings are gradually disappearing. An increasing number of qualified 11th and 12th grade students are permitted to take community college courses.

□ School operating plants should be used as part of the occupational training facilities. The heating plant, food service facilities, the bookstore, the business office, the instructional materials department, and even campus landscaping can be utilized in work-study situations.

□ The design of occupational education facilities should anticipate frequent physical changes as new career opportunities evolve and educational approaches shift.

The concept of flexible facilities is not new. Although vocational education—dormant in its second-class state for so many years—was slow in applying such elements as demountable walls, operable partitions, plug-in utility units, movable seating, and modular building systems that permit economical and quick change as well as spatial expansion, the ideas were at hand, only waiting to be used.

Now, at last, they are. And in some instances, the designers have carried flexibility to its outer limits. The best shop or training space thus becomes a large open area with an adequate power supply, flexible lighting, and effective (often mobile) acoustical and visual equipment.

Many of these ideas are exemplified in the five case studies which follow. Each represents a different approach to the housing of vocational curricula.

They do, however, have this in common with any good educational facility: they are large, flexible, well-equipped, comfortable, efficient teaching and learning spaces. And beyond that, each demonstrates a conscious effort to fulfill these three requirements:

1. A logical relationship between classroom instruction areas and shop or laboratory space.

2. An over-all plan that emphasizes the comprehensive nature of the school and encourages a mixture of students in widely diverse programs.

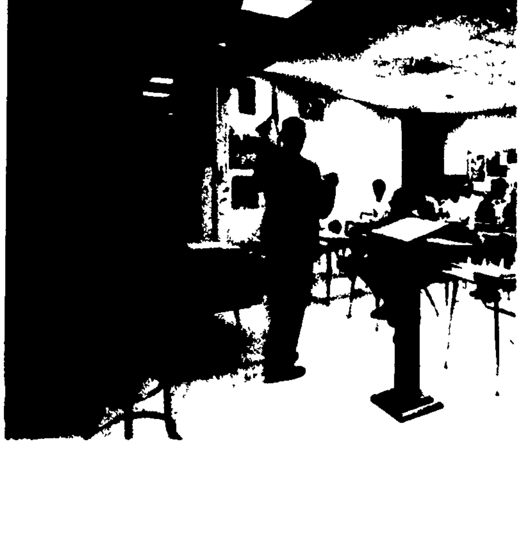
3. Attention to aesthetic considerations in an effort to create an environment that dignifies occupational education.

Breaking Into The Box

Kenosha Technical Institute, Kenosha, Wisconsin

The challenge:
To design a technical institute that functions as a coherent unit, rather than as a group of independent occupational training centers

The solution:
An inward-looking, television-linked break with the concept of clustered, teacher-oriented classrooms adjoining their own shops and laboratories.



When the thoughtful administrator undertakes planning for a new educational facility, he does a lot of homework. Keith W Stoehr, director of the Kenosha Technical Institute, and Jack Banerdt, his assistant in charge of research and development, read widely, performed research, and visited vocational schools across the country for many months. When they had finished, they decided that they knew no more about the shape of the school they needed than they had before they started.

"Education," said Mr. Stoehr, "and vocational education in particular, seems to be full of platitudes. We saw lots of things that, at first glance, seemed to be new In reality, they were just the same old ideas gift-wrapped in fancy packages I have nothing against old ideas—provided they work. Most of what I saw, however, just didn't work well enough."

The Kenosha administrators decided to reinvent the occupational school. Working with faculty committees, and eventually with a sympathetic architect (Clinton Mochon of Schutte-Mochon, Inc., Milwaukee), they started with a clean slate and began writing specifications on the basis of their own requirements.

Along the way, they had to combat some of the misconceptions about occupational education. The first to be assaulted was the one that other innovative planners had already encountered, i.e., that vocational education is somehow second-rate, and that its students are likewise substandard.

Kenosha's approach to a school that would meet the aesthetic and psychological needs of its students turned out to be a kind of educational shopping center.

Climate, of course, was the major factor in directing the designers toward an inward-looking school. In fact, Kenosha winters are so severe that heat lamps have been installed over the front entrance of the school to keep it clear of ice.

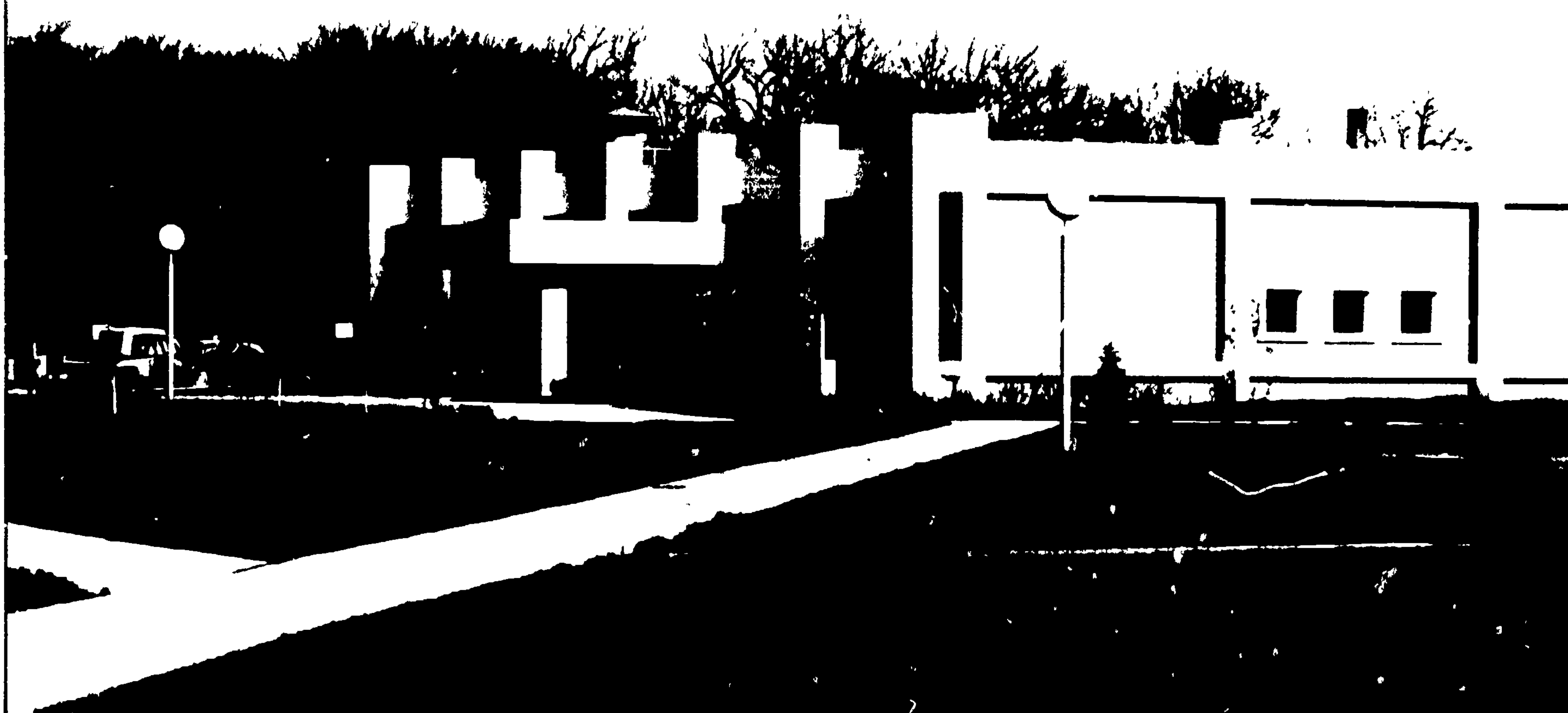
It seems obvious that inward-looking structures tend to induce claustrophobia in their occupants. To counteract that tendency, the architects gave the enclosed walkways an open feeling by installing 6- by 9-foot mirrors at the ends of corridors and by enlivening building entrances with glass and indoor gardens Glass panels large enough to offer relief from the enclosed spaces open classrooms to the view of people passing in the halls. Children from the elementary schools are often taken on guided tours of the Institute. And on the second story, glass skylights help illuminate halls as well as stairwells.

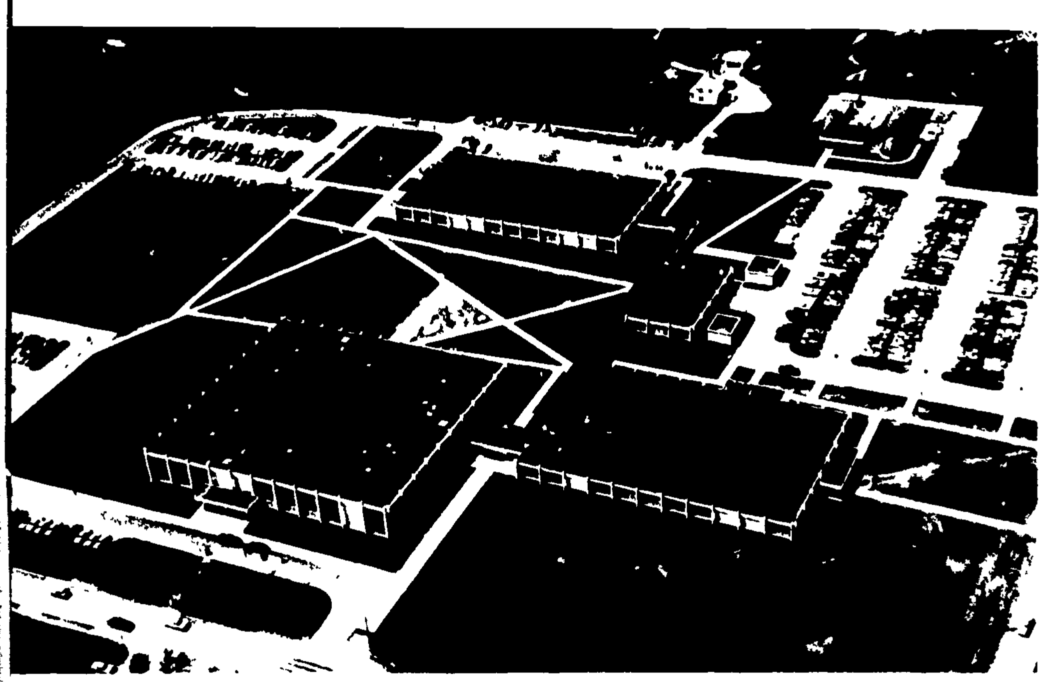
Throughout the building, light colors help to compensate for windowless walls. All walls are eggshell white (vinyl simplifies maintenance in the corridors), but blue, green, yellow, and orange-red doors stave off monotony. Further, instead of hanging flush with the corridor walls, like a dull row of empty picture frames, pairs of doors are frequently set facing each other in triangular alcoves off the hal' . thus providing visual variety and reducing congestion during class changes.

Another concept that Kenosha Technical Institute's designers examined closely and discarded was the one that sanctifies the rectangular classroom with a teaching station located along a short wall. Although rectangular classrooms were used, most teaching stations were moved into corners and many learning spaces made wedge-shaped, thus improving sightlines, increasing seating space, and facilitating combination with adjoining rooms.*

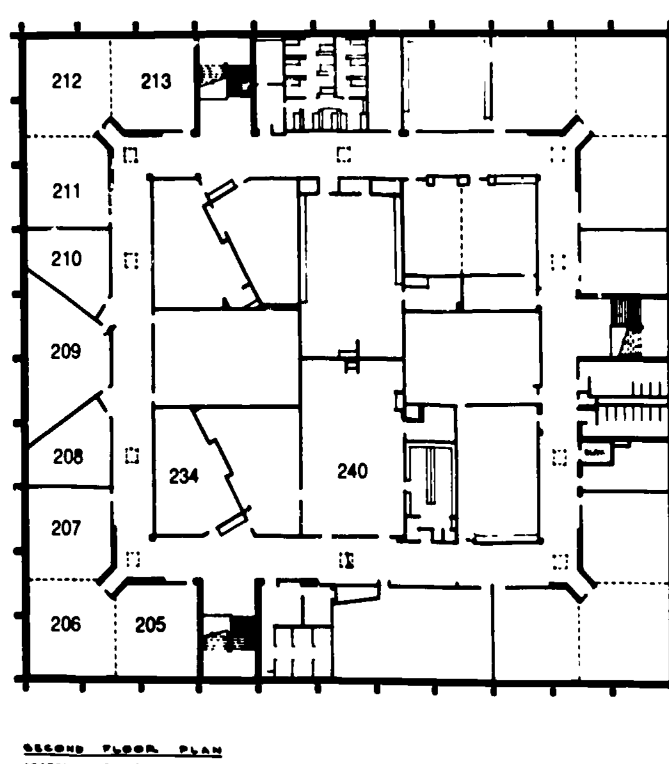
The academic building's seven "corner rooms" are particularly useful. An L-shaped group of three rooms, divided from each other by sound-resistant accordion-fold walls, they can be opened up for large-group instruction (each combination has a seating capacity of 105) or employed separately for 35-student classes. A teacher standing in the interior corner of the middle room can be seen and heard by all students. The ceiling treatment in these rooms changes from sound-absorbing tile over

*For an expansion of this concept see *Design for ETV, Planning for Schools with Television*, EFL, 1960.



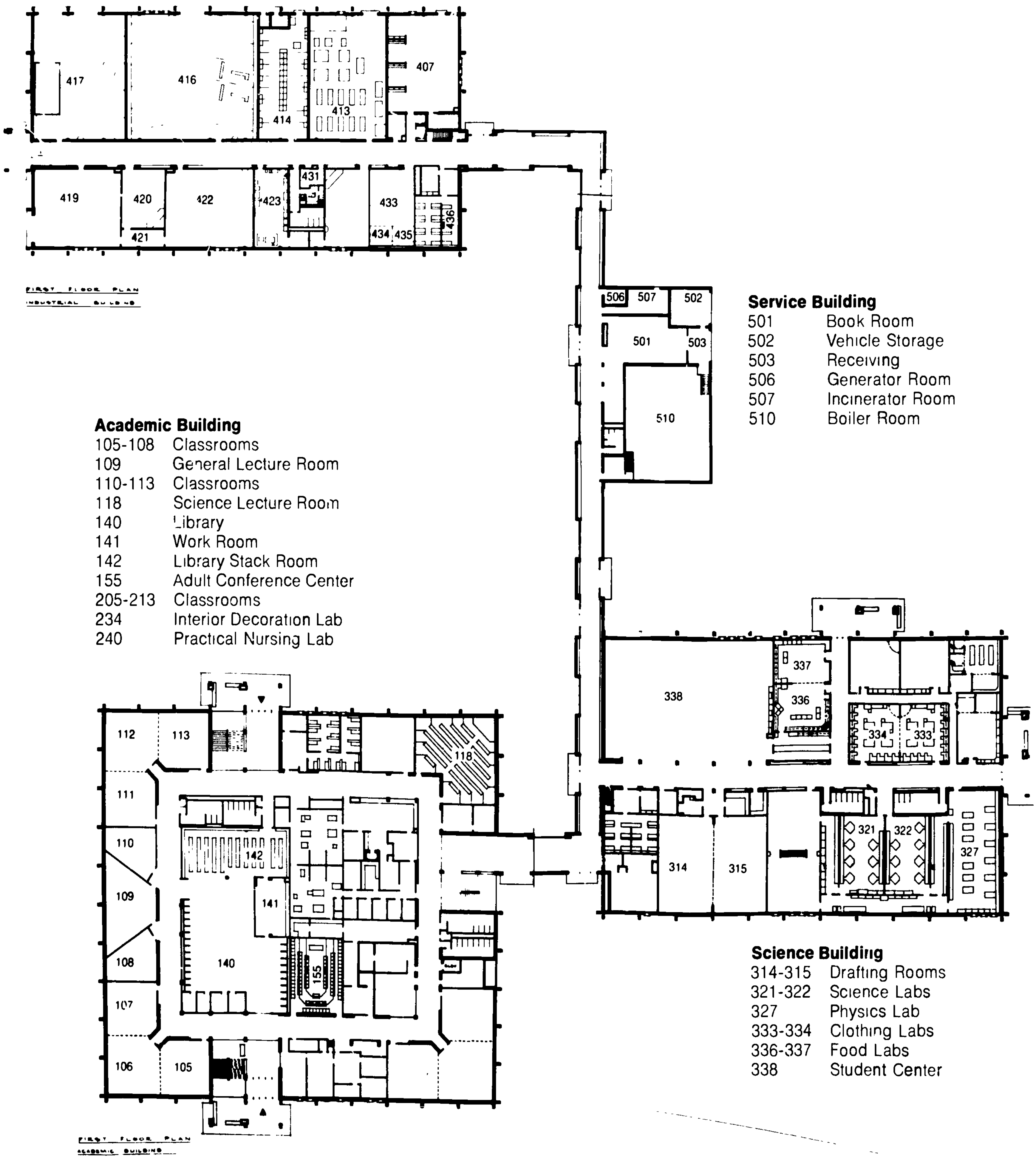


Academic Building
Second floor plan



Industrial Building

407	Const. Trades & Apprenticeship Lab
413	Machine Lab
414	Welding Lab
416	Auto Mechanics Lab
417	Auto Body Lab
419	Fluid Powder & Maint. Lab
420	Classroom
421	Storage
422	Fluid Powder & Maint. Lab
423	Material Testing
431	Conference Room
433	Apprenticeship Lab (Primarily Serving Barber, Cosmetology, & Classroom Activities for Machine Apprentices)
434	Cosmetology
435	Barber
436	Planning



Service Building

501	Book Room
502	Vehicle Storage
503	Receiving
506	Generator Room
507	Incinerator Room
510	Boiler Room

Academic Building

105-108	Classrooms
109	General Lecture Room
110-113	Classrooms
118	Science Lecture Room
140	Library
141	Work Room
142	Library Stack Room
155	Adult Conference Center
205-213	Classrooms
234	Interior Decoration Lab
240	Practical Nursing Lab

Science Building

314-315	Drafting Rooms
321-322	Science Labs
327	Physics Lab
333-334	Clothing Labs
336-337	Food Labs
338	Student Center

most of the surface to sound-reflecting tile over the teaching station.

Corner teaching stations have necessitated custom cabinetwork in many classrooms—corner-cupboard style storage units that combine open shelf space with lockable storage And even the cupboard doors are utilized They are faced with double-hung vertical boards, one for chalk, another for push-pins. The omnipresent television set stands behind these boards and can be exposed by lowering them. In some science and math rooms, chalkboards are painted with permanent grids duplicating those on plastic laminate table tops

Flying in the face of contemporary trends, the Kenosha planners took a close look at fixed-versus-movable seating and found that the former is often desirable, especially when a classroom floor is tiered to form a teaching "theater" The result: two tiered classrooms with fixed seating; one used as a science demonstration center, the other employed for teaching other subjects that might require demonstration techniques

Perhaps the most significant departure from conventional theory was a reassessment of the idea that laboratories, classrooms, and workshops should be clustered according to subject, viz , all health occupation rooms in one area all teaching spaces pertinent to automotive programs in another, and so on.

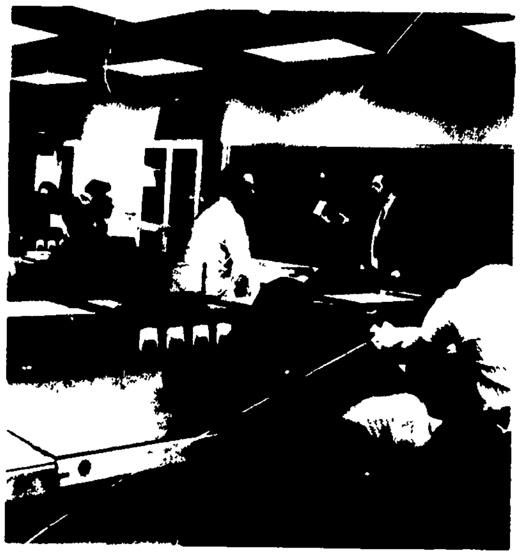
After examining that concept in detail, the planners concluded that subject-clustering causes wasteful duplication of facilities and retards or prevents the kind of mixing among students that they felt was vital to improvement of the image and philosophy of vocational education.

To overcome such clannish tendencies and encourage mingling of students, the administrators turned conventional design approaches upside down Instead of surrounding lecture rooms with workshops and laboratories, they located classrooms according to their mechanical and service requirements. Lab installations, for example, were made multipurpose, so that all students taking lab-connected courses, regardless of major, would use common laboratory facilities *

Similarly, the tiered science lecture room was fitted with mathematics as well as science demonstration equipment, so that it can be used for teaching both subjects. The marketing and practical nursing laboratories were placed back to back, not for academic reasons, but so that they may share a common power and plumbing installation.

Closed-circuit television is also a unifying factor. Each classroom and work area is equipped with a receiver, and

*Teacher conference areas are also scattered throughout the school, a scheme that serves to move students into areas otherwise regarded as "off limits" there is even one in a corridor that functions as a student bulletin board There, televised messages can be held on the screen as long as they are relevant.



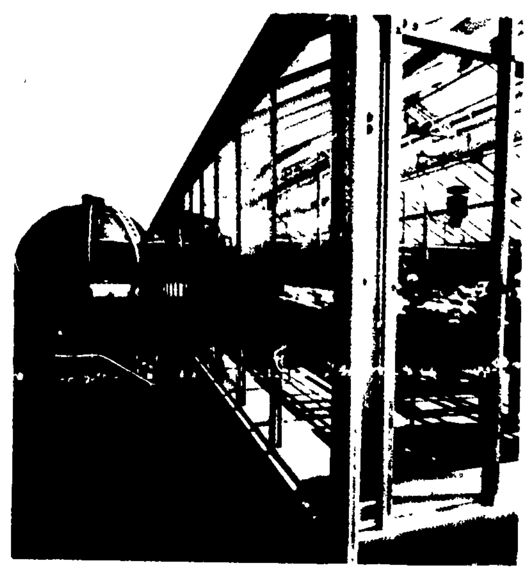
Television is so important at Kenosha Technical Institute that it became a vital core element very early in the planning Installed at a cost of some $175,000, the television system offers four channels Needless to say, it is in constant use Sometimes cameras are set up in a classroom to provide close-ups of a process, such as a dental operation, that all students can see without crowding around the instructor At other times, students in one room can watch live broadcasts from another area, and television tapes are often utilized to illustrate lectures Study carrels in the resource center are tied directly to a videotape circuit that enables individual students to view lectures and demonstrations at their own convenience.

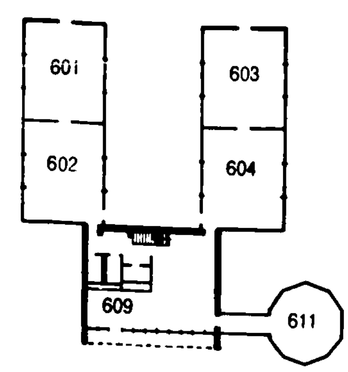
Because audio-visual aids, and television in particular, are so important in the curriculum, all classrooms are equipped with a rheostat, so that illumination may be reduced without plunging the room into total darkness. The lack of exterior windows simplifies projection techniques. Windows to the corridors are easily blocked out with roll blinds.

Several other factors in Kenosha's design and functions are worthy of mention:

- A 400-seat amphitheater, scooped out of the earth between the industrial and academic buildings, answers the once-a-year need for an auditorium. Since television seems adequate for every occasion save commencement, the open-air bowl saves money and lends grace to a most important annual event

- A full-sized horticultural center, comprised of a retail florist shop, four thermostatically controlled greenhouses, and a clear-domed conservatory, supplies offices and public areas of the school with fresh flowers, serves as a groundskeeping and landscaping center (run by students), and provides horticulture trainees with a first-class laboratory *





Horticulture Center

601-604 Greenhouses
609 Florist Shop
611 Conservatory

*A regional florists' association was so impressed with the center that it plans to hold its next convention on the campus, an educational bonus for Mr Stoehr's attempts to unite student and business communities in an atmosphere of mutual respect

☐ Architecturally consistent concrete cubes, decorated with pierced concrete blocks, house above-ground generators that would otherwise mar the appearance of the campus

☐ A wooden wall in the physics lab affords teacher a place to hang pulleys, weights, and other demonstration equipment, and planners have taken advantage of the room's tile floor to inlay a metric scale there in bright colors.

☐ A hydraulic lift, located at the school bookstore's delivery door, enables clerks to receive heavy materials directly from truck tailgates and lower them easily to ground level, where they can be moved inside at the convenience of school personnel

Safety—always an important factor in a school, but especially vital in a vocational facility—is accorded high priority Because the structural design is largely horizontal (only one of the buildings has two stories), fire codes did not require a sprinkler system. But there is a direct alarm connection with the nearest fire station, and the state's civil defense alert system is tied into the school's closed-circuit television network.

Moreover, all laboratory and shop areas are equipped with emergency power cutoff switches, located in the same position near every door, so that there is no question of their whereabouts in any room Similarly, light switches are all located in the same relative position on door frames to eliminate fumbling and groping All laboratories are fitted with open emergency showers, and an abrasive surface has been laid on the fluid power lab floor to prevent slipping

Although security has not posed problems at Kenosha, the school can close off two corridors. The portable gates that serve this function are regarded more as safety factors than security assets, since they block off the industrial shop during social events when that area is not supervised by staff or faculty personnel

The fact that the school is populated during so much of the day—buildings remain open from 6 a m to 10 p m , and sometimes, for M D T A (Manpower Development Training Act) courses, until 2:30 a m —probably accounts for a lack of vandalism and theft

In general, the administrators find little fault with their new facility The important thing, they feel, is that Kenosha Technical Institute has broken the "box" concept of school design, and in Kenosha, at least, occupational education will never be the same old second-class, makework, dropout haven that demoralized several generations of American students and labor

Kenosha Technical Institute,
Kenosha, Wisconsin

Program:
Liberal arts, vocational, and technical courses offered in four basic approaches, i e , a two-year associate degree program, a one-year certificate program, various apprenticeship programs, and individual programs for continuing education High school students enrolled in evening courses and daytime introductory classes Recently, Kenosha added a summer program of pretechnical courses for high school students.

Vocational majors:
Accounting, aeronautics, automotive technology, aviation, court and conference reporting, data processing, fluid power, horticulture, industrial production, interior decoration and home arts and sciences, marketing, mechanical design, and secretarial science.

Physical plant:
School opened January, 1967, at cost of about $5 million for building and equipment Original size, 190,000 square feet An 18,000 square foot aviation center is scheduled for completion in the summer of 1969 Site covers 50 acres, 4½ of which are occupied by school buildings Approximately 2,500 students enrolled in associate degree and certificate programs. An additional 7,000 students are enrolled in continuing education classes.

Administrative source:
Keith W. Stoehr, Director, 3520 30th Street, Kenosha, Wisconsin.

Architect:
Schutte-Mochon, Inc., AIA, IP, 11121 West Oklahoma Avenue, Milwaukee, Wisconsin.

Radiated Unity

Martingrove Collegiate Institute, Etobicoke, Ontario, Canada

The challenge:
To build a truly comprehensive secondary school that does not segregate academic from occupational programs and students

The solution:
To centralize all general, commonly used facilities at the core of the school and allow specialized facilities to radiate from them

Often, when a large community recognizes its need for occupational education, its first step is the construction of a special vocational-technical school Most smaller communities, and suburban districts in particular, cannot justify a separate vocational facility because most of their student populations are thought to be college-bound. The problem is intensified by the fact that many middle-income suburbanites find it difficult to accept the possibility that their offspring might be most comfortable in an occupational program.

For such communities, the comprehensive high school offers a practical solution Not only can it meet most individual student needs without requiring a heavy financial investment in separate facilities, but it also avoids "stigmatizing" any youngster as a vocational major.

Martingrove Collegiate Institute, in Toronto's Borough of Etobicoke, is such a school The district educates 55 per cent of its students in vocational-technical programs

In Canada, the traditional college preparatory program begins in the 9th grade and ends with the 13th. Subjects taught in this 5-year program parallel those of 9-12 college preparatory programs in the United States The difficulty of grade 13 work in Canada, however, approximates that of first-year college work in the United States.

Formerly, Canada's four-year commercial program, offered as an alternative to the college preparatory courses, often became a dumping-ground for unruly students or those who could pretend no interest whatever in traditional academic work. As a result, the commercial program was little more than an expedient, keeping youngsters off the street until they reached the legal dropout age.

This discriminatory and wasteful approach to secondary education was overhauled in 1960, and a new program was designed to offer students a variety of educational options. The new approach divided secondary education into three main streams: business and commerce, arts and science, and science, technology and trades.

Each branch offered students the option of four- or five-year programs The five-year arts and science program is the traditional, college preparatory, diploma course of study The four-year arts and science program is less rigorous, leads to a certificate, and prepares students for (1) employment requiring broad general education, (2) community college work, and (3) specialized training programs

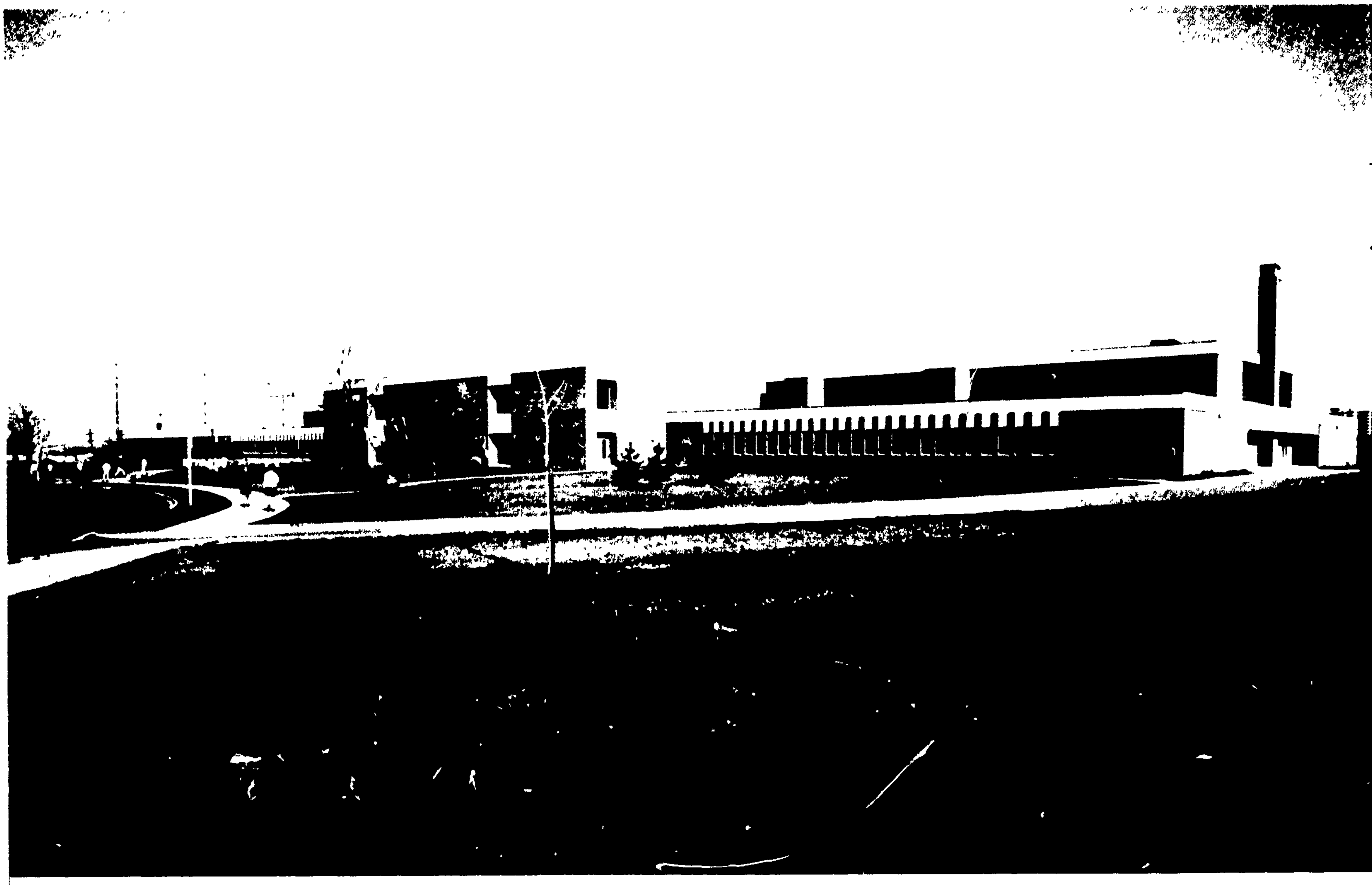
The five-year science and technical program combines a standard arts and science academic course with demanding and sophisticated technical-vocational courses. It leads to a diploma and qualifies graduates for regular university admittance, entry into advanced technical institutes, or jobs in business and industry The four-year program is less rigorous, leads to a certificate, and prepares students for post-secondary technical schools, trade apprenticeships, or lower-level technical jobs in industry.

All five-year students will share about 80 per cent of their academic work, as will all four-year students.

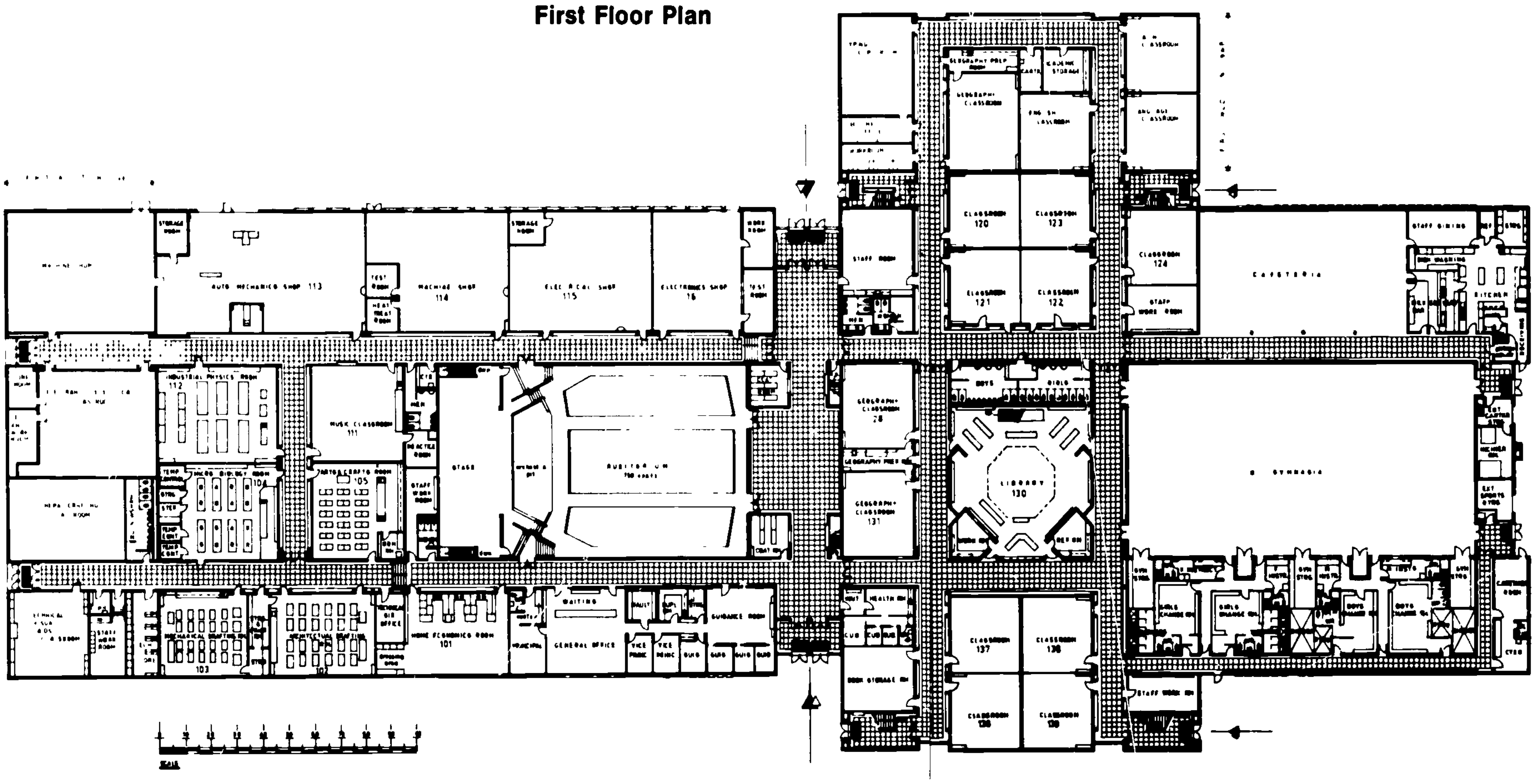
D. Ross King, the architect commissioned to design a comprehensive (or, as it is known in Ontario, a "composite") high school in Etobicoke, found himself bound by several limits. Not only would he have to accommodate three or four separate programs of study, he would have to conform to a variety of provincial and local regulations, specifying the kinds and amounts of space he could incorporate in his plan. For example, in 1968 all metropolitan Toronto schools were built to the following specifications:

They could include no more than 59 square feet of instructional space, 40 square feet of ancillary and administrative space (some of which could be interchangeable with instructional space), and 8 square feet of service space for each pupil. Administrators were required to determine in advance, using various charts and formulas exactly how many students the school would accommodate.

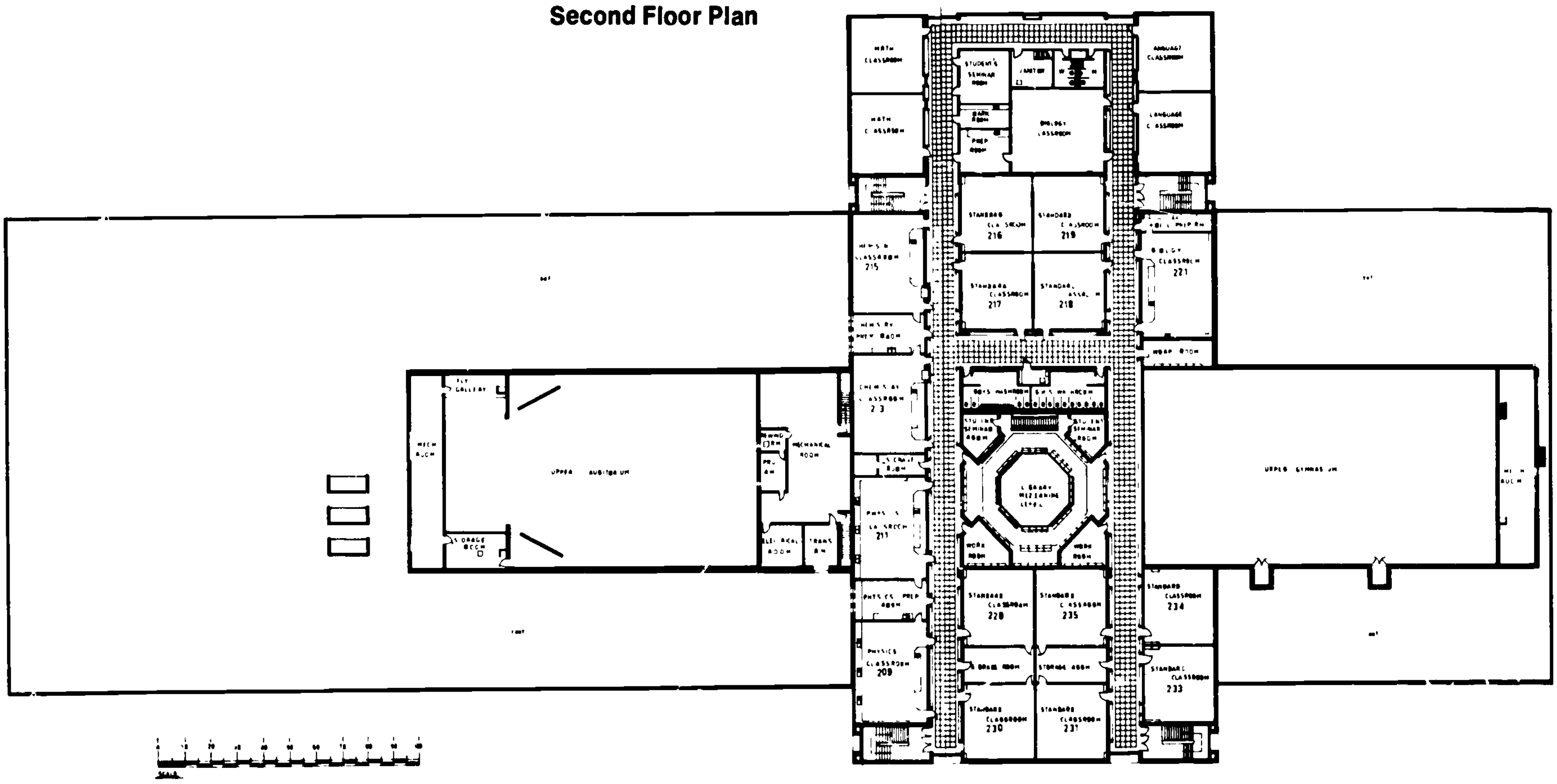
Construction costs were similarly fixed. No more than $24.35 could be



First Floor Plan

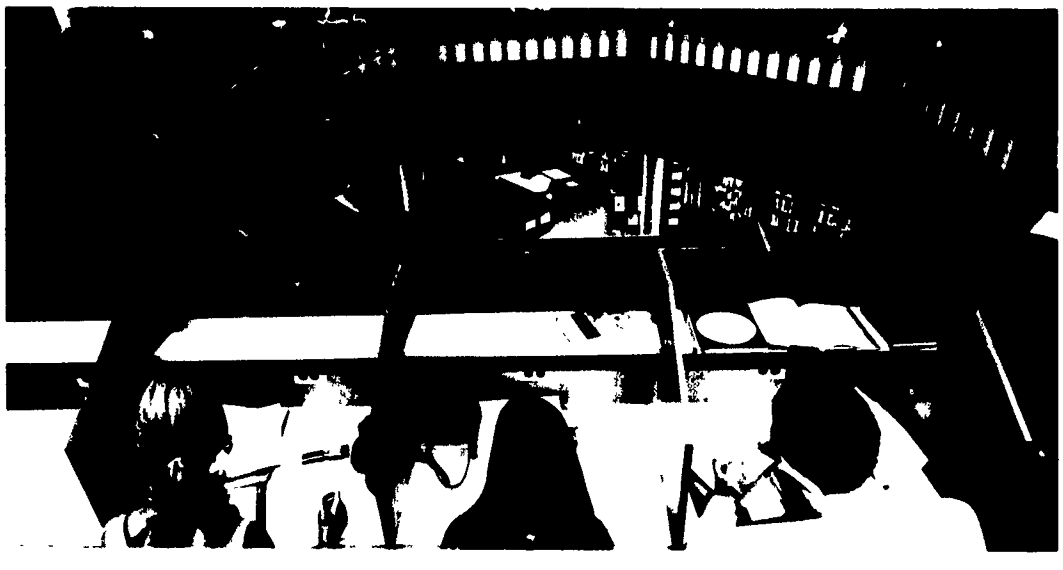


Second Floor Plan



spent per pupil, plus the architect's fee of 6 per cent, plus a 3 per cent contingency fee Audio-visual materials were figured on the basis of $80 a pupil, fittings allocated on the basis of $1,000 for each standard classroom, language laboratory equipment provided for a total of $2,000, and so on *

Although such methods may present obstacles to design and construction innovation, they also offer certain economic advantages to the taxpayer. For instance, the process guarantees that school costs and space will be linked with actual student head-counts, so that all schools will meet minimum standards and each construction item will be budgeted separately, thus preventing skimping in one area to obtain more money for another



*Since Martingrove was built, grants have been provided on a square-foot basis with a variable allowable area for each pupil, based on the type of school

One of the disadvantages of the system is its failure to provide for rapid growth of the student population, which is what happened at Martingrove. At this writing, student enrollment exceeds the capacity of Martingrove's Phase I facilities, forcing the school to accommodate the overflow in four portable classrooms.

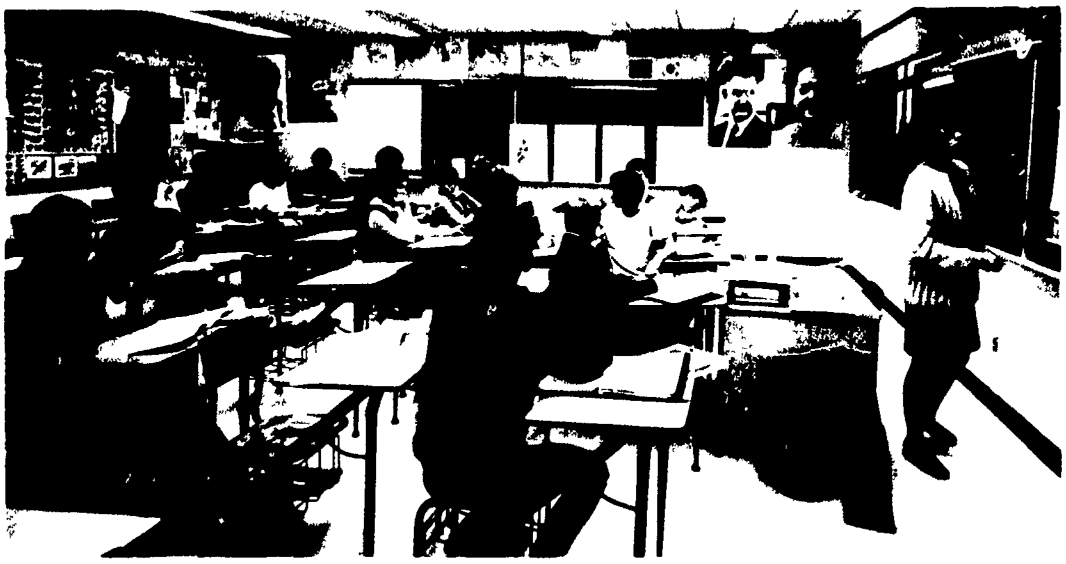
By making a commitment to creativity within this complex of restrictions, the architect was able to design a school that competes physically and aesthetically with any on the North American continent.

Architect King began with the premise that neither academic nor vocational, but *quality*, education was to be housed in his school And because 80 per cent of every student's day was to be spent at academic work, he decided to make the library the core—both physically and psychologically—of the entire design

Octagonal in shape and rising two stories high, the library is the most accessible place in the school. Students can enter it through eight doors, four on the first floor and four on the second. An interior stairway connects the two levels.

The second story, planned for student seminars and audio-visual aids, is a mezzanine rather than a full floor, and lends a feeling of spaciousness. Even the library's enclosed spaces—two student seminar rooms, three work rooms, and a reference room for audio-visual materials, all built into the corners of the octagon—look out onto the library through plate glass windows. Wholly carpeted in orange, lighted by a clerestory set into the cedar-plank ceiling, and ringed by pebbled concrete columns, the library suggests comfort, elegance, dignity, and quiet

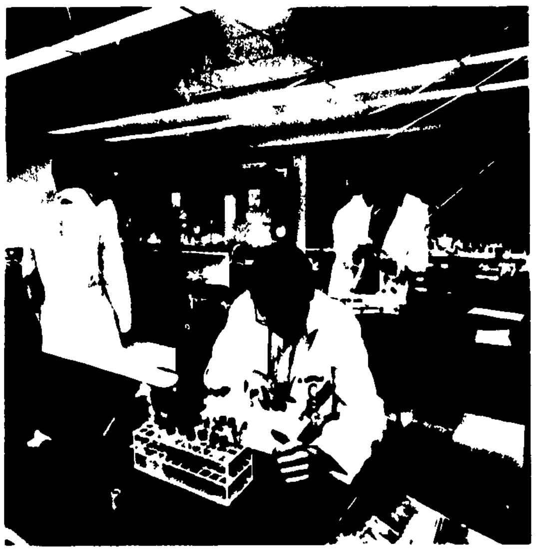
Academic classrooms and science laboratories surround the library in the rectangular, two-story central building. Here, five-year students mix for all subjects except vocational electives. Four-year students are also grouped together in the academic center, separating only for specialized courses such as shop or language electives.

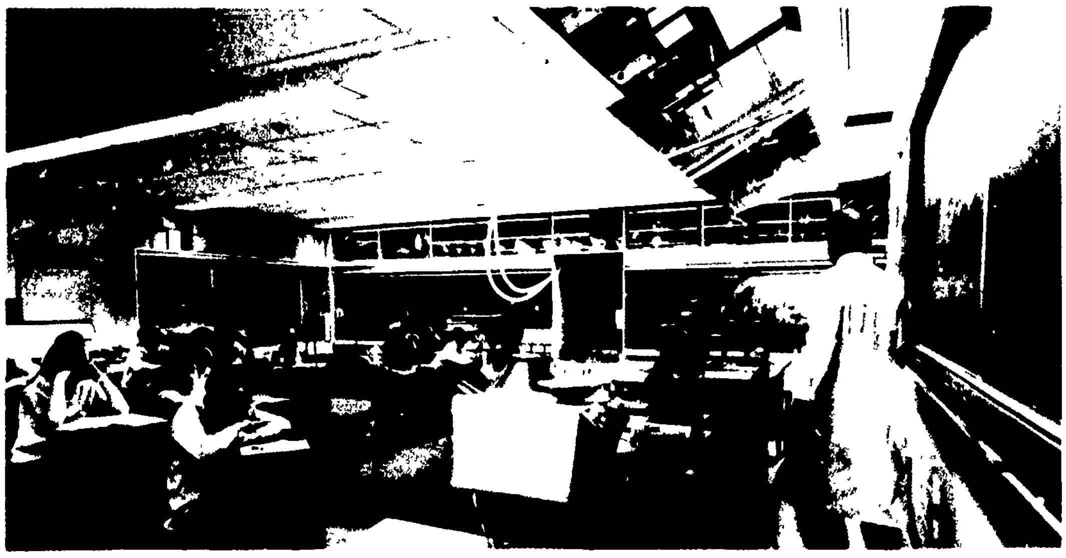


Only one group of four academic classrooms has been equipped with operable or demountable walls. Most class spaces are permanently divided into traditional square or rectangular shapes, but the partitions are not structural and can be removed.

It is worth noting that the standard classrooms at Martingrove are windowless. This feature reduces construction costs, discourages vandalism, and—most important to school administrators—facilitates easy use of audio-visual equipment.

For the arts and crafts room, however, the architect felt natural light was desirable, so provided another clerestory But even that can be darkened by vertically slatted venetian blinds.





Naturally, because so much of the school is windowless, it is completely air conditioned. Where windows are used, they begin 7 feet from the floor in order to provide maximum wall space.

The cost of wall-finishing was further reduced by dropping most ceilings to a height of 9 feet. In shop areas, where ceilings must be 14 feet high to clear equipment, the floor was lowered so that the school's exterior presents an unbroken roof line. Corridor walls are covered with embossed ceramic tiles of rich brown, an economical but highly attractive surface.

Specialized facilities are located in two single-story wings that flank the central building. The east wing houses the gymnasium, cafeteria, and food service rooms. Motorized folding walls can subdivide the gym into three smaller gyms, one of which is generally used by girls' classes Instructors' offices, shower-rooms, and equipment storage areas occupy the periphery of the gymnasium

A 750-seat auditorium, which can be used for teaching (seats in its first seven rows are equipped with tablet arms), dominates the school's west wing. Administrative and guidance offices and classrooms for elective subjects are also located in the west wing.

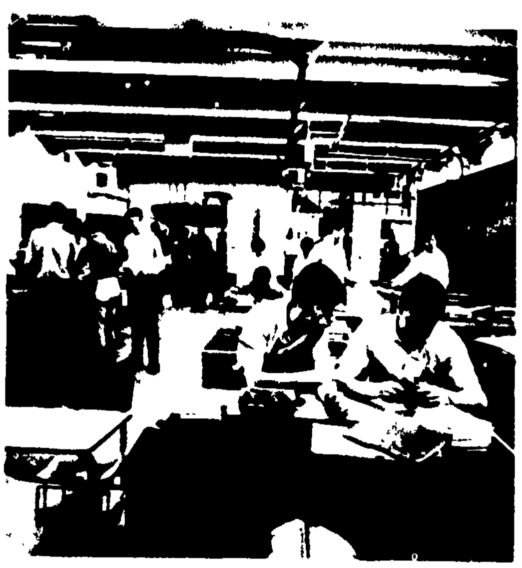
Although key district administrators made most basic decisions about the Martingrove school plant (Etobicoke employs, in addition to an assistant superintendent in charge of vocational-technical education, a business manager and full-time staff architect for supervisory purposes), the men and women who would serve as department heads played important roles in the choice and installation of classroom equipment

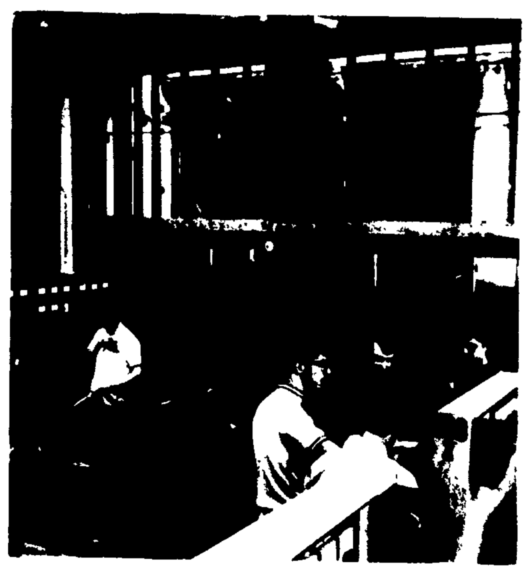
Among special requests made and incorporated in the finished school were book storage space in the auto shop; semi-permanent installations in the machine shop to afford maximum teaching space; a wooden floor in the electrical shop to minimize danger; a glassed-in, lockable area in the electronics lab; custom-built musical instrument storage cabinets, and the north-light source in the art room.

Each of the vocational training areas, from the auto mechanics shop—as modern and well-equipped as any in the province of Ontario—to the home economics room, with three all-electric kitchens and a separate fitting and dressmaking area, would do credit to any vocational school.

But Martingrove is not a vocational school. It is a comprehensive school in which four-year students can upgrade themselves to five-year programs, arts and science majors can transfer into the science and technical programs, and vice versa, and maximum opportunity and choice are offered each student

Canada needs all manner of talents and aptitude in its economy, and Martingrove's administrators refuse to emphasize either academic or vocational skills They prefer instead to emphasize education, and the results seem to support their preference. Half of the boys enrolled in the four-year program—ostensibly those not destined for college—will, in fact, go on to junior colleges or technical institutes after they are graduated. In short, the first phase of Martingrove's plan for the future seems to be succeeding





Martingrove Collegiate Institute, Etobicoke, Ontario, Canada

Program:
Both college preparatory and vocationally oriented curricula, available in either four-year (certificate) or five-year (diploma) programs

Vocational majors:
Industrial physics, industrial microbiology, electronics, electricity, machine shop, auto shop (four-year program only), machine drafting, architectural drafting.

Physical plant:
School opened early in 1967. Enrollment 1,444 in September, 1968, expected to reach 1,700 by 1971. Second phase of construction scheduled for completion in 1969 First phase encompassed 131,500 square feet. Second phase to add 25,000 square feet. Until second phase is finished, school uses four temporary portable classrooms, each supplying 800 square feet.

Administrative source:
Frank M. Mitchell, Assistant Superintendent of Secondary Schools, the Board of Education for the Borough of Etobicoke, 4 Eva Road, Etobicoke, Ontario, Canada

Architect:
D. Ross King, 180 Duncan Mill Road, Don Mills, Ontario, Canada

Educational Shopping Center

Portland Community College, Portland, Oregon

The challenge:
To design a community college that expresses its strong occupational orientation in terms of educational opportunity rather than unimaginative skill or job training

The solution:
An educational "shopping center," in which open corridors and promenades surround observable learning spaces

In order to understand the structure of Portland Community College and the additions that are being planned, one must first grasp President Amo De Bernardis' philosophical attitudes toward post-secondary education. They are, in brief.

- The community college, unlike the four-year liberal arts college, is geared to the needs of the nonacademic, the economically insecure, the disenchanted, and the alienated members of the community Such people often harbor negative attitudes toward schools and education Their school, therefore, must not swallow or overwhelm them it must be inviting not intimidating It must suggest that it exists to meet student needs and not that it is somehow superior to them

- Wherever and whenever possible, the aura of unapproachability that surrounds faculty and staff in most colleges must be eliminated Ideally, teachers and administrators stand in a supportive relationship toward student efforts, not in threatening and authoritarian postures. The school building must therefore place its faculty and staff in highly visible, readily accessible spaces.

- The community college must respect the dignity of its students, and particularly those enrolled in vocational programs, at all times Society's traditional denigration of blue-collar and semi-skilled work must be opposed Students must be made comfortable, physically as well as psychologically. The community college's physical facility must therefore meet the highest standards of comfort and good design

- The system of education must be subordinate to the objectives of the individuals in it. The individual, not a data processing machine, should determine what courses he wants, how many of them, and when and in what order to take them Students must be allowed freedom to make their own choice—and their own mistakes The physical plant, as well as its faculty and staff, must give students a solid sense of freedom and self-determination

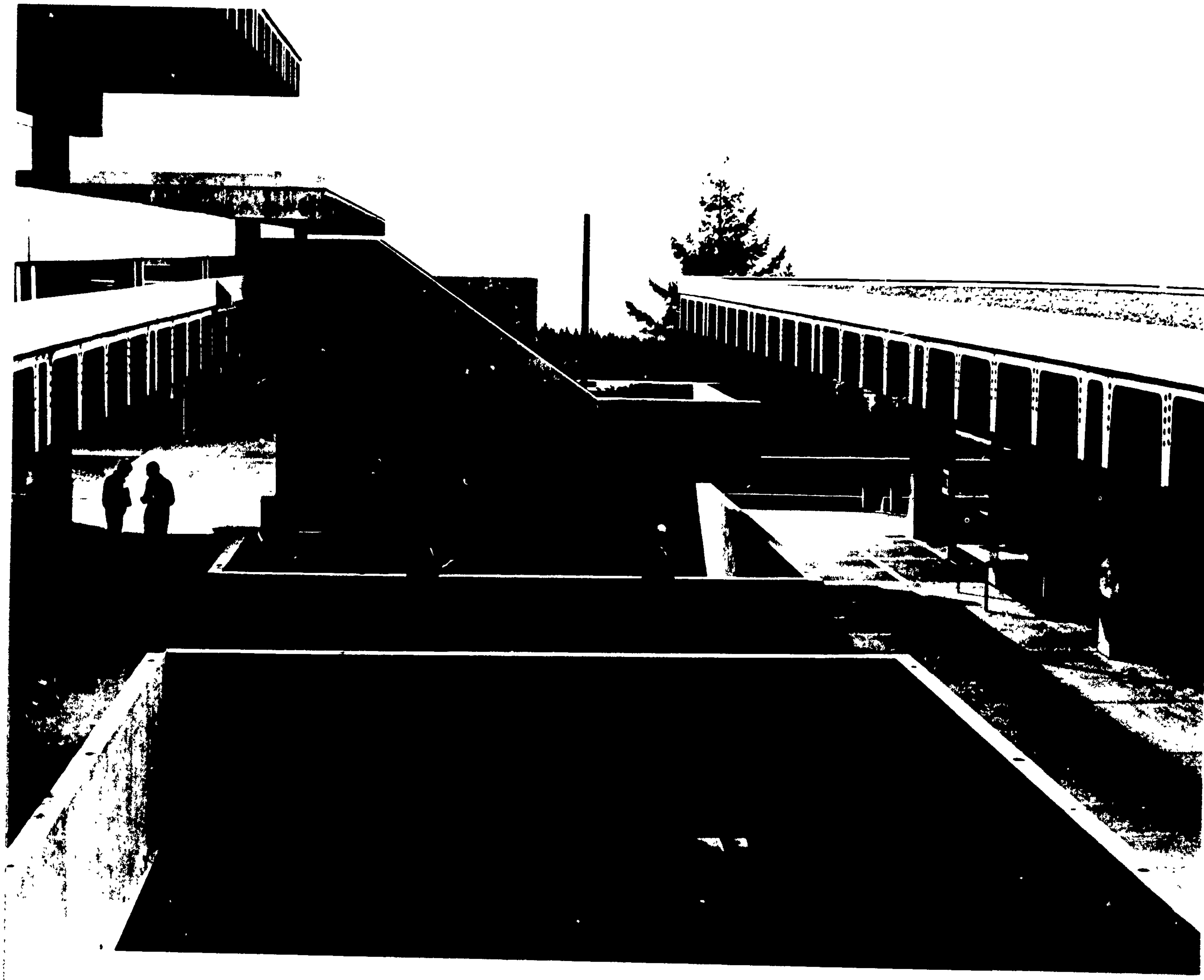
As President De Bernardis and his advisors set about refining, clarifying, and relating these general objectives to a specific design, the structural concept that arose most often in discussions was that of a shopping center. The freedom of the idea, not to mention its audacious approach to an educational problem, appealed to the planners

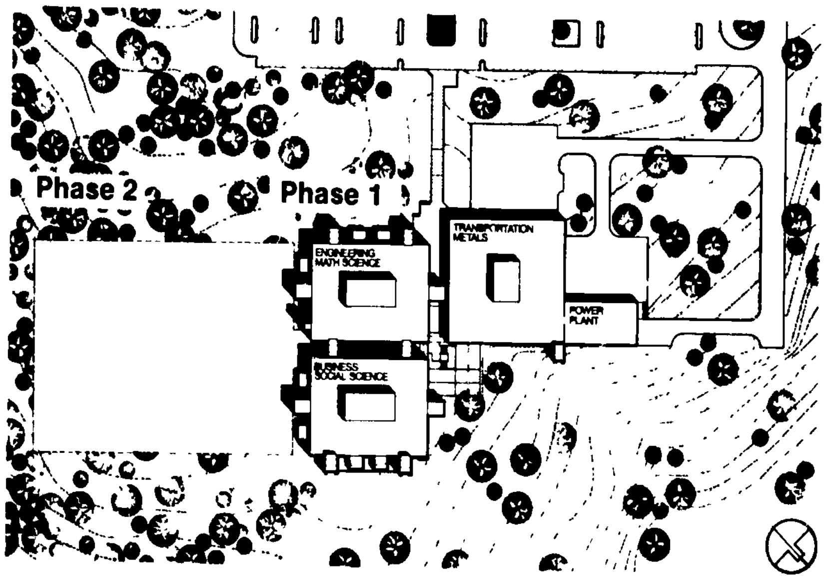
People come and go at will in a shopping center. Some of them spend 10 minutes there; others stay for several hours One feels free to shop at a single store or at many, make one purchase or a dozen, window-shop from a mall or move directly into stores, serve oneself or ask for help, open a charge account or not. Impulse-buying helps sales, and wares are displayed attractively to tempt the passerby So it must be, said the planners, with their community college The parellels would not be denied.

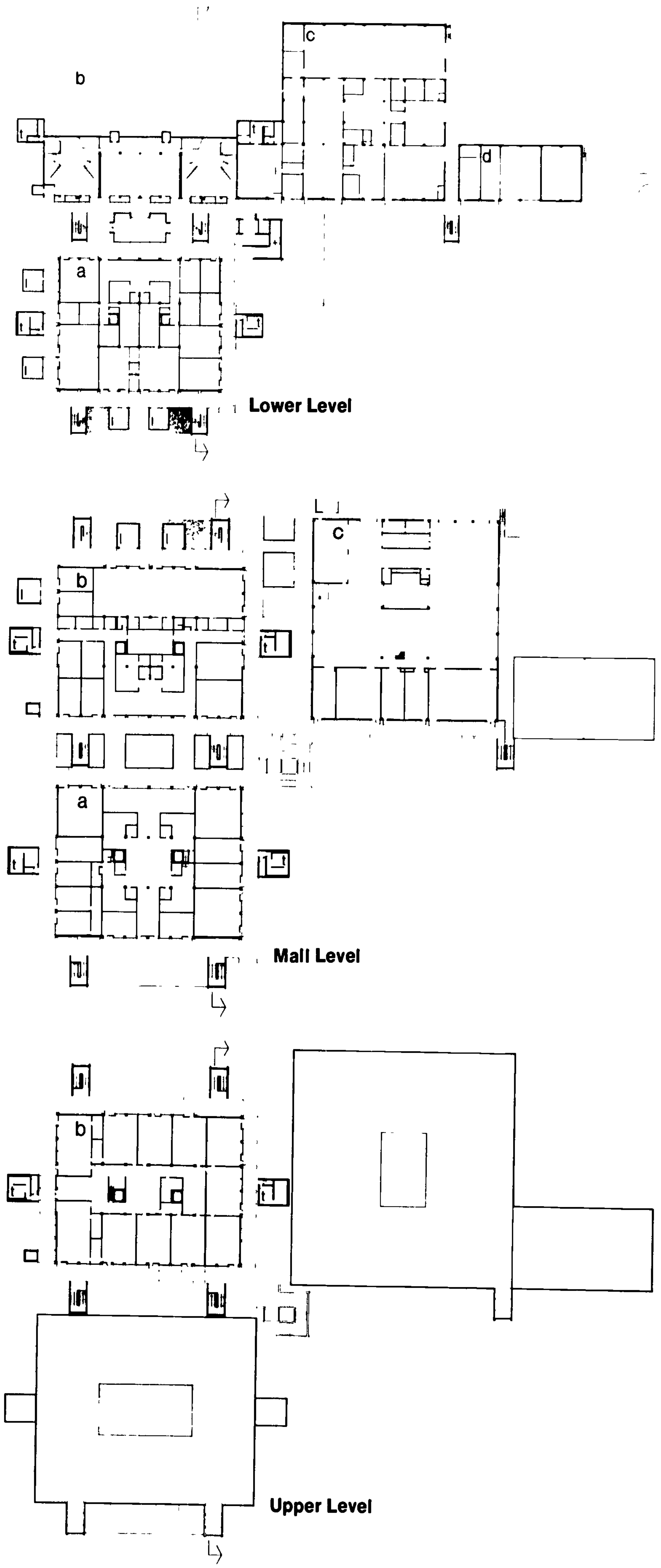
At first, the architects prepared sketches combining shopping center elements with those of traditional schools The design committee rejected them They did not want, they said, a school *reminiscent* of a shopping center; they wanted a school that *was* a shopping center The architects tried again, and this time they came up with the real thing

Instead of linking rooms with interior corridors, halls, and walkways, they designed a complex of learning centers, oriented around various disciplines and accessible from the outside via a system of open promenades and plazas Rather than opening into a passageway, classrooms open directly onto a plaza A student can, if he chooses, walk directly from parking lot to classroom and back again without setting foot in any other part of the school. In this way it is possible to take a course without becoming involved with other courses, or indeed, other rooms Usually, classrooms have only one door—the one to the outside—and because rooms are small, the single exterior exit is sufficient to meet fire safety standards.

Similarly, all classroom windows face plazas and promenades These windows are plate glass, and, like storefront

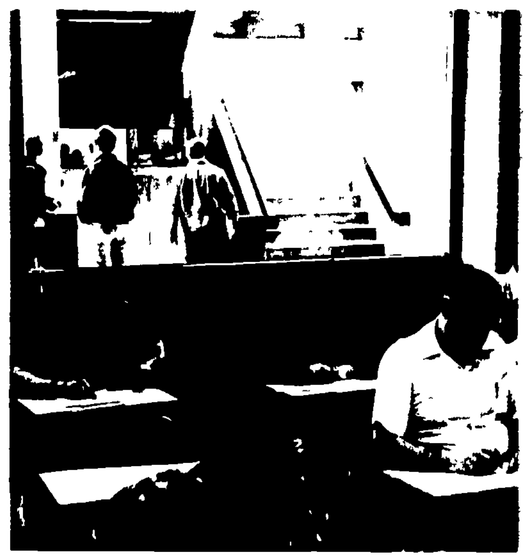



Phase 2
Phase 1
ENGINEERING
MATH SCIENCE
TRANSPORTATION
METALS
POWER
PLANT
BUSINESS
SOCIAL SCIENCE



a Business-Social Science
b. Engineering-Math-Science
c. Transportation-Metals
d. Power Plant
l. Locker Room
t. Toilet Room

"show" windows, they provide ample opportunity for educational window-shopping President De Bernardis, who apparently has the instincts of a good merchandising manager, knows it is easier to lure a potential customer inside if you give him an advance peek while he enjoys the psychological safety of the outside Of course, there are times when the windows must be blacked out for projected material, but this is easily accomplished with venetian blinds.



The externality of Portland Community College's classrooms is carried out in other areas Even such facilities as restrooms, stairwells, and lockers have been installed in separate buildings outside the main structure Towers house the staircases and utilities, but the architects left "windows" of space in them to relieve the enclosed feeling and bring in the environment, which is strikingly beautiful *

The outward-looking shopping center plan offers aesthetic as well as practical advantages Not only do the exterior corridors reduce waste space (and therefore construction, maintenance, and utility costs), but they afforded the architects full opportunity to take advantage of the school's geographic location

Portland Community College is situated on 125 acres overlooking Oregon's magnificent Tulatin Valley, and the student walking from class to class along the promenades is continually exposed to breathtaking vistas To preserve the natural beauty of the site, planners kept parking lots small, masked them with trees, and scattered them around the campus Furthermore, even at class-changing times, when the college promenades are busiest, they seem uncrowded because they are outside

Fortunately, Oregon's climate makes such designs practical Temperatures are never extreme, and winter brings little snow Construction materials are primarily reinforced concrete and Douglas fir, which offer texture and color variation and help avoid problems which might arise from high humidity

Freed from the necessity of interior passageways, the architects made several innovative and creative decisions about the division of enclosed spaces

*Ramps and an elevator were built into the design for the convenience of physically handicapped students

In the business and social science center, for example, where most subjects are taught in a classroom rather than a laboratory setting, the designers provided for a variety of sizes of teaching spaces Because exterior towers or subfloor conduits carry all utility lines, non-load-bearing interior walls can be shifted, and space may be easily redivided

Similarly, the engineering-math-science center contains a useful range of classroom sizes A drafting center houses three separate and simultaneously taught courses; and two arena-style classrooms, seating 125 students, are tiered, carpeted, and equipped with portable seats, shallow stages, permanent display walls, and copious storage space

Another type of learning space is worth noting, i e , small amphitheaters, located just off the school's mall and intended for outdoor lectures on the arts, weather permitting. A larger-size amphitheater is planned for some time in the future

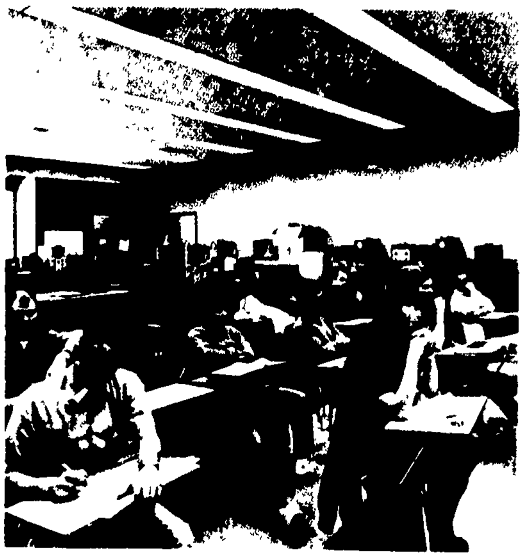
Thus, each portion of the complex houses a resource center In addition to the material relevant to courses taught in its immediate area, each of the four centers stocks books and periodicals for leisure reading All materials are stored in open stacks and arranged according to subject-relevance, rather than the usual numerical systems.

Furthermore, each resource center keeps a regularly updated catalogue of materials available throughout the campus, and all are equipped with lounge furniture in addition to the standard library chairs, tables, and study carrels

Although a central library is scheduled for Portland Community College's second phase, it will not supplant the individual satellite libraries

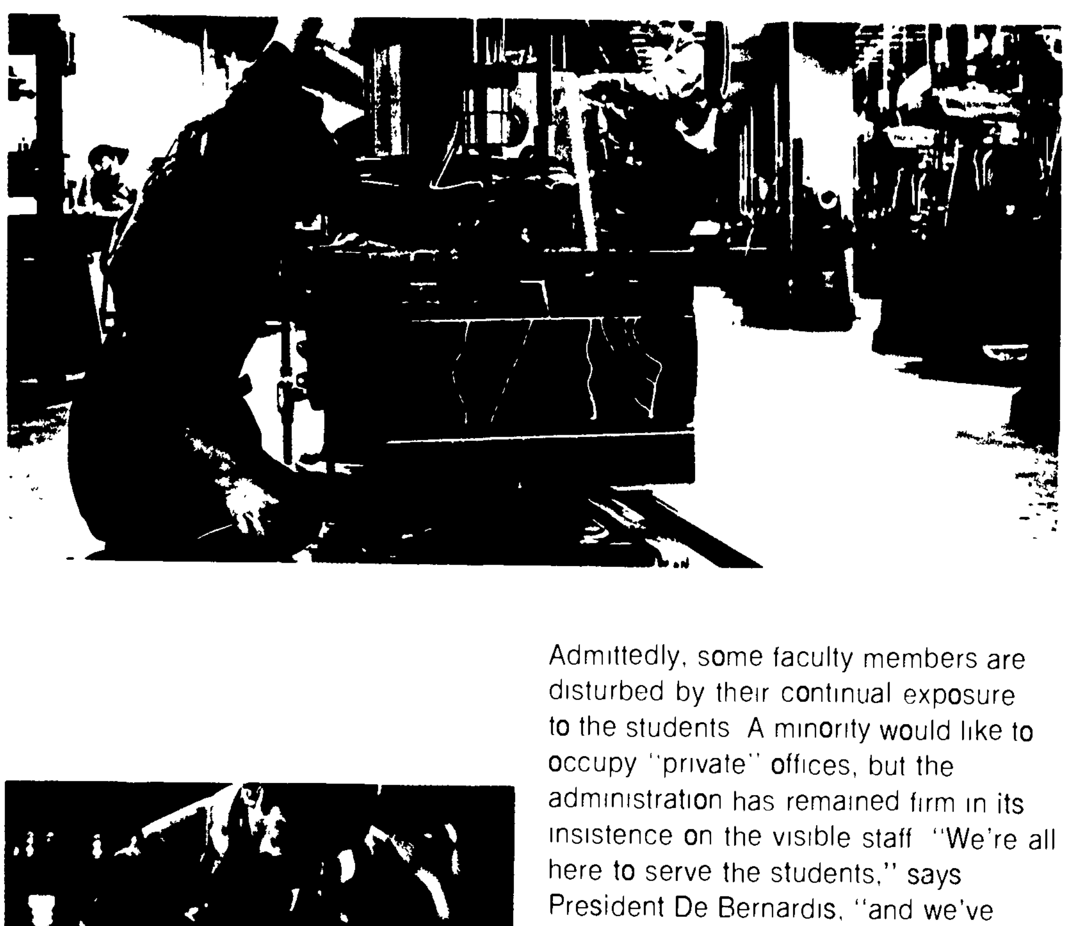
Significantly, each resource center houses or opens onto staff and faculty office space In most schools, students find it difficult to buttonhole a faculty member outside his classroom Here, teachers are hard to miss, and everyone serves in an advisory capacity, assigned and otherwise.

Job placement is a crucial part of a community college's role, and Portland Community College is fortunate in having a State Employment Office representative permanently assigned to the



campus She and her assistant sit at desks just inside the doors of the second-floor business-social science resource center where they are visible to all and readily available for consultation

Since openness is an integral part of President De Bernardis' educational philosophy it is almost startling to find a few totally enclosed rooms built into the community college complex There are of course occasions when absolute privacy is desirable, and recognizing that the Portland Community College planners asked for conference rooms But these are used only for confidential discussions between students and faculty, or for an occasional project requiring isolation



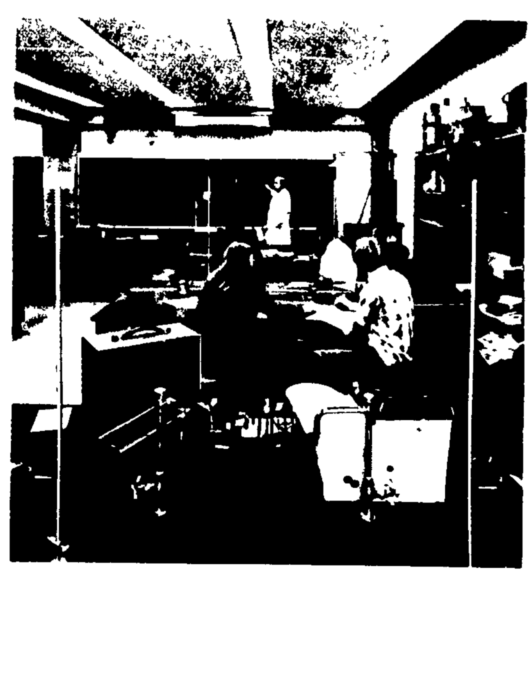
Admittedly, some faculty members are disturbed by their continual exposure to the students A minority would like to occupy "private" offices, but the administration has remained firm in its insistence on the visible staff "We're all here to serve the students," says President De Bernardis, "and we've got to be out where the students can find us "*

Organization of shop and laboratory spaces along job-family lines seems to mesh agreeably with the concept of unrestricted access The transportation-metals center, for example, which groups welding metals testing metal shop, construction and materials testing facilities on one level, encourages an unimpeded, logical flow between areas On another level, auto body, auto shop, paint room transportation diagnostic, transmission and hydraulic, fuel systems, auto electronics engine overhaul, truck and heavy equipment and metal fabrication facilities are grouped in a similar sequential pattern

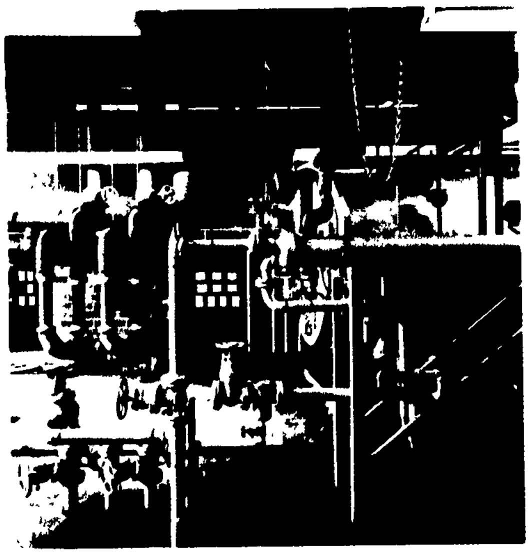
Likewise, the school's two-story power plant, designed as a teaching facility as well as an equipment-shelter, lies adjacent to the transportation-metals center It features color-coded pipes and machinery, a two-story glass wall facing a promenade, and a glassed-in observation balcony connected to the transportation center's engine overhaul lab

In its eagerness to offer students a wide range of information about power systems, Portland Community College relies for its heat on three boilers, each fired by different elements, i e . two kinds of oil burners and one gas-operated An electrically heated boiler is planned The method may be more expensive than one system but it certainly pays educational dividends

The school's two other major segments —the engineering-math-science center and the business-social science center—follow a similar family-grouping logic, with related learning centers clustered and flowing in sequence



*Consistent with his philosophy, the president occupies a show-window office opening onto a promenade



Deciding which broad vocational courses would be housed in the new facility's first phase was relatively easy an amalgam of expediency, space and economic necessity Those courses that were considered adequately housed were left where they were The dental technician program was not moved because its equipment was comparatively new and could be moved only with difficulty and at some expense Also, most of the students found the downtown area a convenient place to attend classes Obviously, popular courses that were overflowing their downtown space received priority in planning the move

Phase II decisions were not as easy, but still presented few major problems The facilities destined for the second construction stage were largely supportive elements, i e , increased library space a bookstore, student dining facilities (including a snack bar, cafeteria, and formal dining room), and various administrative offices, all of which will be incorporated into a "mall complex" that closely approximates the style of contemporary commercial shopping centers

Phase III, which has not yet reached the drawing boards, is envisioned as a communications center, for art, radio, television, and printing, or as a life science center, for health technology Since both are desirable, Phase IV must await a decision on its precedent

Phase V, of course, is even more remote but President De Bernardis has already begun incubating a few ideas

"Maybe a hotel-motel school, so we could teach those interested in management and still have rooms that students could rent by the half-day to catch up on their sleep Or perhaps a culinary arts and hotel kitchen program Then, when a student wants to get married, he or she could hold the wedding reception right on campus Most of them can't afford to have nice downtown weddings, you know, and why should they be denied this pleasure?"

Perhaps, eventually, Portland Community College will operate like a self-contained educational community, accommodating students on something approaching a cradle-to-the-grave program In any event one thing is certain You'll be able to see the whole complex working from the outside Just like a shopping center

Portland Community College, Portland, Oregon

Program:
Liberal arts, vocational, and technical courses, all open to enrollment on a student-selection basis; a two-year college transfer plan, for students who wish the associate degree and the opportunity to go on for the baccalaureate elsewhere, community education programs, including completion of elementary or high school; enrichment courses and adult homemaking and parent education courses

Vocational majors:
Five basic career areas, i e , mathematics, science, engineering, and related technologies; life science, health, and related technologies; communications and related technologies; social science, business, and related technologies; and community and continuing education

Physical plant:
Phase I, completed in April, 1968, encompasses 216,757 square feet Phase II, scheduled for completion in October, 1969, comprises 137,757 square feet Enrollment in Portland Community College totals about 25,000 Approximately 4,000 students attend classes on the new campus on any given day The cost of the new facility, when Phase II is complete, is estimated at $9 million

Administrative source:
Amo De Bernardis, President, 1200 S W 49th Avenue, Portland, Oregon

Architect:
Wolff, Zimmer, Gunsul, Frasca, Ritter, 2386 N W Hoyt, Portland, Oregon

Tabula Rasa With Clusters

Quincy Vocational-Technical School, Quincy, Massachusetts

The challenge:
To plan a first-class occupational education facility without tying it to a particular curriculum

The solution:
A flexible contemporary structure linked to and integrated with an existing academic high school

Planning a school around a set of educational specifications is difficult enough but the task seems almost insuperable without a curriculum or even a detailed philosophical premise

Unfortunately (or perhaps in the long run it was really quite fortunate), the school administrators of Quincy, Massachusetts had little choice In 1963, the city was growing out of its schools A community of 90,000 people located south of Boston. Quincy was sending only 30 per cent of its high school students to college, and another 15 per cent to some form of non-collegiate post-secondary training Most of the city's youngsters attended its two academic high schools and the old trade school could not accommodate all of those who wished to enroll

The community clearly favored building a new vocational high school While they agreed, school administrators were reluctant to rush into a facility that would only repeat the pattern of Massachusetts' old-fashioned trade schools. They believed strongly that an effective school of the 1960s should be an innovative structure, designed around a new concept of occupational education and a new approach to technical training. And they were determined not to draw up specifications until they knew the shape of the "new" vocational education.

Quincy's school administrators found that knowledge more difficult to acquire than they had expected Universities, approached for aid in performing the necessary research turned a deaf ear Local business and industrial leaders, sure of the "product" they wanted from a vocational high school, were less certain of how to "produce" it Other recently built vocational schools seemed only new packages for old concepts.

Finally, in the spring of 1965, the U S Office of Education granted funds for a joint Quincy-American Institute for Research project in curriculum development By that time, however, the need for a new vocational high school had become urgent An expanding high-school-age population began to force administrators' hands The community pressed for its school City Council was ready to grant approval for construction To delay further would be to lose popular support Only positive action could be tolerated

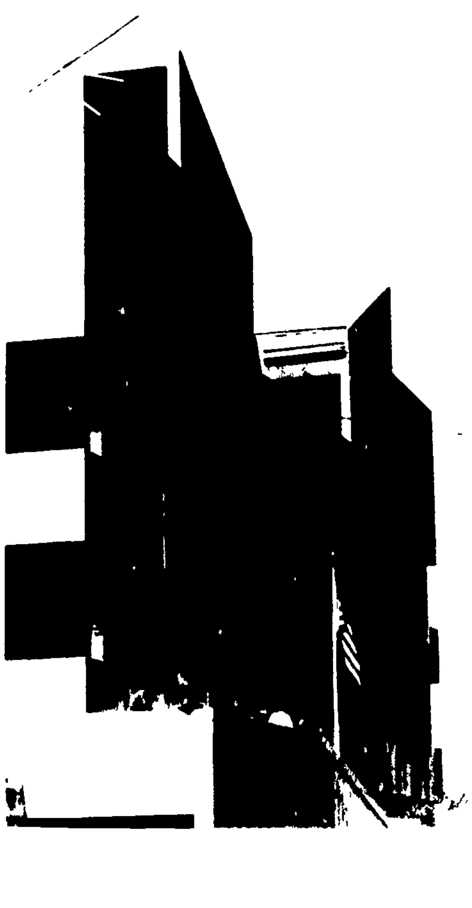
In that critical atmosphere, Quincy's school administrators decided to take a bold step They would build the new school and perform research for it simultaneously They understood the risks involved—it was like designing a bridge while you attended engineering school—but they hoped to find an architect creative enough to provide an extremely flexible plan one not only elastic enough to change with the normal requirements of an expanding community but adaptable enough to digest research findings *after* the school was built

After much searching, the administrators hired the New York and Houston firm of Caudill Rowlett Scott, a group of architects with extensive school design experience, a staff large enough to assign several specialists at once to Quincy's design problems, and a policy adventurous enough to undertake a job demanding something like clairvoyance

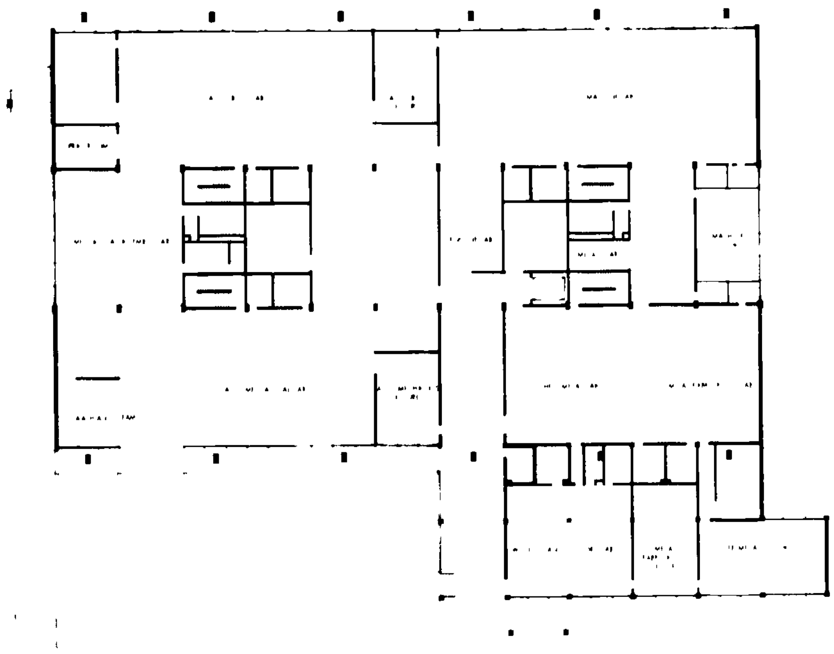
Since educational specifications were not available, the architects drew up tentative designs based only on a list of general objectives and a site plan In brief, the objectives were

- The school must be as attractive as possible, to overcome the notion that vocational education is second-rate
- The school must integrate academic, shop, and laboratory spaces, so that students understand that all elements are part of their education.
- The school must minimize the distinctions between college preparatory and post-secondary training programs
- Above all, the school must be as flexible as possible

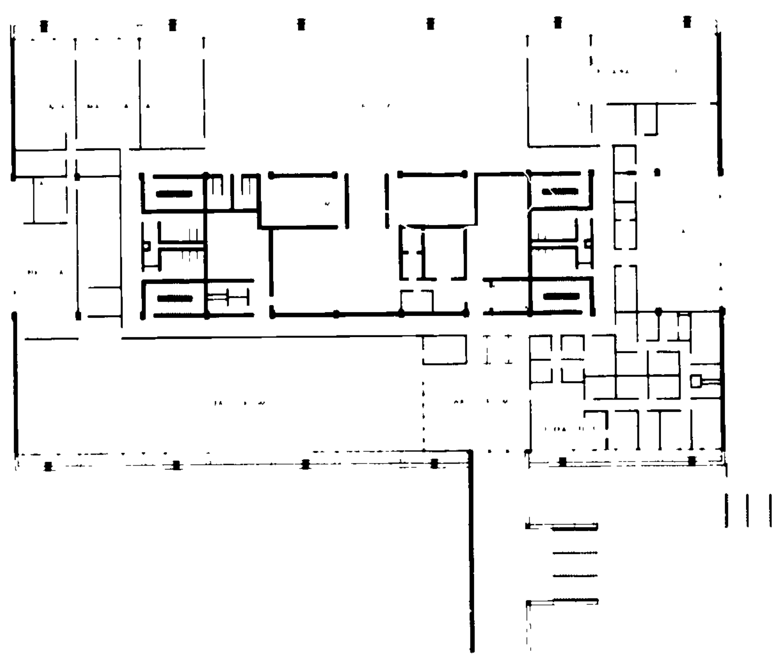
Because the site for the new school was adjacent to an academic high school, the architects suggested treating the vocational facility as an extension of



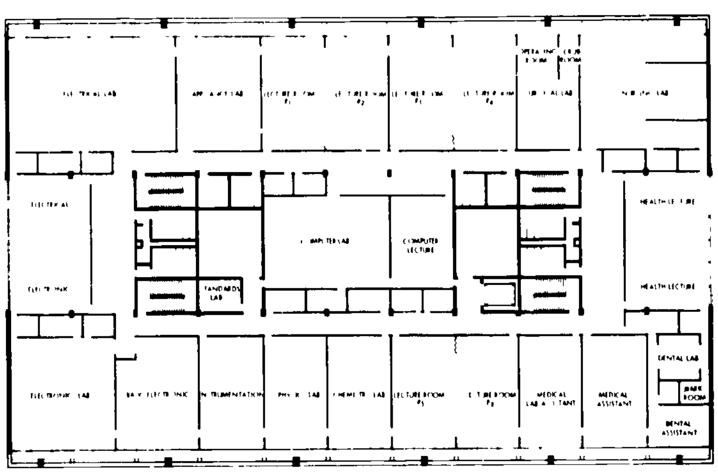
First Floor



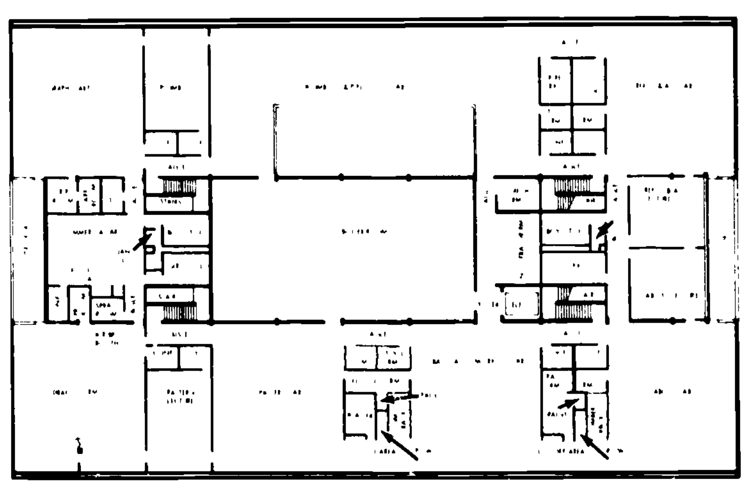
Main Floor



Third Floor



Fourth Floor



the older structure, rather than as a wholly autonomous unit Moreover, they felt that the two might even be connected with a bridge, thereby creating a comprehensive high school Not only would such an arrangement reduce the "separate school" stigma of vocational education, it would also help in avoiding costly space duplication.

For example, a library seating more than 300 students could be located in the new building, but serve both facilities The older building's library space could then be converted to much-needed classroom space And similarly, because the old auditorium could serve students enrolled in the occupational program, the need for a second auditorium in the new structure would be eliminated

The bridge became the tangible expression of the philosophical link between Quincy Vocational-Technical School and Quincy High School. An electrically heated, glassed-in promenade connecting the main floors of the two wings, it brings academic and occupational students together in an educational complex where courses as well as physical facilities are open to all

In practice, each school retains its own identity and is separately administered But the fact that a recent traffic count on the bridge registered 3,600 student crossings a day attests to the effectiveness of the connection. Of course, automatic snack-vending machines on the bridge make it a popular stopping place, and in addition to the shared library and auditorium the schools share gymnasiums Many courses mix students from both schools and pupils are free to use cafeterias in either building

If the site aided Caudill Rowlett Scott in bridging the gap between disciplines, it also presented them with serious problems

First, the parcel of land was comparatively small—only a rough square of 19 acres—forcing the architects to design vertically, rather than horizontally

Second, the land was a virtual swamp; peat to a depth of 25 or 30 feet, 90 per cent water, and almost impossible to fill.

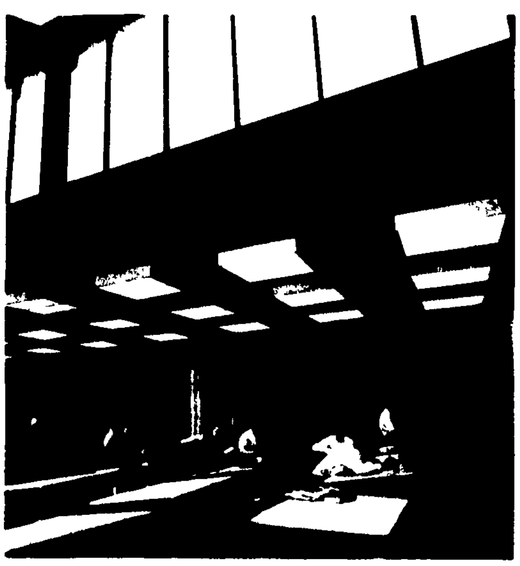
Considering the fact that design loads required by vocational school equipment tend to be higher than those for a purely academic school, the size and condition of the site combined to pose a major engineering problem

The solution to that problem began with 444 caisson-type, reinforced concrete Franki piles driven into subsurface sand and gravel, anywhere from 15 to 30 feet below the surface On this base, engineers built a stressed concrete superstructure—vertical columns 48 feet apart and connected by beams—within which the school itself is cradled.

The architects' decision to locate Quincy Vocational-Technical School's structural skeleton at the perimeter of the building enabled them to design clear span interiors, probably the single most important component of flexible space. And since the school's curriculum was being planned even as its physical plant took shape on the drawing board, a decreased number of fixed structural elements increased the possibilities for adapting the finished facility to its completed curriculum

The final design was almost as flexible as the Quincy administrators had hoped, i e , four floors, each with 43,500 square feet of virtually unobstructed instructional space A fifth, ground-level floor, was left unfinished except for its gymnasium-locker room wing, and has no teaching or laboratory space.

Four utility core towers, two at each end of the building, house the school's four stairwells and most of its other permanent structures Except for these towers, and a few fire walls in some of the heavy-duty areas. all walls in the school are demountable Most of them are metal stud-and-sheetrock partitions, 8 feet. 4 inches high



From one point of view, the partitions pose a serious problem. Although educators are delighted with their flexibility, they concede that such walls are insufficiently noise-resistant. Further investigation and less skimping, they feel, could have turned up an equally flexible but more acoustically satisfying product

Construction of the school was already under way when Quincy's researchers began reaching conclusions about the location of individual learning spaces And because the building was simply a four-decker space sandwich, they were completely free to tailor their floor plans to an emerging curriculum. The eventual plan focused on two basic premises

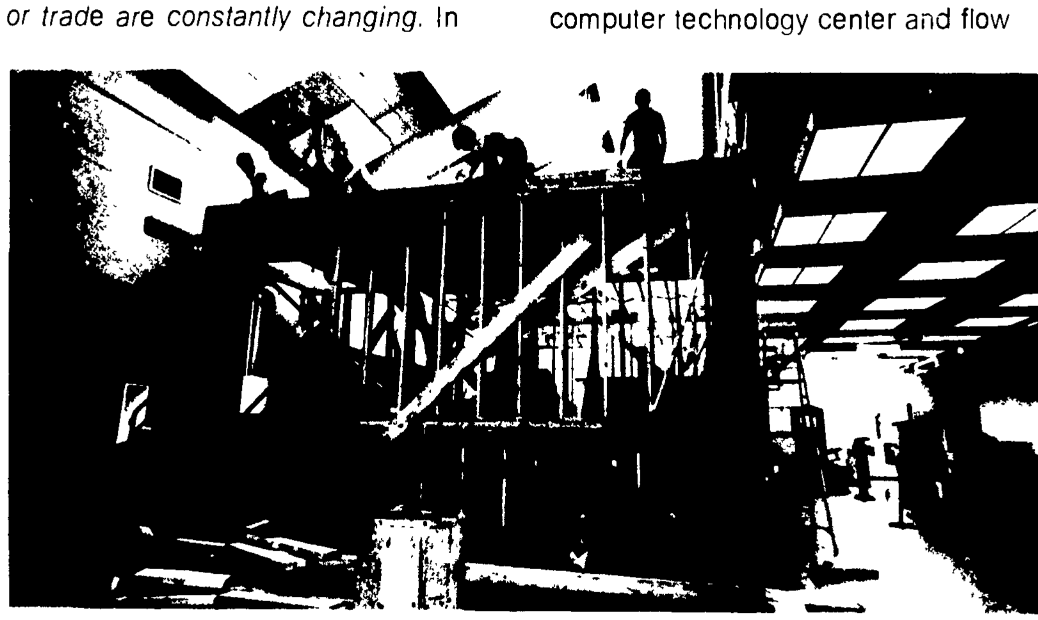
(1) *Continuing guidance is the key to successful education* Counselors must help students to understand themselves, the demands of the nonacademic world, and how the individual can best fit into a working situation When the time comes to choose a specific occupation, counselors must help students to evaluate their chances for success in various jobs

(2) *Specific aspects of any occupation or trade are constantly changing.* In view of this fluidity, emphasis should be placed first on skills pertinent to a wide range of jobs Broad "occupational families" should be determined (the Quincy planners agreed on 11 of these for their own school), and a hierarchy of skills designated for each The longer a student remains in the Quincy program the higher he will move on the skill ladder and the more specialized his training will become

Obviously the Quincy Vocational-Technical School's floor plan would have to incorporate the tenets of the two philosophical premises The translation from philosophy to design was made in the following ways:

Clustering of certain shop areas and laboratories mirrored the concept of relating specific trades to job families. On the fourth floor, for example, the graphic arts center shares workrooms with the drafting center The drafting center, in turn, flows logically into the pattern shop area, which flows into the basic woodworking shop, which connects with the cabinet shop beyond Similarly, the plumbing and pipefitting shop lies in natural relationship to the refrigeration and air-conditioning shop, and both are readily accessible to the boiler room.

On the third floor, which is devoted to the medical-technical family of skills, teaching spaces are smaller, but grouped according to a similar logic Electronics, physics, chemistry, medical, nursing, surgical, and appliance repair laboratories are clustered around a computer technology center and flow



naturally into eight classrooms that may be combined into four large lecture spaces

The second, or main floor which opens onto the bridge and houses the library and cafeteria assembles conference rooms and testing spaces in close proximity to the school's administrative offices

Location of the boiler room on the top floor offers some advantages Perhaps the most useful fact is that the machinery is not noisy (modern heating and cooling plants bear little relationship to the old-fashioned variety) and can be vented directly through the roof without routing pipes through the rest of the building In addition the data processing and food services areas have been located close to their utility source, i e below the boiler room an arrangement that conserves power for both heating and chilling

The graphic arts and drafting rooms and the plumbing pattern and woodworking shops were also placed on the fourth floor In this instance although the shop areas produce a moderate amount of noise the top floor location enabled Caudill Rowlett Scott to employ clerestory windows to provide the natural light preferred for graphics and the wall space needed in the shops

Addition of the clerestory however, raised the top level s ceiling to a height of 24 feet obviously requiring a break in the pattern of 8-foot 4 inch demountable partitions used throughout the rest of the building The architects solved this problem by roofing over the fourth floor teaching spaces with acoustical tile thus creating a room-within-a-room effect while preserving the flexibility of the modular wall components

In keeping with the modular wall units, a 4-by 4-foot modular lighting unit, suspended from the permanent ceilings, and ventilator segments fabricated in 12-foot lengths, make it possible to erect dividing walls almost at will without rewiring Furthermore, sub-floor conduits containing all electric, telephone, fire alarm, and similar utility channels are accessible at regular intervals, and classroom furnishings are completely portable

The ability to re-divide spaces and move equipment easily has already proven its value Although the chemistry and physics laboratories are separate, teachers have been considering combining them into a single science center The portable walls will allow them to experiment with such an arrangement without committing the school to it irrevocably

The school's planners gave as much thought to equipment as they did to the spaces it would fit into Advice from the local trade and professional groups proved extremely valuable, and the learning environments closely approximate those of real situations outside The autoshop is comparable in size to the largest school facility in the state; a model hospital ward comes complete with 12 beds, a scrub room, examining

room and operating room all used in training licensed practical nurses and the dental lab has two chairs an x-ray room darkroom and reception area all used for training dental assistants Unfortunately the nursing and dental facilities can be used only by Quincy's few post-secondary students because even 12th graders are too young to meet Massachusetts licensing boards minimum age requirements

Safety of course has been emphasized in all shops and laboratories Bus bars keep machine power lines off floors, dust-collecting vacuum units collect debris in the woodworking shops at both floor and working levels; Pyrex pipes drain off all chemical wastes in the labs the x-ray room is lined with lead, and each shop is equipped with power cutoff switches, not only for individual machines but also in central locations where entire areas may be shut down at a moment's notice

Shop area floors are bare concrete, classroom floors are covered with vinyl asbestos tile, and reception areas, administrative offices, and the library are carpeted Wall surfaces have been treated with epoxy resin paint that gives them a hard, clear, easily cleaned finish.

Quincy Vocational-Technical School suffers from a security problem Construction of a walk-in cage, where valuable equipment can be stored, has inhibited the theft of tools and parts, but eventually 10,000 square feet of the ground-level floor will be devoted to a lockable store room, which should further reduce the problem

Significantly, although small thefts have been annoying vandalism has proved minimal at Quincy Vocational-Technical School Assistant Superintendent Maurice J Daly feels that the lack of wanton destruction indicates something positive about the school Students, he believes, take pride in their new facility They respond positively to the quality of their environment Certainly there is a lesson to be learned from that

Quincy Vocational-Technical School, Quincy, Massachusetts

Program:
A 10 14 curriculum offering 11 occupational majors leading to more than 250 specific jobs and trades, postgraduate programs in several vocational skills special coordinated programs under the Manpower Development and Training Act

Vocational majors:
Power mechanics metals and machines home economics health occupations, graphic and commercial arts general woodworking general piping foods preparation electro-electronics, computer data processing business education

Physical plant:
School opened September 1967 Enrollment expected to reach capacity of 1,100 full-time students by September, 1969 Encompasses 235 000 square feet of space, built at an approximate cost of $21 a square foot on a 19-acre site

Administrative sources:
Robert E Pruitt Superintendent, Quincy Public Schools 70 Coddington Street, Quincy Massachusetts Maurice J Daly, Assistant Superintendent for Vocational and Technical Education, Quincy Public Schools, 70 Coddington Street, Quincy, Massachusetts

Architects:
Caudill Rowlett Scott, New York and Houston Texas Kenneth F Parry and Associates, 29 Cottage Avenue, Quincy, Massachusetts

Modular Flexibility

Southern Nevada Vocational-Technical Center, Las Vegas, Nevada

The challenge:
To design an occupational training center flexible enough to meet the needs of the present and the immediate future without expensive alterations, but capable of growth as funds become available

The solution:
A modular structure that provides aesthetic satisfaction as well as functional opportunities for change

From the beginning of their discussions about a new occupational training center the trustees of the Clark County, Nevada School Board sought a conscious break with the old concepts

One of the first to be attacked was the idea that occupational education is second-rate If the new school was to operate effectively its subjects must be presented honorably, with distinction Work has dignity, and those who do it deserve to be surrounded by its rewards The new school must be comfortable, attractive, and dignified

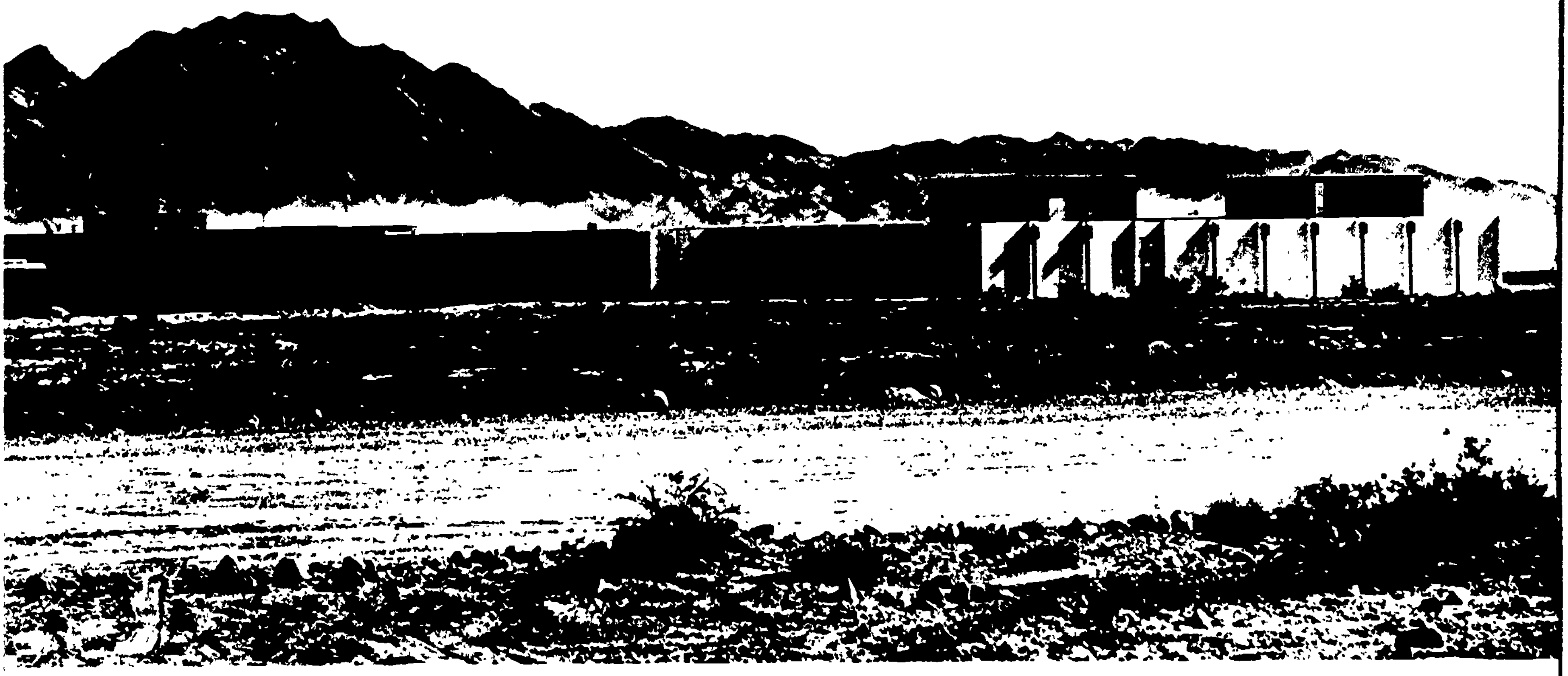
And indeed it is A rectilinear mass of earth-colored brick and white concrete, the low, wide structure of the Southern Nevada Vocational-Technical Center might house a corporation headquarters or a fine arts center as well as a modern, efficient vocational school

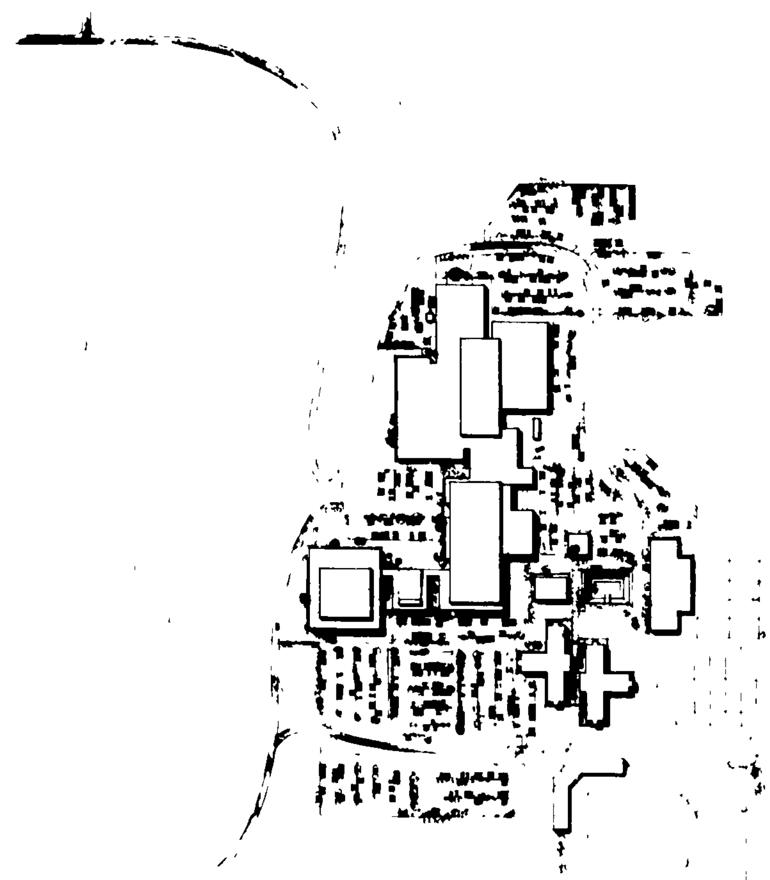
But that was only the beginning

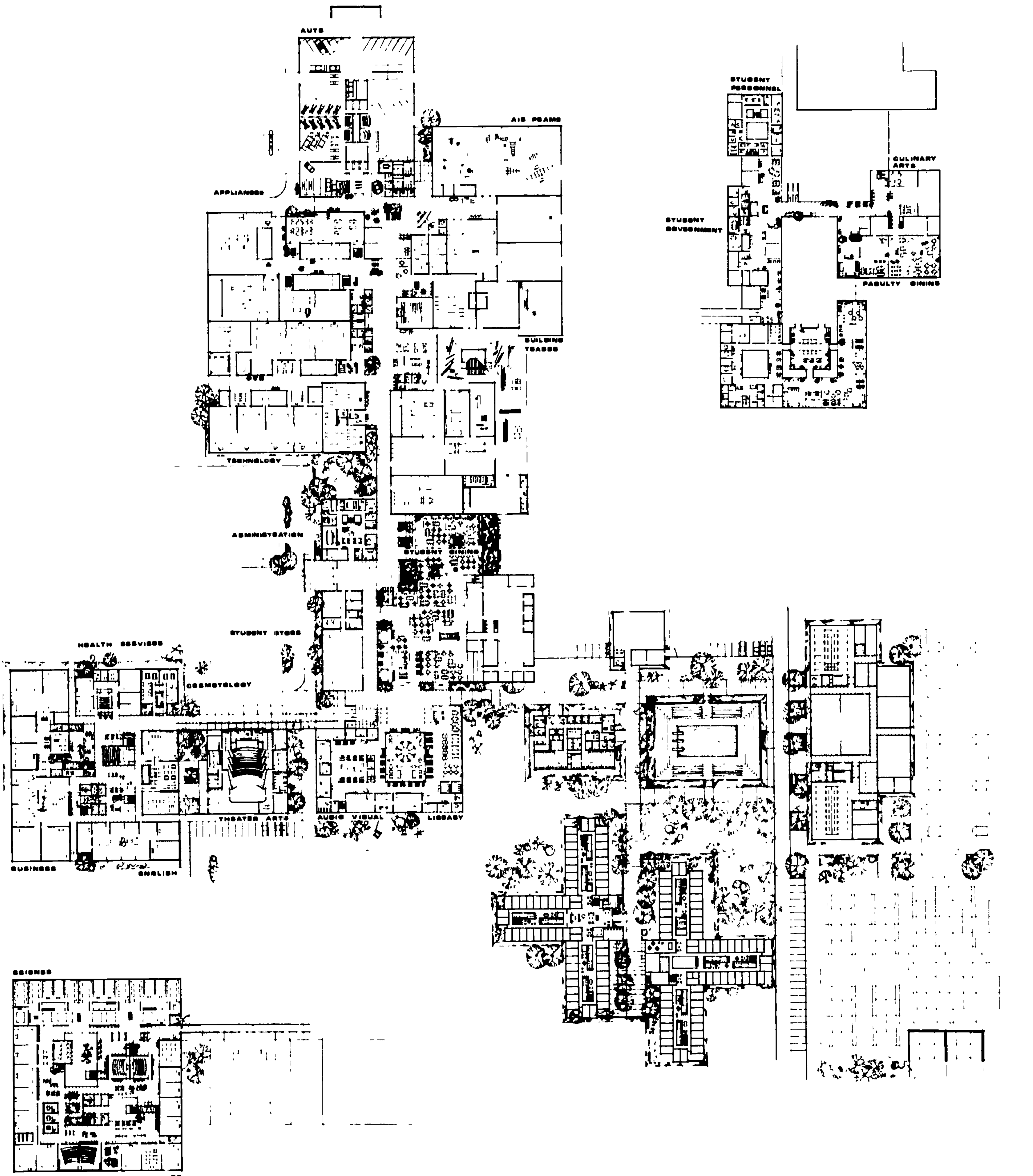
Having determined the general tone of their school, its planners addressed themselves to the allotment of its specific offerings They lacked established concepts and procedures that could be used as guides In fact, the only particular limit they had was a rough course list, suggested by a skills-market survey conducted among the Las Vegas business and industrial community, and an isolated site; 390 acres on a mesa about 100 feet above the desert floor.

Over a period of some 12 months, the architects, William E. Blurock & Associates, consulted with all concerned elements of the community Not only were administrators educational consultants and future teachers brought in to offer their suggestions but representative members of the skilled segments of the community—businessmen, tradesmen, craftsmen, mechanics—were also asked for their opinions about the plant and its curriculum Their suggestions proved invaluable

For example, the head chef of a leading resort hotel, serving as consultant for the culinary arts program, made crucial changes in the design of the school's food service facilities A dumbwaiter, provided for moving food from the kitchen to the cafeteria above it, would not conform to Nevada State health regulations and was replaced by a full-sized elevator The layout of the school's teaching kitchens, designed by planners of hundreds of institutional kitchens, could be improved, the chef



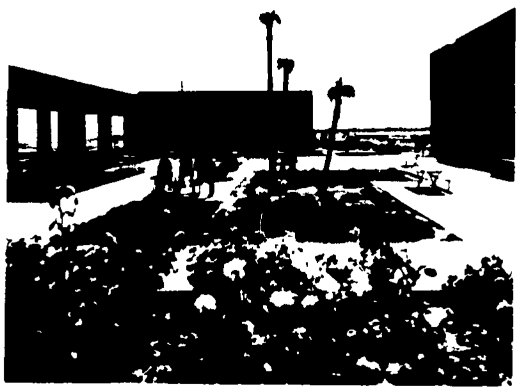



AUTO
AIR FRAME
APPLIANCES
BUILDING TRADES
TECHNOLOGY
ADMINISTRATION
STUDENT DINING
STUDENT STORE
HEALTH SERVICES
COSMETOLOGY
THEATER ARTS
AUDIO VISUAL
LIBRARY
BUSINESS
ENGLISH
SCIENCE
HISTORY
MATHEMATICS
STUDENT PERSONNEL
CULINARY ARTS
STUDENT GOVERNMENT
FACULTY DINING

pointed out, by moving a stove here, a refrigerator there, opening up an area for demonstrations in another place

Similarly, the air frame and building trades shops were improved at the suggestion of local craft unions

classroom, for example, would be as much like a commercial beauty parlor as possible, without eliminating the requirements of a learning situation, such as the necessity for additional demonstration space



Many of the people who were to teach in the new facility were drawn directly from appropriate occupational fields Since they had little academic experience, their suggestions for teaching facilities seemed unorthodox Upon examination, however, the architects and administrators found many of them to be pedagogically sound, and the ideas were incorporated in the design

During this planning period, the work of various advisory groups was coordinated by employing the PERT (Program Education and Review Technique) method. This system, which employs periodic reports to determine project status at any given time, eliminated guesswork, timing errors, and haphazard planning, and brought all parts of the planning function into an organized sequence, with a master-flow chart indicating how ideas were to be processed.

Gradually, a list of imperatives began to emerge:

□ All teaching facilities would have to duplicate, as nearly as possible, facilities generally employed in the working situations outside the classroom. At the same time, educational effectiveness was not to be sacrificed The cosmetology

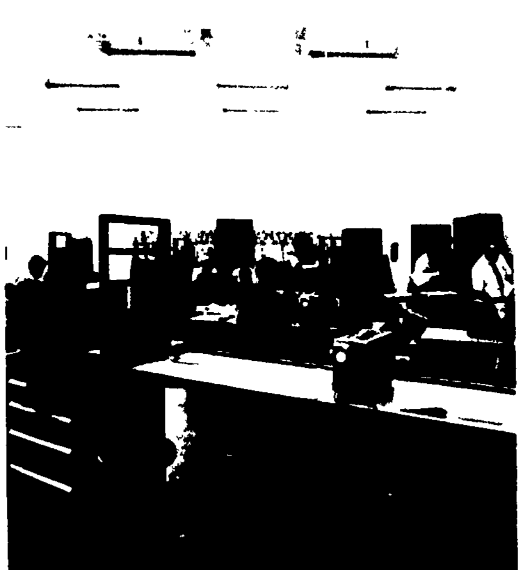
□ Within the limits of practicality, shop areas would have to be open and contiguous, so that students and visitors might be exposed to various kinds of work activity; thus developing interest in and respect for a wide range of occupational opportunities In this way, a student learning how to service an automobile engine might also find his interest piqued by students working nearby on an air frame, or a drafting student might be intrigued by a class in graphic arts

□ Those shop areas to which the public was to be invited on an actual, working basis—the gasoline service station, auto body shop, auto paint frame, and cosmetology lab—would be grouped together for ease of access from the outside, and would require at least one common showroom, where the community could see samples of the school's work.

□ Heating, ventilating, and air-conditioning plants, as well as lighting systems, would have to be designed for use by day and evening students, and perhaps for year-around operation, since the school was intended to serve the community on many levels and at frequent times.

- Administrative, academic, and shop areas would not be sharply divided Traffic, not only physically but psychologically, would flow easily between areas, so that neither educators nor students would feel disassociated from the total learning environment

- Maximum flexibility would have to be built into every aspect of the physical facility in order to accommodate the constant program changes that the planners felt would be needed to compensate for changes in the practical world beyond the classroom.



Furthermore, the need for flexibility was intensified by the planners' decision to build their center in four stages. They intended to add new buildings at each stage, thereby accommodating more students, offering more courses, and altering current courses to meet changing conditions.

The result was a systems approach to school design, utilizing some of the components developed in the California School Construction Systems Development (SCSD) project.[1]

In a systems building, all major components, including air conditioning, lighting, and interior partitioning, are designed in related modular units. The planning modules employed in the Southern Nevada Vocational-Technical Center system are 5 feet by 5 feet by 2 feet.

Lighting, heating, air conditioning, and similar utilities are incorporated in a self-contained ceiling unit that can be coupled into the general system with comparative ease. To comply with fire

[1]A detailed description of the systems approach to school construction appears in *SCSD The Project and the Schools*, published by EFL in 1967

regulations, an automatic sprinkler system was added to the standard ceiling unit at the center, and since the building employs few corridors it is completely equipped with sprinklers without major plumbing problems

As one would expect in such a design, the architects have used no interior load-bearing walls Solid concrete partitions were built in shop areas to conform to local fire regulations, but they were not crucial in the structural design. Furthermore, walls between classrooms are operable wherever possible, and many were made demountable

Significantly, the architects' freedom to create does not seem to have been circumscribed or inhibited by the use of systems building components, which are themselves rigidly defined In fact, the components appear to enhance the structure's effectiveness as an educational facility that can be continually brought up to date.

There are already signs that the planners' insistence on flexibility has been beneficial. For example, shortly after the school opened, some 6,500 square feet of non-instructional space—originally the automobile shop showroom—was readily converted to accept the installation of all facilities for KLVX-TV, the local educational television station.

Clayton E. Farnsworth, the center's principal, hopes eventually to join his school with KLVX-TV in working out a television technology training program, and also to persuade the station to pipe special closed-circuit broadcasts into the center. A new showroom, designed to replace the one lost to educational television, is scheduled for construction during Phase II of the school's long-range plans

Admittedly, the amount of flexibility that can be built into a design is limited. And there are certain disadvantages to multi-phase construction. At Southern Nevada, for example, the cosmetology laboratory, now part of the Phase I structure, will ultimately be moved to a building not scheduled for construction until Phase III In order to insure an easy move, beauticians' cabinets—which include sinks, faucets and sprayers—were built as units that can be shifted by simply uncoupling them from wall-mounted pipes and coupling them to plumbing at the new location Floor plumbing was thus eliminated and the space left clear for other installations

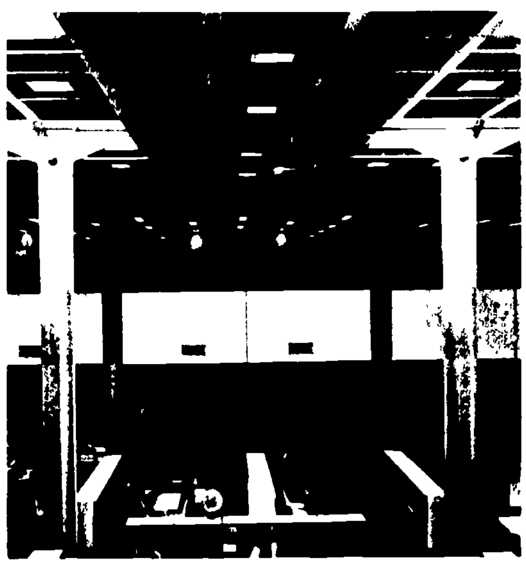
It seems obvious that in phase construction, certain major installations must be made at the outset although they may not be used until much later Thus, when the air frame instruction space was built, under-floor exhaust ports were installed, along with knock-out floor slabs, because a few years hence, the auto shop will have expanded into the area Elsewhere, to avoid the cost of excavating and restoring an exterior roadway, a complete gasoline station was installed during Phase I construction, although the course requiring gasoline pumps will not be introduced for several years And of course, the central heating and air-conditioning space had to be planned for the addition of boilers and chillers as new construction adds more volume to the buildings

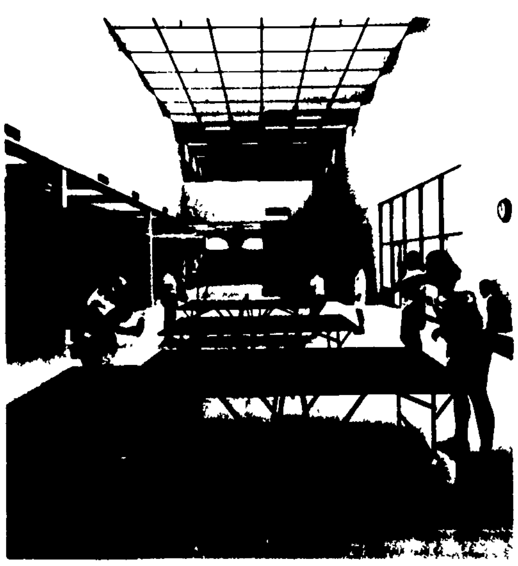
Despite such temporary inconveniences, the economics of phase construction override most objections. The most readily apparent fact is that money can be raised more easily over a period of years than all at once. Eventually, the centers' planners hope to accommodate 5,000 students and offer such plush facilities as a runway for the delivery of light planes to the air frame repair department.

Approximately 10 per cent of the present structure is devoted to administration The rest is assigned to teaching and shop areas The ratio of administration to instructional space will drop, however, as each new construction phase is completed.

Two of the traditional school space-eaters do not exist at all in Phase I of the Southern Nevada Vocational-Technical Center. Because so many of its students are post-secondary or non-degree matriculants who need not fulfill a physical education requirement, the school has no gymnasium. A few sports

are encouraged—mostly for their conditioning value in later life—and showers have been installed in one of the shop areas to accommodate participants When a more formal athletic center is completed (Phase IV) the showers will be used exclusively by shop students.





An auditorium is planned for Phase III, but its construction will coincide with the establishment of a theatrical trade course, designed to supply stage technicians for Las Vegas' thriving hotel show trade

Another traditional space-consumer, the school library, not only occupies a prominent place in the center, it is the focal point of the building's administrative-academic wing. Open and informal, its two-story space is framed on three sides by interior balconies, and lies within view of classrooms, the faculty dining room, and a student promenade Moreover, it is accessible on both levels and the levels are connected, so that students can enter the library from either floor

In keeping with the school's vocational orientation, the library emphasizes audio-visual resource materials rather than books and periodicals, and is equipped with individual carrels for listening and studying Eventually, the library will also be wired for video tape reception. Physically, aesthetically, and philosophically, the library constitutes the heart of the school, reinforcing the viewpoint that occupational education is intellectually valid.

Classrooms in the vocational-technical school are closely integrated with their resource centers Nevada law requires that all high school students be taught English, social studies, and mathematics The academic spaces, in which these subjects iibe with occupational training, surround the library in two concentric rings Similarly, each shop area has its adjacent classroom, so that students may move from theoretical to practical work with a minimum of discontinuity.

Instructional hardware is as advanced and flexible as the classrooms The consultants who helped plan Southern Nevada's curriculum also helped select the equipment that students would use in training. They made sure that every tool and machine was typical of the equipment that trainees would find out on the job

Secretarial students, for example, train on the latest model electric typewriters. Their shorthand skills are sharpened in audio carrels, where they can dial up any one of four speeds of prerecorded dictation, and their techniques as receptionists are developed as they manipu. a regulation-size telephone switchboard.

In the school's data processing center, equipment is sufficiently sophisticated to enable students to perform much of Southern Nevada's routine record-keeping functions: grade processing, attendance record maintenance, textbook inventorying, and individual student scheduling. The data processing equipment, though installed at the school, actually belongs to a local project unit operating under the Manpower Development Training Act. Under a reciprocal agreement, the school borrows the computer and the M.D.T.A. group holds its own training sessions in the center at night, rent-free.

In some instances, equipment was custom-built for the school. In the cosmetology lab, for example, a full-length mirror was needed at each girl's work table. But such mirrors are permanently fixed to the standard commercial consoles, and obscured the students' view of their teacher. Special consoles were built to remedy that situation, and now students can slide their mirrors down far enough to obtain unobstructed vision.

Consistent with the flexibility of the school's design, all of its furnishings—desks, chairs, study carrels, even chalk boards—are movable. Teachers' desks are part of this scheme, although they are not located in individual classrooms. Instead, desks are clustered in a spacious teacher's center adjacent to the faculty dining room and lounge. Here, teachers can maintain their permanent files and records, meet with one another and with students, and spend their free periods in comparative privacy

Not only do the teachers seem to prefer their special preserve to individual classroom stations, but they feel that keeping their desks away from shop areas more accurately duplicates on-the-job conditions. And of course, it facilitates team teaching, a technique that Principal Farnsworth finds particularly adaptable to the demands of occupational education.

Although the center boasts a substantial array of audio-visual hardware, Principal Farnsworth concedes that it is not used extensively. In part, this is because the faculty—drawn from areas outside of the academic world—is unfamiliar with audio-visual education techniques (an effort is being made to overcome this barrier), but it is also attributable to the slowness of software manufacturers in developing suitable materials for vocational courses.

As the market for such materials expands, however, it is hoped that more good films, slides, tapes, and models pertaining to vocational subjects will be produced. Farnsworth believes that if effective teaching tools are available, his teachers will use them. He is probably correct in this, although there is evidence that availability is not always the key to utilization. (See the experience of Kenosha Technical Institute elsewhere in this report.)

Striking as it is, and highly efficient, too, the Southern Nevada Vocational-Technical Center is far from perfect. Some mistakes in design are already apparent. Fortunately, these are correctable; another virtue of the systems approach to construction.

In some of the shop areas, for example, the insistence upon open, uninterrupted space has introduced security problems. Some equipment cannot be locked up, and there has been theft. The problem is intensified by the lack of a full security staff. The eventual solution may take the form of lockable space, easily built with modular units.

It was thought, when the school was built, that public transportation would bring students to the door. Bus service has not kept pace with construction, however, and since the center is situated 2½ miles from the nearest public transportation, students must provide their own Some who would truly benefit from enrollment cannot be accommodated

The present size of the school is also a limiting factor. Clark County School District encompasses 8,000 square miles and has a population of 300,000, some 63,000 of whom are old enough to attend school. The vocational-technical center's administrators would like to make their facilities available to all comers, but at present, they accommodate only 450 high school students (grades 11-14) and 225 post-secondary adults in the regular program, with more adults using the center at night under the M.D.T.A. program.

But these are not insurmountable problems, and the school trustees are determined to overcome them. Certainly, they have made an impressive and auspicious start.

Southern Nevada Vocational-Technical Center, Las Vegas, Nevada

Program:
A bridge between secondary and post-secondary education, combining 11th and 12th grade programs leading to a high school diploma, with 13th and 14th grade courses designed for continuing education in 14 major areas.

Vocational majors:
Air frame and power plant, auto mechanics, auto body repair, carpentry, cosmetology, culinary arts, drafting, electronics, home economics occupations, business data processing, secretarial science, bookkeeping, graphic arts, and refrigeration.

Physical plant:
First phase—151,000 square feet—completed in September, 1966, at a cost of almost $3.1 million. Second phase—95,000 square feet—completed in February, 1969, at a cost of nearly $1.9 million. Third phase, planned for completion in 1972, will add 150,000 square feet. Fourth phase, expected to be finished in 1975, will add 100,000 square feet, for a total of almost 500,000 square feet. The size of the school site is 390 acres. Some 12-1600 students could be enrolled in full-time programs in the fall of 1969.

Administrative source:
Clayton E. Farnsworth, Principal, 57100 Maple Road, Las Vegas, Nevada.

Architect:
William E. Blurock of William E. Blurock & Associates, Post Office Box 577, Corona del Mar, California.

Designed by Harper & George
Anthony Aviles, Design Director
Printed by Herst Litho Inc.
Copy edited by Gaila Coughlin

All photos of
Kenosha Technical Institute,
Martingrove Collegiate Institute, and
Quincy Vocational-Technical School
by George Zimbel.

All photos of
Portland Community College and
Southern Nevada Vocational-Technical Center
by Rondal Partridge.

[illegible]

A College in the City: An Alternative.
[illegible] to the planning [illegible] with facilities dispersed [illegible] designed to serve [illegible] and to stimulate [illegible]

Bricks and Mortarboards.
[illegible] makers in higher [illegible] the colleges and universities [illegible] space for the burgeoning [illegible] decade how the space [illegible] to the inevitable [illegible] educational process in the [illegible] (One copy available without [illegible] Additional copies $1.00.)

Campus in the City.
EFL annual report for 1967 and an essay [illegible] problems and trends in [illegible] urban colleges and universities [illegible] potential role as a catalyst in the [illegible] of the cities.

College Students Live Here.
A report on the what, why and how of college housing, reviews the factors involved in planning, building, and financing student residences.

Design for ETV— Planning for Schools with Television.
A report on facilities, present and future, needed to accommodate educational television and other new educational programs. Prepared for EFL by Dave Chapman, Inc., Industrial Design.

Design for Paperbacks: A How-To Report on Furniture for Fingertip Access.
[illegible] solutions to the problems of displaying paperback books for easy use in schools.

Educational Change and Architectural Consequences.
A report on school design that reviews the wide choice of options available to those concerned with planning new facilities or updating old ones.

The Impact of Technology on the Library Building.
A position paper reporting an EFL conference on this subject.

Relocatable School Facilities.
A survey of portable, demountable, mobile, and divisible schoolhousing in use in the United States and a plan for the future.

The Schoolhouse in the City.
An essay on how the cities are designing and redesigning their schoolhouses to meet the problems of real estate costs, population shifts, segregation, poverty, and ignorance.

The School Library: Facilities for Independent Study in the Secondary School.
A report on facilities for independent study, with standards for the size of collections, seating capacity, and the nature of materials to be incorporated.

School Scheduling by Computer/ The Story of GASP.
A report of the computer program developed by MIT to help colleges and high schools construct their complex master schedules.

SCSD: The Project and the Schools.
A second report on the project to develop a building system for a consortium of 13 California school districts.

Profiles of Significant Schools

A series of reports which provide information on some of the latest developments in school planning, design, and construction.

Schools Without Walls.
Open space and how it works.

Three High Schools Revisited:
Andrews, McPherson, and Nova.

Middle Schools.
Controversy and experiment.

College Newsletter

A periodical on design questions for colleges and universities.

Case Studies of Educational Facilities

A series of reports which provide information on specific solutions to problems in school planning and design.

8. The Schools and Urban Renewal.
A case study of the Wooster Square renewal program in New Haven, Connecticut.

9. Air Structures for School Sports.
A study of air-supported shelters as housing for playfields, swimming pools, and other physical education activities.

10. The New Campus in Britain: Ideas of Consequence for the United States.
Recent British experience in university planning and its implications for American educators, architects, and planners.

11. Divisible Auditoriums.
Operable walls convert little-used auditoriums and theaters into multipurpose, highly utilized space for the performing arts and instruction.

12. The High School Auditorium: Six Designs for Renewal.
Renovation of little-used auditoriums in old and middle-aged schools to accommodate contemporary educational, dramatic, and music programs.

Technical Reports

1. Acoustical Environment of School Buildings.
Acoustics of academic space in schools. An analysis of the statistical data gathered from measurements and study.

2. Total Energy.
On-site electric power generation for schools and colleges, employing a single energy source to provide light, heat, air conditioning, and hot water.

3. 20 Million for Lunch.
A primer to aid school administrators in planning and evaluating school food service programs.

A report from Educational Facilities Laboratories,

EFL

Kenosha Technical Institute,
Kenosha, Wisconsin

Martingrove Collegiate Institute,
Etobicoke, Ontario, Canada

Portland Community College,
Portland, Oregon

Quincy Vocational-Technical School,
Quincy, Massachusetts

Southern Nevada Vocational-Technical Center,
Las Vegas, Nevada

Profiles of significant schools