French schools

a report of the U.S. Team visit to France from November 13 to 23, 1977

NBSIR 78·1521

National Engineering Laboratory
National Bureau of Standards
U.S. DEPARTMENT OF COMMERCE
Washington, D.C. 20234

March, 1979

NBSIR 78-1521

French Schools

a report of the U.S. Team visit to France
from November 13 to 23, 1977

Center for Building Technology
National Engineering Laboratory
National Bureau of Standards
Washington, D.C. 20234

Prepared in cooperation with

School Construction Branch
U.S. Office of Education
400 Maryland Avenue, SW
Washington, D.C. 20202

March 1979

U.S. DEPARTMENT OF COMMERCE, Juanita M. Kreps, Secretary

Jordan Baruch, Assistant Secretary for Science and Technology

NATIONAL BUREAU OF STANDARDS, Ernest Ambler, Director

ACKNOWLEDGMENTS

The National Engineering Laboratory of the National Bureau of Standards would like to express its sincere appreciation to R. Rossi, Director, Centre Scientifique et Technique du Batiment,and his staff, James L. Haecker, Editor, and S. Porter Driscoll, Program Coordinator, for their efforts in producing this document.

Preface

In November 1969, the French Minister for Industrial and Scientific Development and the United States Science Advisor to the President met to continue their discussion, begun two months earlier in Paris, on ways to expand scientific and technical cooperation between the two countries. Subsequently, a number of French and American officials met to discuss specific cooperative projects in a variety of fields, including building technology, urban development, environmental pollution, marine sciences, meteorology, transportation and medicine.

By June 1970, the National Bureau of Standards and the Centre Scientifique et Technique du Bâtiment had effectively begun a cooperative program in building technology. The purpose of this program was to increase jointly the French and United States capability to:

1. develop building sciences and technology to meet the needs of increased housing and building requirements,

2. seek answers to significant building technology problems of interest to both countries, and

3. reduce costly and wasteful duplication, in both time and resources, of parallel national efforts in building research by sharing the results of such research efforts.

This collaboration has provided opportunities for representatives of both nations to exchange ideas, skills, information and techniques in attacking problems of particular mutual interest. These opportunities have included the exchange of selected literature, with translations of main papers and publications; the exchange of long-term interns working in the organization of the other country on subjects requiring special facilities; work by one organization for the benefit of the other not as well equipped, either in staff or in equipment; joint work by both organizations following a plan of mutual problem-solving; and the exchange of missions of experts from one country to the other to study special work. It is precisely this exchange of missions of experts, to study specific work, that produced the report which follows.

In March 1975, a team of French architects, engineers and educators visited in the United States to observe the U.S. process of education, its organization and the implementation of school building programs necessary to support educational needs. Their observations have been reported in a document which has been printed in both English and French and will serve as an interesting companion to the report of the U.S. team visit. Together, these documents will provide the reader with a comparison of systems used to provide buildings for educational requirements, showing some distinct similarities, some diametrical dissimilarities and some interesting emerging trends and concerns of both nations.

The Mission

Introduction

The purpose of the trip was to observe and study French educational facility design, construction and utilization. The selection of the United States team and the mission were arranged by James L. Haecker, then coordinator of International Programs, Institute for Applied Technology (IAT), National Bureau of Standards (NBS). The visit was in conformance with the agreement between the Institute for Applied Technology at NBS (IAT-NBS) and the Centre Scientifique et Technique du Bâtiment (CSTB).

The U.S. team report will deal with elements of the educational program, particularly as it relates to the building program. It has been written by the individual team members, each providing his or her own interpretation of situations and conditions noted from the point of view of his or her own expertise and background. The fact that some observations, or aspects, may be duplicated by team members serves to emphasize the importance of those aspects.

The schools visited were those mutually selected by the Ministry of Education and CSTB. All were of recent vintage and typified the several systems of construction. Each school possessed individual design qualities that set it apart from others visited by the team. These differences are significant and arise largely from unique combinations -- site, building orientation, designer and builder -- since the educational programs for the schools of a given size and grade level serving the same function are almost identical. Because the buildings visited were relatively new, the programs were being phased in on an annual basis. Consequently, the team did not have an opportunity to observe older types of building design and some of the more established programs, particularly at the secondary level.

Trip Itinerary

Background

IAT-NBS and CSTB established a series of joint activities aimed at informing each other of the best state-of-the-art knowledge and practice related to several building types. Schools were selected as a building type important to both countries, and a 16-person French team lead by M.J.C. Parriaud studied U.S. Schools in 1975. This counterpart study tour by the U.S. team completes a current series based on building type studies.

Locations Visited: Paris, Toulouse, Marseilles, Valence, Grenoble, Geneva, November 13-23, 1977, specific visitations are noted on page 5.

Purpose of Trip: To observe and study French educational facilities as a member of the U.S. Team created in conformance with CBT--CSTB agreement.

Team Composition:

Mr. Samuel Bates, AIA, Architect, Dallas, Texas.
Dr. William W. Chase, Team Leader and Chief Construction Branch, U.S. Office of Education, HEW.
Mr. Porter Driscoll, AIA, Manager, DAC/TAP, Center for Building Technology, NBS.
Professor Jonathan King, HAIA, Director Architectural Research Laboratory, University of Michigan, Ann Arbor, Michigan.
Mrs. Margie Thompson, Principal Terraset Elementary School, Reston, Virginia.

Itinerary:

The study tour began with a team briefing given in Paris Monday afternoon, November 14, by Mlle. Angela Ghivasky, Secretary to M. Rossi, Director, CSTB, and by M. Jean Rousseau, Chargé de Mission, CSTB. During the meeting Mlle. Ghivasky identified the schools to be visited and the meetings to be attended in various locations. She also explained in detail the transport, lodging and financial arrangements that had been made for the team's benefits and identified the French specialists who would be traveling with the team; M. Rousseau, CSTB; Mlle. Sauvage, Ministère of Education and Mlle. Bensilum, interpreter.

At each of the major centers - Toulouse, Marseilles, etc. - the team was met by a group of departmental and regional representatives of the Ministry of Education, and architects, contractors and local officials who presented briefings during which questions were sought and answered. Thereafter at each of the schools, a more detailed briefing was presented by the principal and staff. After this briefing, the team studied the various aspects of the educational and building program, the design and construction process and the building in use.

This proved to be an effective information transfer technique, and CSTB and the Ministry of Education are to be congratulated for the flawless execution of the following complex and fast-paced itinerary:

Monday, November 14, 1977 Briefing by CSTB	Paris
Tuesday, November 15, 1977 Collège de Saint-Orens	Paris-Toulouse
Wednesday, November 16, 1977 Dental School, University P. Sabatier Lycée Henry de Toulouse-Lautrec	Toulouse-Marseilles
Thursday, November 17, 1977 Collège d'Istres (Istres) Collège de Bollene (Bollene)	Marseilles-Valence
Friday, November 18, 1977 Collège de Crest (Crest) Collège du Clos d'or (Grenoble) Centre Intégré de Ville Neuve (Grenoble) L'école Trimaire de Pontcharra (Pontcharra)	Valence-Grenoble
Saturday, November 19, 1977 Collège de Champs Fleuri L'école Maternelle de Rumilly (Rumilly)	Grenoble-Geneva-Paris
Sunday, November 20, 1977 CSTB Briefing-School Building Design and Construction Process	Paris
Monday, November 21, 1977 Station du Châtelet Centre Pompidou, Work session with Ministry of Education Staff	Paris
Tuesday, November 22, 1977 U.S. Embassy, Conference with René Rossi, Director, CSTB, and, William Salmon, Scientific and Technical Counselor	Paris

Education and Educational Organization

Elementary and Secondary Education in France

On July 11, 1975, the Senate and National Assembly adopted a bill on the reform of the French educational system that had been presented by René Haby, Minister of Education. The main lines of this reform are:

1. to offer general education to all children in both intellectual and practical areas;

2. to adapt the school to the child: to enable a child to pass to a higher grade on the basis of his maturity rather than age;

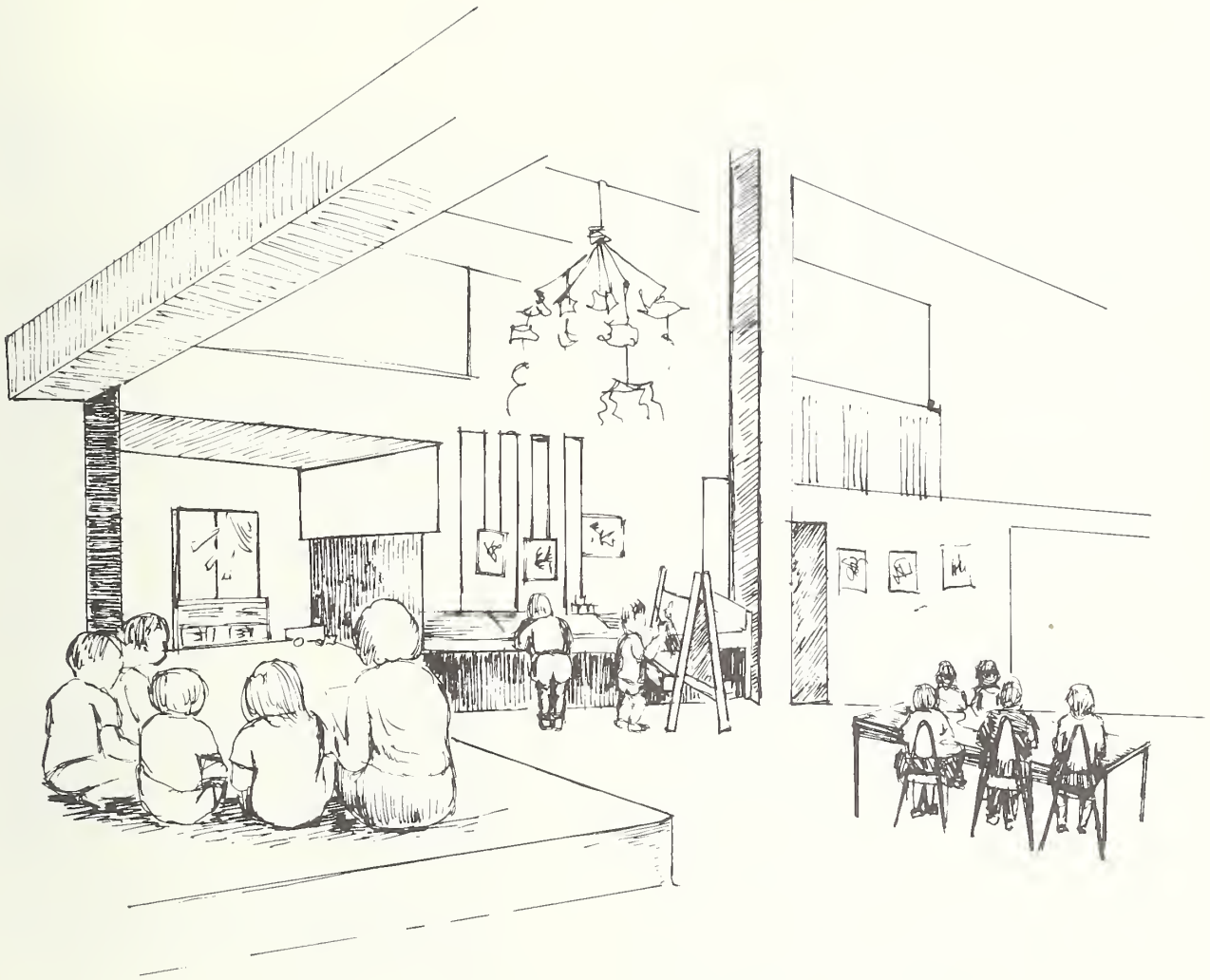
3. to bring schools into more direct contact with the contemporary world: to over-haul curriculums, introduce new subjects and to develop a new approach to school life.

Pre-elementary Education

France is the only country that requires its nursery school and kindergarten teachers to attain the same level of education as its elementary school teachers.

Nursery school and kindergarten education is optional and available to children ages two to six. Of course, nursery schools have no formal syllabus, the aim being to help children learn how to live in society. Activities are varied, but principally include educative games and self-expression through movement, singing, stories and art.

A child may then enter elementary school as early as age five, depending on his level of maturity which is determined by his teacher, his parents, a doctor, and a psychologist.



Secondary Education - First Cycle

A child's entry into secondary schools, occurring usually between ages 10 and 13, again depends on his level of ability and maturity.

Although the first cycle is intended to reinforce and extend a child's primary learning, the school programs do include rich and varied introductions to such studies as physics and foreign languages.

The first cycle is divided into two parts:

a) Le Cycle d'Observation

Equal emphasis is placed upon disciplines to encourage the child's full range of abilities in intellectual and artistic activities as well as sports and manual skills: French, a second language, math, economics, humanities, physics, natural sciences, manual and technical training, art and music, physical education and sports. Extra classes are provided for children who have fallen behind, and accelerated classes for students who do well.

b) Le Cycle de'Oreintation

In addition to general subjects listed above, a student may choose among the following:

> A modern second language, or Latin or Greek; or prevocational training courses, including training periods in a technical high school, a firm, etc.

A second level certificate is awarded upon completion of this cycle. The certificate is based on the student's school record and, where applicable, the results of facultative examination, the B.E.P.C. (Brevet d'Études du Premier Cycle).

After completing the first cycle, the student has three options:

a) to further his education in a lycée d'enseignement general et technologique where he may prepare for the Baccalauréat examination or the Brevet de Technicien.

b) to further his education in a lycée d'enseignement professionnel where he may study in preparation for the CEP (1 year), the CAP or BEP (2 years), ordinary technical certificates.

c) or, at age 16, (the minimum school-leaving age) to begin an apprenticeship in a training center or firm.

Secondary Education - Second Cycle - The "Lycee"

There are two kinds of "lycées":

Lycee d'Enseignement Professionnel (LEP)

These are two-year schools preparing pupils for a trade (the CAP certificate) or several related trades (BEP certificate). All diplomas are awarded on the basis of tests given throughout the year. Students failing to maintain a satisfactory level are given attendance certificates.

Lycee d'Enseignement General or Technologique

The main role of these schools, which are classical, modern or technical lycées, is to provide general instruction in French civilization (classes des 2ème et 1ère) and prepare students for advanced studies, for specialized training, or for active life (Classes Terminale).

French, philosophy, math, science, technology, economics, social studies, plus one modern language compose the curriculum of the first two years of the lycée. In addition, students have a large range of electives: ancient and modern languages, arts, sports, technology, and advanced courses in math, engineering, economics and business management. A certificate is awarded at the end of the class du 1ère. The certificate is based on test grades during the year and a final exam, and is of particular value to those students leaving school at this age.

In the "Classe Terminale," or the final year of the "lycée," the student chooses his own program which prepares him either for higher education or for his future occupation.

The compulsory Baccalauréat examination culminates a balanced secondary education.

The Baccalauréat

The examination consists of a series of written and oral tests. These include the level of general education acquired in the programs of the first two years of the "lycée," and the specialized knowledge acquired in the Classe Terminale.

School Program

If one can conclude that the school facility is an outgrowth of the type of curriculum to be taught in the school, the schools visited lead one to at least the following assumptions about school programs:

1. Most teaching observed by the team assumes that the student learns best through direct instruction, using the auditory modality.

2. Little "hands-on" learning was demonstrated except in the Arts.

3. Extending learning via the Media Center is not yet a reality, since the absence of books, tapes, visual learning materials was acute.

Exceptions to these assumptions exist in the nursery schools and vocational schools, both of which evidenced many learning materials and students participating actively in their own learning.

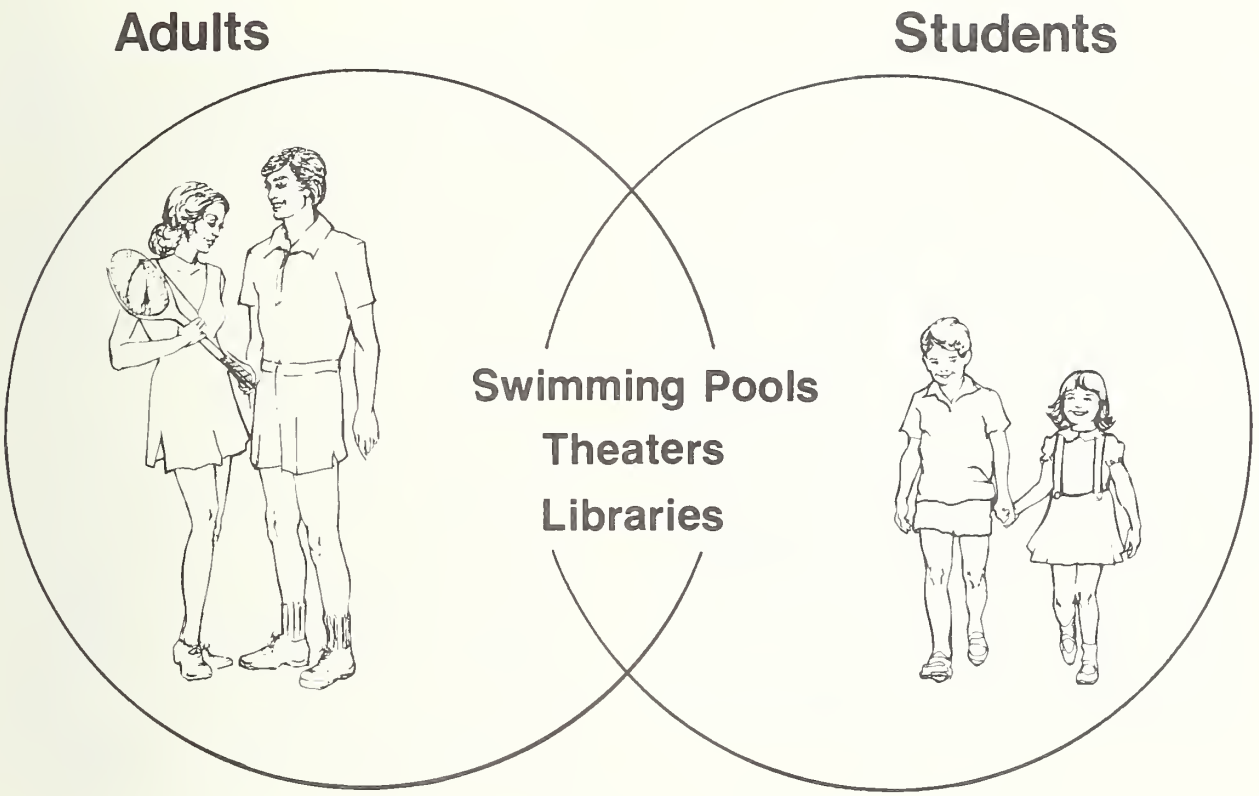
One notable effort seems to be emerging in the control of class size. The schools visited had very small sized classrooms and were properly called lecture classrooms. The addition of media centers for extended learning opportunities seems to be an effort toward "opening" the methodology of teaching to a more inclusive notion that the student can indeed learn much on his own.

The direction of curriculum is centralized in Paris, and all students are exposed throughout the state to the same curricula. It seems clear that this concept is not fully practiced by either the local school directors or the Ministry; however, both groups tend to favor the centralization of control of the curriculum. Where leadership at the local school was strong, the Ministry appeared to approve curriculum practices that were divergent.

If we use the term curriculum to include all the child's experiences during the school day, mention must be made of the child's play experiences and lunch experiences. The children are notably self-directed, and the absence of extreme supervision was refreshing. It would appear that liability for student accident is not yet a serious factor in French public schools; moreover, the apparent assumption that children are noisy in play, should relax at lunch, and largely tend to themselves during their mid-day period is again a difference between American and French schools that is noteworthy. Perhaps the definition is less one of pedagogical theory than it is of pragmatic job description of the teachers by the French teacher's union. Perhaps the teachers do not consider supervision of children part of instructional duties.

The Arts seem to play an integral part in the curriculum; however, the absence of children's work in the corridors or classrooms was indeed startling. Only in the Media Centers of the schools visited was there any evidence of the really quite superior work done by the

Community



children in the visual and graphic arts. The exception to this was in the nursery schools where the children's work was carefully and completely displayed.

Generally speaking, the curricula offered the French student in the schools visited by the team appear to offer more real-life experiences for students. It appears that the subject disciplines are for the most part taught in isolation at the local level, while the Ministry of Education recognized the desirability of an interdisciplinary approach as outlined by the reforms of 1975.

The common use by the community of school facilities such as swimming pools is economically viable since funding can come from the Ministry of Recreation. In three schools visited by the team, the covered pools, complete with exercise rooms adjacent to the schools, were in use by students and hours were posted for adult use. Libraries and drama facilities were also shared. Perhaps this is the most noteworthy community involvement in the public schools visited. The Ministry was candid in their response to team questioning regarding community participation in the development of schooling in France.

Community Involvement in Education Process

The subject of community involvement in public education is of particular interest when assessed in the French school system. At first examination it would appear that because of the centralization of all planning activities by the Ministry of Education in Paris, little, if any, local involvement exists in either program planning or development of educational facilities. However, through visitation in the schools and interviews with both local citizenry and Ministry personnel, there is a process for community involvement in the public educational system. Because the process is somewhat obscure and difficult, it seems fair to say that the rather generalized feeling of non-involvement prevails among the citizenry. Basically the citizen wishing to have an impact on his local public educational program has two avenues: 1) the power of the vote and 2) the power of the purse. The vote seems to be the most effective of the two.

If a local community wishes to effect change in its educational program or facilities, it works through the mayor and municipal council. They, in turn, work through the regional Prefect and the Academy Inspector at the Ministry of Education whose major responsibility is long range planning of public school facilities. The local community must provide five-year demographic data to support need. If data supports need, the new school will be included in the next construction program. It is obvious that the Ministry cannot approve all justified proposals; therefore, the politics of need and money obtain. It is interesting that 85% of the dollars allocated for construction of secondary schools comes from the state. About 20-30% of the construction costs for primary and elementary schools, which are the the property of cities or groups of villages, are also subsidized by the state. However, only 3% of the total state budget goes to school construction. It takes approximately two or three years to decide where a school will be built and to acquire financing. It takes about one year to construct the building, thus making the five-year demography somewhat questionable. In schools visited by the team it seemed apparent that the schools were built to house more students than were in attendance; this makes the per-pupil cost for construction and program somewhat difficult to ascertain.

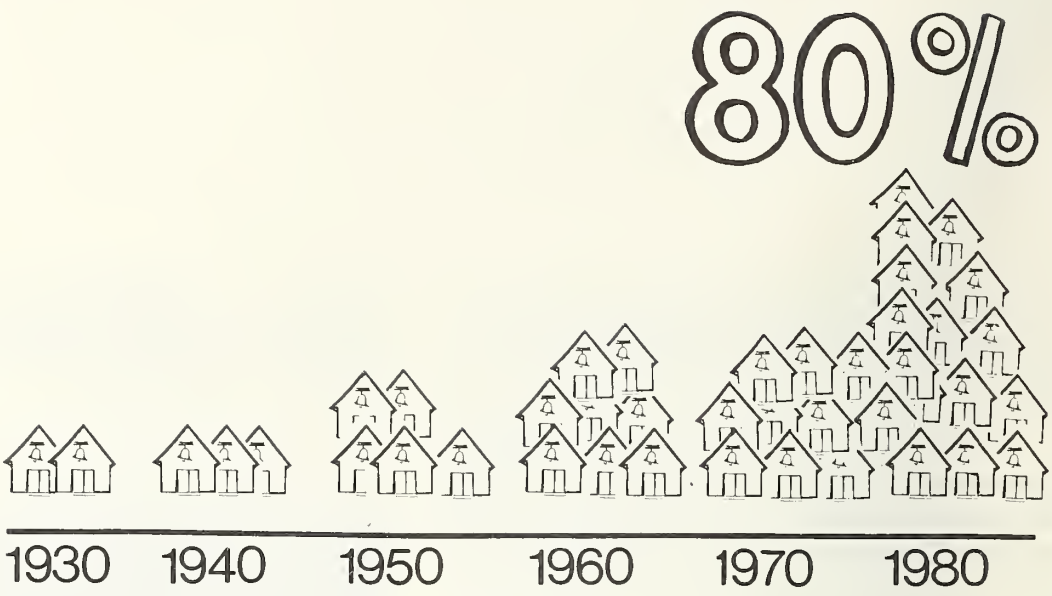
In one school the team visited - a Nursery School "de l'Avenue André" in Rumilly, France - the aspect of community involvement in the development of the type of school program to be offered to children, as well as the kind of structure in which to house the program, was clearly understood. With the involvement of the mayor and town council in paying building costs and in working closely with the nursery school's county inspector on the program desired by the community, an end result was a building unusually sensitive to its environment and its function in the development of pre-school children. The community, as represented by its mayor and parents, was clearly proud of its school, its program and the

resulting educational process. At Saint-Orens the principal made a particular reference to his desire for more parent involvement.

While generalizing on community involvement either in French or American schools is risky since observation is limited to the schools visited by the team, it would appear that real user involvement in the development of plans for a school building or in curriculum changes is in a state of evolvement. It would not be appropriate to comment on the effectiveness of the reforms introduced by the Senate and National Assembly in 1975 since they have not had sufficient implementation time to allow the French citizen a greater level of participation in decision-making in public education. Further, it remains to be seen if the type of societal structure and political ideology of France will find such citizen involvement in education feasible or attainable.

Nursery School at Rumilly

Nursery School at Rumilly



Growth of School Building in France

School Building Process

The post World War II baby boom, the shift from a 50 percent rural, 50 percent urban population to a 85 percent urban population, and the change of required schooling from 12 years of age to sixteen years of age created a tremendous demand that has been substantially met - 80 percent of all schools in France were built since World War II.

To meet this strong and continuing demand, a centrally controlled decision-making and building acquisition process was developed by the Ministry of Education. In the early post-war years, primary emphasis was placed on providing essentials, and later, as the resource/need balance permitted, refinements were added and desirable elements incorporated. However, strict central controls are still exercised over quantity, quality and costs.

France is composed of 22 economic regions headed by a government employee called the Prefect of the Region. The Ministry of Education annually distributes a subsidy ("gift of credit") to each Regional Prefect. The Prefect, assisted by the Regional Assemblies, decides on the division of this "total amount of credits among costs for new construction, maintenance, safety work, etc." The Prefect, not the Ministry, decides on the number of new constructions.

In order to reduce the uncertainties of costs, product quality and delivery times, extensive emphasis has been placed upon industrialized building. Firms and their associated architects are invited by the Ministry of Education to demonstrate through the detailed design of a typical school that their firm can meet Ministry of Education requirements. Since there are a number of larger industrialized builders successfully active in housing and other types of design and construction, it is understandable that the Ministry of Education should want to make use of the strengths of this system. The school building projects designated for construction are matched to the selected industrialized builder.

Villard-Benoit at Poncharra (Grenoble)

The city chooses the architect who will construct a primary school, for example, the School at Pontcharra. When the school is a college or a lycee, the architects are chosen by the Ministry. In this instance, there are two architects who are responsible for the construction. The adaptation architect who is chosen by the Ministry makes the studies for adapting the industrialized process to the terrain and to the future site of the establishment. The operational architect, named by the Ministry but chosen by the municipal council, is charged with following the construction progress at the site. This division of tasks is theoretical; it can be modified by the two architects, as well as their honorariums, through an understanding between themselves. The selected architects design within the limitations of the selected system, and the schools are built very quickly. For example, a highly individual school -- "Villard Benoit" at Pontcharra near Grenoble -- was begun in April, 1976 and was completed on September 15, 1976, using the Costamagna System.

The Process of Designing and Building Schools in France

The way schools and particularly secondary colleges are planned, designed, and built in France was of substantial interest to the team from the United States. The process differs dramatically from the way it is done in the United States, and it is difficult to compare the two without getting into issues of pedagogical theory, the direction of the building industry, the place (and value) of the architect as an independent consultant, and localism versus nationalism.

The first and possibly most important difference in the management of French education compared to that in the United States is the centralization of decision-making in Paris at the Ministry of Education. This applies to curriculum, staffing, educational techniques and theories, and of course to the design and construction of buildings.

Because of centralized decision-making regarding all these factors, it is far easier to utilize the building of schools as a force to encourage the industrialization of the building industry in France (and to do so is national policy). The fact that the Ministry of Education in Paris can settle such matters as the size of schools in terms of numbers of pupils and space per pupil, and can establish structural modules (such as the all-pervasive 7.2M.), both reduces the number of variables for the building system producer and also increases his potential market to include schools anywhere in France. This makes it far easier technically to design a building system for French schools (and less risky economically) than it is in the United States. The result is a group of thirty-two industrialized building systems, each of which can apparently meet the technical, spacial, and safety requirements for French schools. This brings a level of industrialized efficiency to French school building that is only present occasionally in the U.S.

The general process by which school buildings are designed and built in the United States puts much of the economic, pedagogical and building design decision-making in the hands of the local school board, its administrative and teaching

Villard-Benoit

Villard-Benoit

staff, its architectural consultant, and other participating local citizens. In contrast the French model places most of the decision-making in Paris. At its best, such a system is more efficient than the United States model, but it can also be less sensitive to local needs and aspirations. It may have a tendency to inhibit local initiatives, both architecturally and educationally. In terms of building process, the French system insures a greater uniformity with fewer errors and weaknesses than appear in United States school building. The French context is, however, considerably more limited in terms of cultural and climatological variety than is the United States.

The role of the architect is also quite different in the French process. In general he lacks the opportunity to have a strong input into the development of the program for the school, since most of the program decisions are determined by the Ministry of Education. He does, however, have an opportunity to work closely with the major contractors in developing the industrialized building systems utilized for the school building program. This is an opportunity many American architects would like to have available to them. The typical United States architect's clear role in the school building process, to serve as the representative of the client/school-board, doesn't exist in France. The architect is employed by a contract-

Villard-Benoit

ing group to design the industrialized building system, or by the Ministry of Education to utilize the system in the design of a particular school. The architect is not paid by the Ministry unless he is designated to be the adaptation or operation architect. Frequently the architect who designed the system does the primary design for a school, with a local architect adapting and coordinating the project and doing what we in the United States would call construction administration.

As indicated above, there are thirty-two industrialized building systems (each of which belongs to a contracting firm) which have been pre-qualified for school use by the Ministry of Education on the basis of detailed architectural and engineering plans and some physical testing.

The industrialized processes are put into operation either by a society of national stature or by a smaller group which may have 30-40 members or by some means which is divided throughout the territory based on a limited geographical sphere of action. These groups of enterprises have a common study bureau, generally in Paris, and only the operation of the process is given to local enterprises.

Cost, ability to meet the educational and spacial requirements for schools, safety, thermal insulation, acoustic separation between spaces, and the resistance of wall surfaces to the wear and tear schools receive in all countries are the principal issues considered by the Ministry in pre-qualifying the systems.

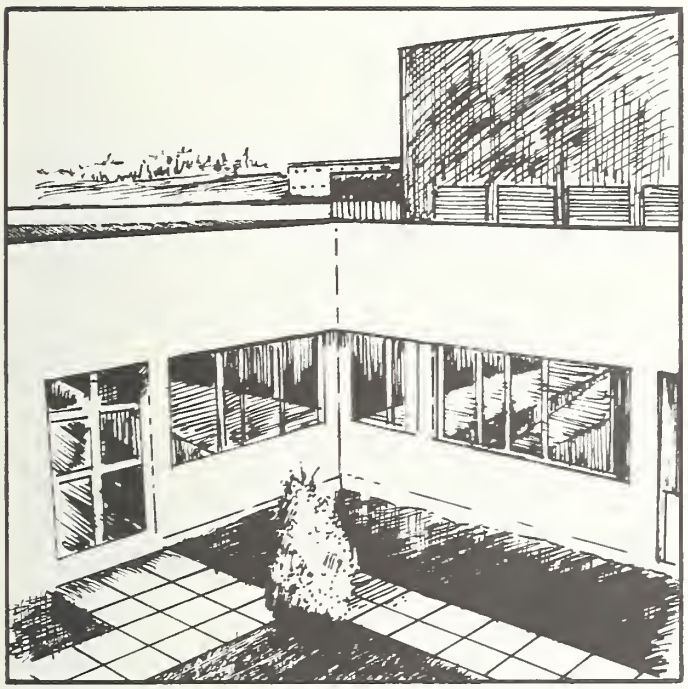
Having selected a group of systems on a national basis, almost all secondary school projects are assigned to one of the thirty-two prequalified contractors, and often to the architect who collaborated with the contractor in the development of the system. The program for architectural spaces is issued by the Ministry of Education in Paris; it is quite specific, and the project can proceed very efficiently.

After drafts are selected on their technical quality and their functional expectations, the Ministry asks the enterprises which presented the selected drafts to make cost proposals. The Ministry proposes a price per meter squared which should not be exceeded and the enterprises then propose their reduction. The size of the orders given by the Ministry depends on the correspondence between quality and price.

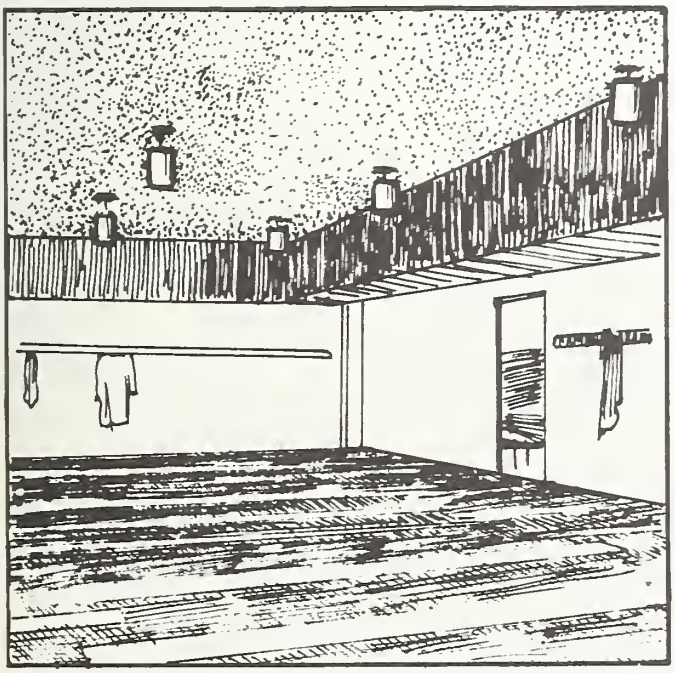
While the general level of the schools the team visited was quite high, it appeared that more attention might well be given to the specifications of the performance of the system in relation to acoustics - specifically to the reduction of reverberent sound - and to improving the quality and quantity of lighting. The normal French heating and ventilating systems (i.e., perimeter radiation and operable windows) is less than would be acceptable most places in the United States, but in view of the more temperate climate in France and the increasing cost of fuel, this may well be a very sensible long-term solution.

However, there is obviously some interest in the development of more sophisticated heating-ventilating-cooling systems. The Collége Henri - Boudon which the team visited in Bollene had a forced-ventilation system with separate duct networks for heating and cooling. The system was developed by the Centre Scientifique et Technique du Bâtiment (CSTB) to provide higher comfort levels while being both economical to build and to operate. The system utilizes an evaporative cooler. It was encouraging to find the French national building research agency, CSTB, working to solve a problem in the area of educational facilities.

Henri-Boudon á Bolléne



Henri-Boudon á Bolléne



Henri-Boudon á Bolléne

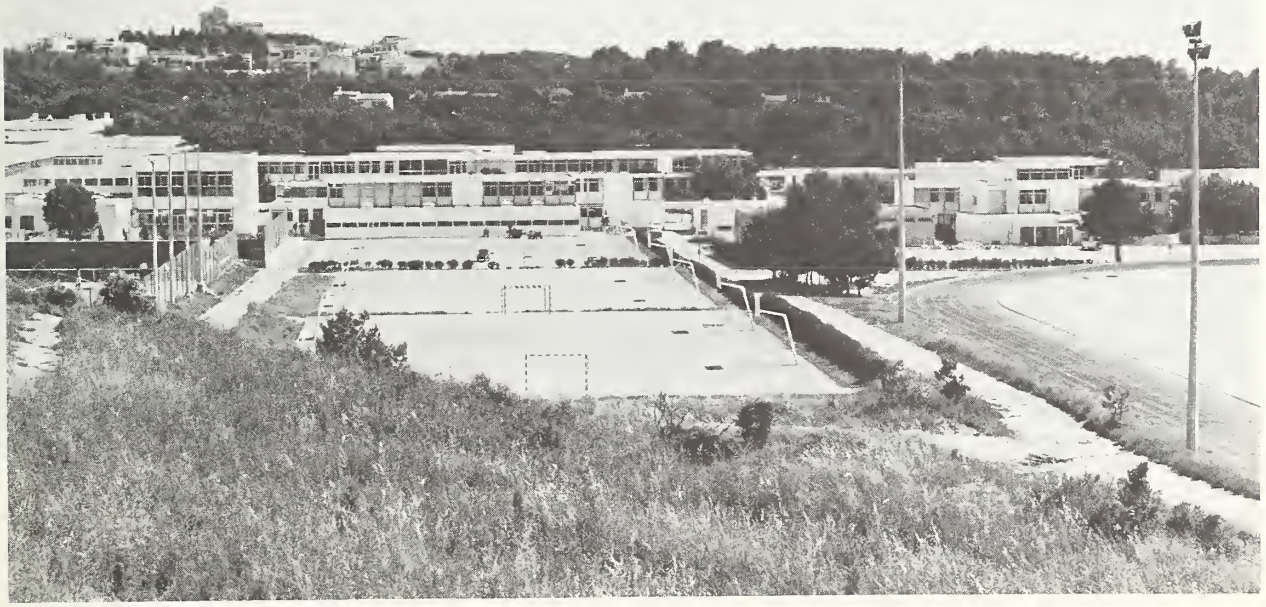
Reflections on the Schools Visited

The test of any process is its ability to solve problems. In this respect, the school buildings visited reflected well the ability of the French school building process to deal imaginatively with real problems. The ability of the Ministry of Education to work cooperatively with other Ministries was particularly impressive. The results included sports facilities at several schools which served both the schools and the other members of the community. The Team was impressed with two pre-engineered (Poly Vinyl Chloride) domed indoor-outdoor pools.

The Educational and Cultural Center - Les Heures-Claires at Istres - thirty to forty kilometers northeast of Marseilles was an extremely effective demonstration of the value of fifteen governmental agencies working together. The educational effectiveness of this school could not help but benefit from the presence on one campus of the College for 1200 students (a middle school in United States terminology) along with the public library, theatrical facilities, health facilities, sports facilities (including the pool and sailing facilities), vocational retraining facilities for adults, and facilities for other community purposes.

Les Heure Claires
Educational/Cultural Center at Istres

Les Heure Claires, Istres



Les Heure Claires, Istres

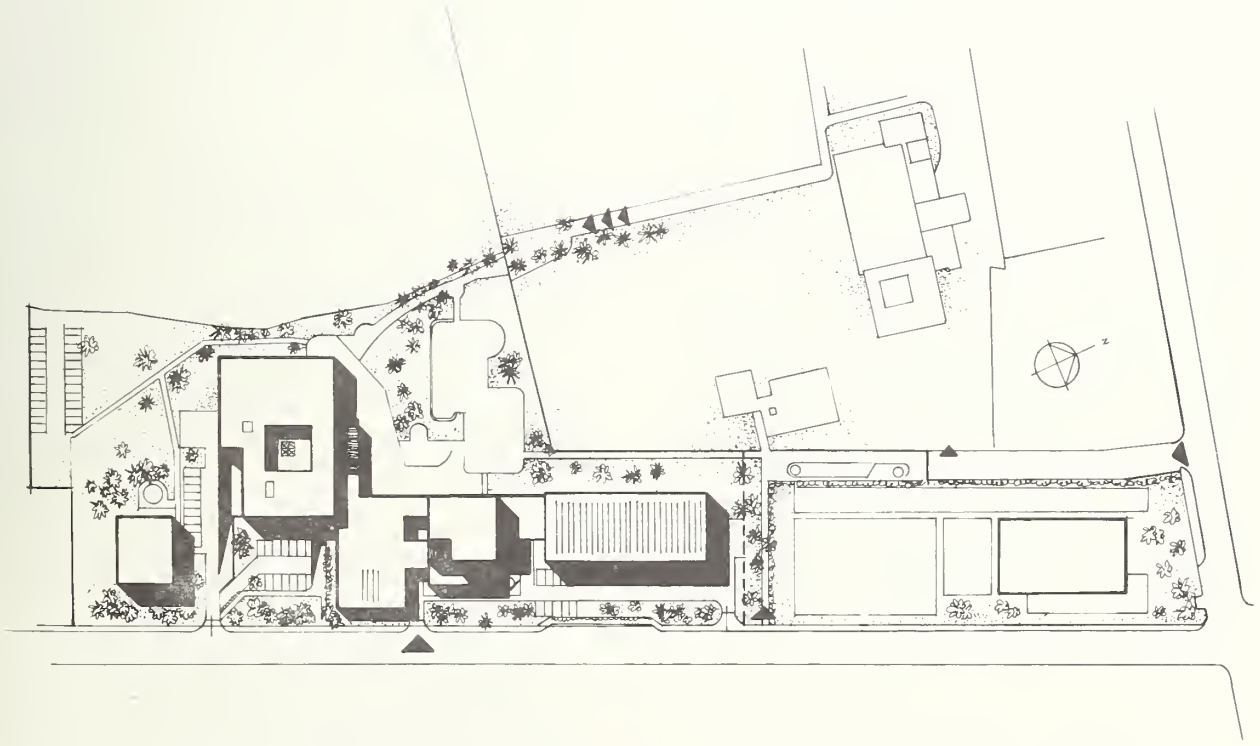
The integration of the school and the new housing at La Ville Neuve, a housing project for 10,000 persons in Grenoble, was also impressive. So the French process gets high marks for its ability to bring governmental agencies together to get greater value from its school facilities by integrating them with other appropriate activities.

In dealing with new issues, the system is quite adaptable as well. The Dental School, a part of the Toulouse complex and the first one constructed under state control, demonstrated great care in regard to fitting the building and the newly developed program. The close integration of the Dental School, and the Dental Clinic with its separate management, also gave evidence of the ability of various agencies to work together in the public interest.

The vocational school for food preparation workers in Grenoble - Collège d'Enseignement Technique du Clos d'Or - had extremely fine vocational facilities for its very specialized purposes, again reflecting the ability to program and build a highly unusual facility.

U.E.R. d'Odontologie
Dental School at Toulouse

College d'Enseignment
de Clos d'or



College d'Enseignment
de Clos d'or

Implications of the French Process of Building Schools

The French political system, the French view of education, and the French approach to building schools all differ radically from those in the United States. The result is a system more centralized, more uniform and hence democratic. But it involves far less participatory decision-making at the local level. In this respect, it is less democratic. The school building system, above all the secondary schools, supports the Federal governmental policy of strengthening the hand of industrialized systems procedures. The process produces safe and appropriate schools, but possibly provides less opportunities for architectural excellence than the United States system. The French system also limits (indeed almost eliminates) the possibilities of building schools that are inappropriate or uneconomic. The benefits and problems of centralism and uniformity go together.

In the process of developing the building systems themselves, there appears to be heavy emphasis on the 7.2M module. The results are systems that ordinarily appear to be able to deal with most of the problems encountered. Some systems, however, seem to have rather makeshift or awkward solutions to achieving longer spans. There also appeared to be rather more space dedicated to corridors than would be acceptable to an economy-minded school board in the United States.

One factor relating to process, which our team noted repeatedly, was that the schools designed around libraries (or instructional materials centers) - biblioteques/mediateques - didn't have the literary or audio-visual materials needed to make them vital instructional areas at the time when the school was first occupied.

However, many of the building systems the team saw were impressive in their well thought through detailing and adaptability to a variety of plans and site conditions. And the schools visited in general were excellent solutions to France's school building needs.

School Building Standards

French school buildings are constructed in accordance with general building codes and standards, including those regulating building strength, fire resistance, means of egress, plumbing and electrical distribution. In addition, the schools must reach given quality and quantity levels established by the Ministry unlike some American states where minimum standards are developed for school building construction which is to be funded in part by the state. And wherein local municipalities are urged to exceed these standards whenever possible with the understanding that the local community pays for the extra costs, the prevailing French opinion is that the Ministry of Education must establish an optimum level which every community must observe. They felt strongly that "a rich community shouldn't have richer educational facilities."

The Ministry of Education spacial requirements, as well as those for equipment and materials, are largely derived from post-occupancy experience and observations. While this works well in the evolutionary development of traditional classrooms, especially those of a special nature such as physics or chemistry laboratories it is somewhat less successful in the rapid introduction of new types of spaces, such as media centers where there is little or no domestic experience.

The Ministry of Education has a small group of architects and engineers but has no research teams or laboratories. To solve problems such as the development of requirements for new types of spaces and equipment the Ministry staff is utilized and assistance is sought from other ministries. CSTB is relied upon to solve technical problems related to school buildings. Performance requirements are established where possible and acoustical, fire and thermal requirements are expressed in these terms. Security and hygiene requirements are expressed only partially in performance terms. Where performance levels cannot be rationally established or tests cannot be devised to measure achieved levels of performance, then requirements are stated in prescriptive standard terms.

School Building Features

1. Location and Site Plan

The schools are generally located on relatively generous sites sufficient to provide room for initial construction and expansion of the school, ancillary physical education and community-use buildings, parking and playgrounds. In addition, a residence is often provided for the principal on the same site.

On-site vehicular and pedestrian traffic is well segregated. Conventional playgrounds are provided and are designed for staff control of student activities. In addition to the conventional playground, there exists in many cases an enclosed interior court designed for less strenuous activities such as concerts and theatrical productions. Close attention is paid to siting buildings in order to minimize negative site features such as noise and wind.

2. Building Plan

Since the secondary school building is most often situated on a generous site, it generally is of one or two story construction. The French ideal is not to create large schools of 1500 to 2000 pupils, but rather to keep the size around 900. In low density areas schools are often combined to reach this size and become "polyvalent" (serving more than one standard educational age group, e.g., nursery and primary). When this is done, facilities such as cafeterias, kitchens, assembly halls, and physical education buildings are shared by the two groups. The arrangement of spaces in the schools is not surprising but is generally well handled. (There are exceptions to this, however, when a relatively inflexible structural system or other design problem causes a poor fit between form and function.) Various elements are grouped logically according to function, and the buildings are easy to "learn" - there is no confusion as to where things are.

The tradition of individual classrooms for instruction by the teacher persists, but there is a new emphasis on responsive student involvement. Large and small multi-use spaces and media centers are widely used and are also shared by the two age groups. School building construction money comes from one fund and school equipment comes out of another appropriation generally provided over several years. For that reason, the science laboratories and media centers are often ill-equipped by any standards, and suffer particularly by U.S. standards. Circulation spaces including stairs are generous and particular attention is paid to fire safety and fire safety design; e.g. signage, lighting, and protected means of egress.

3. Structure

Reinforced concrete, cast-in-place, and several varieties of precast concrete dominated the construction scene. All twelve schools visited made extensive use of concrete and only two of the twelve use any significant quantity of other materials. The Educational and Cultural Center at Istres utilizes a steel rationalized-traditional form of construction, i.e., rolled steel

Cultural Center at Istres

Nursery School at Rumilly

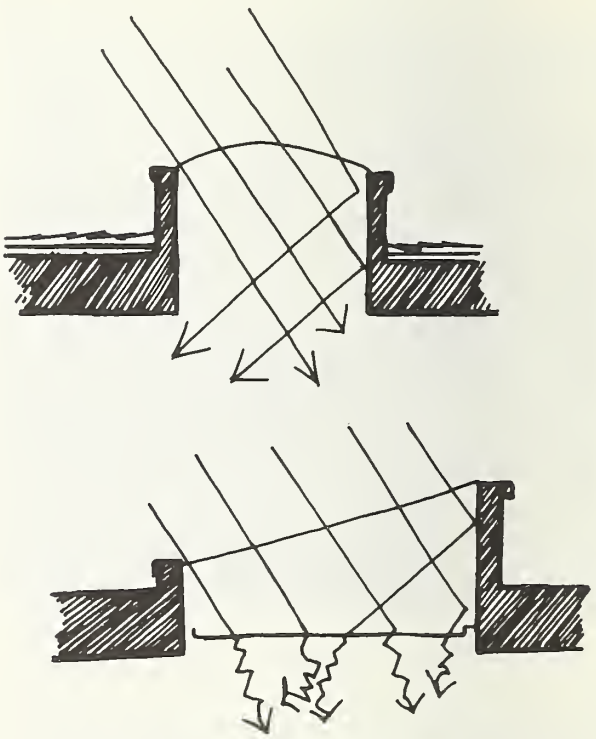
Nursery School at Rumilly

shapes and steel deck, stabilized with exposed diagonal bracing both vertically and horizontally; and the nursery school at Rumilly uses laminated wood beams and conventional wood roof framing to achieve a domestic scale and character. Cast-in-situ concrete is of good, but not outstanding, quality. Pre-cast concrete is of excellent quality and in many cases is given no "cosmetic" finish. The heat loss through concrete floor systems over unheated or exterior spaces appeared to be a problem and was diminished somewhat through the insertion of rigid wood fiber panels into the coffers or channels of the floor system.

4. Building Envelope

Exterior walls are most often of concrete and are produced in a wide variety of forms, textures and colors. Large concrete exterior wall panels and deep concrete beltcourses between the window heads and roof line are often heavily textured to add interest and to visually unify disparate elements. In some cases the large panels contain windows formed into the panel themselves, whereas in other cases the window is joined in a conventional manner to adjacent vertical wall panels and roof or floor panels. The windows are mostly horizontal sliding or of the "Italian" pattern, which allows the head of the window to tip in toward the room about six inches to provide ventilation and also to swing into the room about a vertical axis for cleaning. This latter style window is extensively used and is available both in aluminum and wood. Almost universally windows are shielded from vandalism, excessive heat exchange and glare by means of wood, metal or plastic slats which roll up into a box placed above the window head. In many cases this exterior device can be tipped out at the bottom to provide a solar shade for the window while still providing natural ventilation.

The majority of the school roofs are generally flat (having a slope less than 1/2" per foot), but there are two examples of sloped roofs - one in concrete (Pontcharra) and one in wood (Rumilly) to give regional character, but both were pre-elementary schools, having broader local conception and financing than secondary schools. Extensive use is made of sky lights in circulation areas, places of assembly and workshops, and "Pyrodomes" are used for venting in case of fire. The combination of extensive fenestration and sky lights provides great quantities of natural light into the building. In most cases the head of the window comes very close to, if not flush with, the ceiling and provides natural light deep into the room. This, coupled with reflections from relatively light colored interior finishes, often provides all the illumination necessary.



Skylights

5. Finishes and Equipment

Exterior and interior finishes are generally good and of types that require little maintenance. Heavy-duty floors in circulation spaces are either ceramic tile, terrazzo, or flexible composition floor tile approximately one-half meter on a side. In places of assembly, media centers and libraries extensive use is made of carpeting. Partitions are often of concrete or masonry units exposed or plastered or gypsum board with a sprayed on finish. Color is a prominent feature of the schools particularly in the assembly and circulation areas. Sometimes the strong, raw colors are very successful, but often they provide a dissonance that detracts from some of the better interiors. Acoustical correction is provided on ceilings of special classrooms and is required in places of assembly. Acoustical separation between spaces appears to be very good but the acoustical character of all spaces seems to be quite "live."

Equipment in many cases is reduced almost to a minimum. A single chalkboard, approximately 2 meters wide by 1 meter tall, with a chalk tray but otherwise with unbound edges, often serves as the sole common display element in a classroom. This chalkboard is often lighted by means of a separately switched pendant fixture suspended approximately one meter in front of the top edge of the board. Science equipment and other specialized forms of equipment are of French design and manufacture and are characteristically clean-lined and economical in their use of materials. Seating and furniture is often of an American design manufactured under franchise in France.

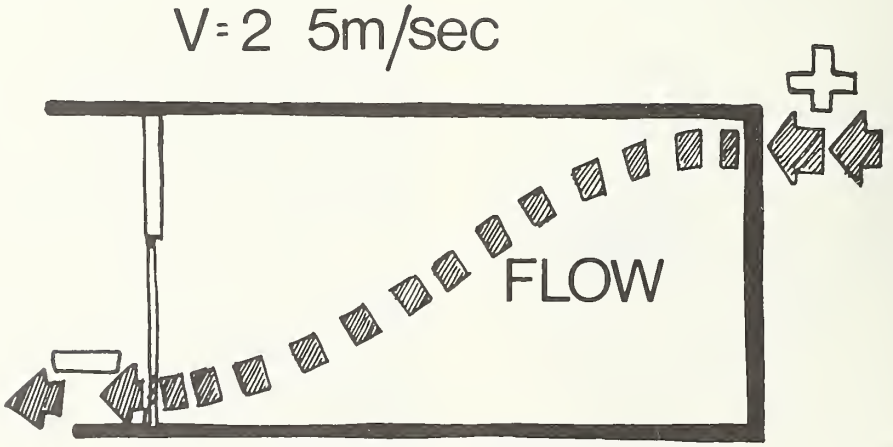
6. Mechanical Systems

Heating systems in the schools consist of electric resistance heating, fossil-fueled hot water and steam systems, or forced hot air systems. During the heating season artificial ventilation is provided at the rate of three to four air changes per hour, or not less than 15 cubic meters per pupil per hour. There was no evidence of air conditioning in any of the schools, but this lack is causing a certain amount of discomfort particularly in the southern regions. CSTB research is being conducted on alternative methods of providing thermal comfort during hot weather and a presentation was made to the U.S. team at C.E.S. 996 Henri-Boudon (Bollene) describing a low-cost "air-conditioning" process. In lieu of mechanical refrigeration, they utilize intense mechanical ventilation providing 20 volumes of air per hour, taking advantage of the thermal inertia of the building with supplemental air cooling by means of water evaporation. In both summer and winter the inlet velocity varies from 2 to 5 meters per second, with the range of 3 to 4 meters per second being most usual. This translates into approximately 60 feet per minute velocity at the outlet, which they feel does not trouble the room occupants. The tempered air is pumped into each classroom high on the wall opposite the window wall and is drawn

out through acoustically trapped openings in bottom panels of the doors. There is a perceptible breeze at the seats adjacent to the window wall, but it is not uncomfortable or annoying.

Lighting and electrical distribution is most often handled quite simply and directly in school building construction. Artificial lighting appears to be designed to supplement natural illumination. Fluorescent fixtures are used in classrooms and incandescent elsewhere. Incandescent fixtures are modest and unobtrusive except where they are used to accent design elements, then the fixture and the light it produces is playing a major role.

In the case of ceilings of precast concrete, the electrical conductor, while insulated, is often run unprotected in the joint between two adjacent slabs and emerges only to enter a surface-mounted junction box to which the light fixture is secured. Overhead electrical distribution for typewriters, sewing machines and other appliances is common with the final connection by means of drop cords into which the appliance is plugged. The overhead electrical distribution system consists of Romex supported on a pendant mounted perforated metal channel. No sleeves were provided to avoid chafing of electrical insulation on the rough edges of the steel channel.



Ventilation System

The Construction of School Facilities in France

It became apparent that to grasp the ways and means of French school construction specifically, and the educational process in general, it would be necessary to understand differences which exist between the French system of school acquisition and acquisition in the United States.

As mentioned earlier, notable of these differences, and the one which possibly most affects secondary school construction in France as compared to that in the United States, is the complete centralization of all educational and educational facility planning within the Ministry of Education located in Paris.

The major result of this centralized decision-making, insofar as school construction techniques are involved, is the development of highly industrialized building systems. Prequalified by the Ministry, the systems are individually developed and owned by contracting firms. An architect is often called in to collaborate with either the Ministry of Education or the construction contractor in the development and utilization of a system. (A similar such system in the U.S.A. would be a modified design/build approach to building construction.) This use of prequalified industrialized building systems, each of which has been developed through complete architectural and engineering planning phases, with continuing input from professional research and material testing programs, has allowed the French Building Industry, following World War II, to greatly increase productivity, cost effectiveness, quality control and overall construction excellence.

The team was impressed with the examples of industrialized school building systems visited. The itinerary allowed for inspection of two major types of systems: precast concrete and concrete frame; steel and steel frame; to which can be added wood, wood frame and masonry for pre-elementary schools. In virtually every instance it was noted that great attention and care were given to detail at both design and construction phases. Most ways and methods of detailing, handling and constructing the roofing, ceiling, interior partitions, cabinetry, millwork, finishes, sitework, etc, vary little from practices in the United States. All of these items, under the French manner, are easily coordinated and collated as a system within a system to become part of parts of any one of the above mentioned 32 industrialized building systems.

It was apparent that many benefits are accruing to French school construction as a result of an advanced research effort. Single membrane and upside-down roofing systems are successful examples. Other benefits include a retractable and adjustable exterior window blind and shutter system, as well as the work in heating, ventilating and air-conditioning systems at the College Henri-Boudon in Bollene.

In isolated instances there is a possible need to give additional research and investigation to classroom lighting levels, a broader building energy conservation program, sound and noise level control at student occupied spaces and professional selection of color schemes at the interior and exterior of some school buildings.

Several important questions were raised by the team members from time to time concerning the school construction contracting firms and the various ways they are effected as participants in the French construction program. The subjects are:

1. Responsibilities Assigned to the Contractor

The responsibilities of the French construction contractor are legally defined and determined on the basis of two articles of the French Civil Code, sometimes referred to as the Napoleonic Code.

In simplified terms, the first relevant article of the code states that, should a building be proved defective in any way or manner due to errors or omissions in design and/or construction, within a period of ten years after completion of construction, the architects, contractors and any other individuals or firms bound to the building owner by a construction contract shall be responsible.

The second article states that the ten year period of responsibility, or guarantee period, referenced above, applies only to the structural, roofing and weatherproofing aspects of the building, or those parts of the building normally called rough work. The parts of the building referred to as smaller work are guaranteed for a period of two years only. Included are joinery, cabinetwork, partitions, plumbing, heating and electrical installations.

In the event litigation arises from a violation, or an alleged violation of the contract, the case can be resolved in one of two kinds of courts.

France has a double order of jurisdictions: civil jurisdictions and administrative jurisdictions. Civil jurisdictions resolve litigation between particulars and administrative jurisdictions handle litigation where administration in the large sense is implied. Administrative jurisdiction is constituted by the administrative tribunal, judges of the first order, and by the council of the state.

If the client or owner of a building is the State or a public agency, the applicable court is the Conseil D'Etat. This court does not judge as to the "Letter" of the contract, but as to the "Intentions" of the concerned parties. This is brought about because the contractor is considered first to be in the State's service, since before he is a contractor he is a citizen. The contractor is ordinarily considered to be more competent and experienced than the officials representing the State, with whom he must deal. Consequently, when an unforeseen event occurs during the construction process, the contractor must take all measures required to protect the work, even if the required measures appear to be against his immediate interest. At a later time he may ask the State to repay him. The Conseil D'État is known for being extremely slow, and in some instances the contractor must wait several years before the court releases its decision. The State does eventually pay, but the contractor must be prepared to wait.

When the client or building owner is a private entity, contract disputes will be judged by the second kind of court, or the Court of Com-

merce. In this court, only the "Letter" of the contract is binding upon the parties. Consequently, only that which is written is binding unless the contractor has acted in contradiction with a public regulation.

2. The Contractor's Legal Liabilities

The contractor, as a citizen of France, is bound by the general duties and obligations resulting from the laws which apply to any citizen. This set of laws is called the Civil Liability and is quite comprehensive. As far as his activity as a contractor is concerned, his specific responsibility, and therefore liability, is governed by the articles referred to under Responsibilities of the Contractor above.

3. Labor and Labor Concerns

Over all of France the Labor Code rules and regulates the relations between the employer and his employees.

In addition, for each profession and recognized business endeavor a collective agreement or Convention Collective has been discussed and signed between the employers association on one hand and the employees union on the other, both being representative and represented at the National level. The association representing French contractors and builders is aptly named Convention Collective de la Federation du Bâtiment.

This collective agreement, at the National level, establishes the bases of the labor contract regarding holidays, retirement, welfare, seniority and other fringe benefits. An additional agreement, involving the same parties at the regional level, determines the minimum salary or wage rate guaranteed for each work or labor classification.

In essence, the labor code which incorporates the laws and rules and the professional collective agreement, are binding upon the contractor or employer as well as his worker personnel.

4. Contractor Insurance Consideration

It is compulsory in France for employers to have in effect, at all times, two kinds of insurance social security and automobile (company and individual). The implementation and enforcement of the insurance laws, rules and regulations fall under both civil and criminal court jurisdictions.

The social security insurance program, of Federal (or National) Government origination, is designed to protect the individual against the risks of illness, accident and death, and provides for retirement benefits. It is compulsory for all French workers.

It is the prerogative of the individual employer to decide whether or not he desires additional types of insurance such as fire, casualty, liability, etc.

It is normal practice for French construction firms, on their own prerogative, to carry adequate liability insurance coverage and protection when concerned with the two types of guarantee imposed by the two

articles of the Civil Code referenced under Responsibilities Assigned to the Contractor. This type of insurance is usually acquired only for larger construction projects (including schools) and not the smaller projects such as individual family housing units.

5. Construction Practices and Approaches

The usual approach for a French construction firm seeking work on a specific project is to submit a bid or cost proposal in answer to an inquiry or request for proposal (RFP) issued by the project owner or his representative. The owner will have acquired the services of an architect and commissioned him to design the project prior to release of the RFP. The architect will have completed drawings through the architectural document stage (design development in the United States) and, in addition, will have prepared a tender file. As a general rule, the French architects execute design development drawings at a scale of 2 cm/m but will release neither a bill of quantities nor working drawings. Therefore, the contractor must arrive at the bill of quantities, the appropriate structural system calculations and a complete project cost analysis. Prior to the start of, or during construction, the client will request lump sum prices to be revised in accordance with the construction contract escalation clause indexes published by the French Government.

Many French construction companies prefer to avoid the type of contractual arrangement described for the following reasons:

- o When the contractor is unfamiliar with the architect and his work, it is difficult to evaluate the type of building he designs.

- o Each construction contractor uses particular construction equipment in his own particular way to gain the experience and capability to better and more efficiently accomplish the work for which he contracts.

- o When the architect doles out the orders by lots on a siz able project, the contractor is unable, at a given time, to determine the future scope of the over-all project. As a result, large parts of the construction cost are not under his control and, in all probability, will not meet his expectations.

For these reasons, and more, many contractors with backlogs of experience prefer to work on projects in a turn-key manner in order to, as the general contractor, act and execute for all the required trades. In so doing the contracting firm management can state to the client or owner the total scope of the project work, and also ascertain it for themselves.

Many contractors prefer to quote a project cost when the owner originates a building program and an accompanying fiscal or cost objective. The contractor can then offer a building for which his firm has executed the drawings. Much the same kind of arrangement exists in the United States under a Design/Bui Process or System.

This procurement method has been used for nearly two decades by the Ministry of Education, the Ministry of Health, the post office and other French public authorities. The procedure involves inviting tenders through a contest or competition. In an instance of this sort, the contractor will collaborate with architects who are fully aware of the firm's construction methods, having worked with that particular contracting firm over a long period of time on a large number of projects. Several French contractors have enjoyed success on the international scene using the above described design/build approach. The team quickly became aware of a number of large and small differences, addressed above, which exist between the French way of school acquisition and construction and that of the United States, i.e., centralization, use of the everpresent 7.2M module, industrialized building systems.

The team also became aware of the tremendous progress which has taken place in the French building industry since World War II. Much of this progress is attributable to the same factors found to be fundamental to the success of a major part of the French building industry - the school building program. The practical application of the centralized decision-making process, competent and capable design/build teams and industrialized building systems (particularly those using reinforced concrete and precast concrete) made it possible for the French people to literally rebuild, in a limited time, an entire national school system largely destroyed by the ravages of war and time.

After accommodating the rather large difference of centralization versus decentralization, the American team found no other marked differences in most of the construction methods and approaches used in either of the school systems. The builders in each country have to suffer through much the same kind of governmental red tape, labor problems, insurance and liability woes and tight construction time schedules. The French school builders demonstrate a remarkable ability to overcome these kinds of difficulties, and yet complete a well designed and constructed school facility in approximately half the time required in the United States and at a considerably lower cost.

Many construction and design techniques considered to have been peculiar to the school building industry in the United States have had long term use in French school construction. Design/build, value engineering, life cycle costing, construction management, energy conservative construction and design, and solar and wind energy design are but a few.

Conclusions and Recommendations

In this report the respective team reactions and opinions represent those of the individuals themselves in accord with their own personal interests, background and experience. There were many instances in which the team recognized very basic differences between the French and American systems in the planning, design and utilization of school facilities and the reasons for them. On the other hand, the similarities in overall attitudes and philosophies were quite striking.

At nearly every one of the school sites visited by the team, the planners, designers and builders of each were willing and open in their discussion of all aspects of local and State relationships in the total design, support and operation of the school system. It was interesting and refreshing to note the eagerness with which the French team pursued the kinds of problems both countries are facing and possible ways and means of solving them. Among them are the rapidly rising costs of construction and operation, coupled with decreasing enrollments in the schools. Shortages of fossil fuels and the consequent high costs of energy have been and will continue to be a mutual problem to be solved. Concerns for life and fire safety standards in school buildings, and also designs for physically and mentally handicapped were given much attention in the team discussions. There is also a growing awareness of the community-school philosophy and the planning and design necessary for it.

The purposes for the exchange of visits of educators and architect/engineer/designers and builders of educational facilities in the two countries are, in the opinion of the American team, well founded and provide the potential for improved systems of education and building research in both countries.

NBS-114A (REV. 7-73)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBSIR 78-1521	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

FRENCH SCHOOLS - a report of the U.S. Team visit to France from November 13 to 23, 1977

5. Publication Date: March 1979

6. Performing Organization Code

7. AUTHOR(S)

P. Driscoll, Coordinator

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No.

11. Contract/Grant No.

12. Sponsoring Organization Name and Complete Address (*Street, City, State, ZIP*)

U.S. Department of Education
School Construction Branch
400 Maryland Avenue, SW
Washington, D.C. 20202

13. Type of Report & Period Covered

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

16. ABSTRACT (*A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.*)

By June 1970, the National Bureau of Standards and the Centre Scientifique et Technique du Batiment had effectively begin a cooperative program in building technology. The purpose of this program was to increase jointly the French and United States capability to develop building sciences and technology; seek answers to significant building problems; and reduce costly and wasteful duplication of parallel national efforts. This collaboration has provided opportunities for representatives of both nations to exchange ideas, skills, information and techniques in attacking problems of particular mutual interest. These opportunities have included the exchange of selected literature, with translations of main papers and publications; the exchange of long-term interns working in the organization of the other country on subjects requiring special facilities; work by one organization for the benefit of the other not as well equipped, either in staff or in equipment; and the exchange of missions of experts from one country to the other to study special work. It is precisely this exchange of missions of experts, to study specific work, that produced the report which follows.

17. KEY WORDS (*six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons*) Building technology; France/NBS cooperative program; French schools

18. AVAILABILITY

[X] Unlimited

[ ] For Official Distribution. Do Not Release to NTIS

[ ] Order From Sup. of Doc., U.S. Government Printing Office Washington, D.C. 20402, SD Cat. No. C13

[X] Order From National Technical Information Service (NTIS) Springfield, Virginia 22151

19. SECURITY CLASS (THIS REPORT)	21. NO. OF PAGES
UNCLASSIFIED	39
20. SECURITY CLASS (THIS PAGE)	22. Price
UNCLASSIFIED	$4.50

USCOMM-DC 29042-P74

☆ U. S. GOVERNMENT PRINTING OFFICE: 1979—281-067/91