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Abstract

The technical director of the Metropolitan Toronto School Boards Study of Educational Facilities (SEF) presents a description of the general theory and execution of the first SEF building system, and his views on the general principles of system building as they might affect architecture and the economy. (TC)

# SYSTEM BUILDING AND ARCHITECTURE

ADDRESS TO

THE COMMITTEE ON SCHOOL AND COLLEGE ARCHITECTURE

OF THE AMERICAN INSTITUTE OF ARCHITECTS

15 August 1969

at

HOUSTON, TEXAS

by

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TORONTO
August, 1969

# SYSTEM BUILDING AND ARCHITECTURE

In making my presentation, I will first describe the general theory and execution of the First SEF Building System and follow this with some views on the general principles of system building as they might affect architecture and the economy.

## THE FIRST SEF BUILDING SYSTEM

Work on the primary studies of SEF commenced early in 1967, the first three months of the program having been spent in overall planning.

It was at this time that we decided that it would be unrealistic to first complete a substantial portion of the educational user requirements study before commencing work on the building system, if useful progress was to be made by the project within its three year life.

As a consequence of this decision we have carried forward the primary studies of the program with upto a 3½ year overlap in the case of the building system program and the educational user requirement studies. I understand this mode of organization has come to be known as the "Fast-track" method of project planning.

The instructions of the Metropolitan Toronto School Board were clear in requiring the development of a specific building system for schools.

In initiating the execution of this instruction I reviewed the two primary courses open; that of the development of a closed building system, similar to the CLASP and other British and European school building systems, or following the California, SCSD program, in the direction of an open building system. I chose the latter as I felt it would build on the pioneering work of SCSD, but most particularly would benefit the long-term economic interests of Metropolitan Toronto, Canada, and ultimately North America.

This may sound a little presumptuous, but I feel it should be noted when considering SEF, and the other current first generation building systems, that these programs are, for their size, a disproportionately strong force in the long term remolding of North America's building industry. The continent's largest and most backward industry.

I often feel that there must be deep significance in the fact that North America's most influential social institution - education, in renewing itself is triggering the regeneration of North America's largest industry - building, and building products production.

The Advisory Committee to SEF and the Metropolitan Toronto School Board Concurred in the decision to develop an open building system for SEF, and guaranteed a minimum order of one million square feet of construction for a two year period - September 1969/1971, with an order ceiling for the same period of two million feet.

To determine the minimum basic order size in order to obtain a true open system tender from industry, SEF canvassed 270 companies and contractors in Canada during the early part of 1967, and held 120 meetings during that year with every representative interest in the building industry.

The purpose of these meetings was to enable myself and my two senior staff members, Mr. Peter Tirion, and Mr. John Rankin, to exaplain my concept of the open systems approach to the building industry in Metro Toronto, and to obtain the unedited reactions of all interests to that approach.

This exchange which embraced architects, engineers, general and trades contractors, trades unions, statutory officials, and many miscellaneous other groups, and interests associated with the industry, provided a realistic base of data and opinion from which to structure the organizational form and management of the First SEF Building System. It was and still is my firm belief, that the problem confronting the building industry in North America, at this time, is a desperate need for a total management approach to building, rather than the development of new technology, in other words the systems approach.

As a result of this view, the SEF program expressly asked the building industry not to innovate technically when bidding the First SEF Building System, but rather to rationalize the skill, techniques, plant and capital resources it already possessed into a truly modern and efficient working totality. I am pleased to be able to report that the industry did in fact follow this request, and has limited innovation to those areas of activity where there was a gap in the existing technology.

During 1967-68 performance specifications were written for a building system comprising 10 sub-systems, and a non-system category. Two of the sub-systems were further sub-divided giving a total of 14 sub-systems. In addition the tendering method and all aspects of the conduct of the bid were described in detail in SEF Document T-1: Introduction to the First SEF Building System, which with SEF Document T-2: Specifications for the First SEF Building System, and The Bidding Sheets for the First SEF Building System, constitute the contract documents for the SEF Building Program, and may be purchased from the SEF Offices at 49 Jackes Avenue, Toronto 290, Ontario, Canada.

The First SEF Building System comprises the following sub-systems:

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|---|---|
| No. 1 | Structure |
| No. 2 | Atmosphere |
| No. 3 | Lighting-Ceiling |
| No. 4 | Interior Space Division |
| No. 5 | Vertical Skin |
| No. 6 | Plumbing |
| No. 7 | Electric-Electronic |
| No. 8A | Caseworks |
| No. 8B | Seating |
| No. 8C | Standard Furniture |
| No. 9 | Roofing |
| No. 10A | Carpet |
| No. 10B | Gymnasium Flooring |
| No. 10C | Hardware |

which together constitute just over 80% of the finished cost of a school, or just over 90% if the general contractor's overhead and profit is not included. In the case of the SEF schools, management contractors retained on a professional fee basis are being used.

The SEF specifications and introduction were sent to 1000 representatives of the building industry for review and criticism, and duly revised as a result of this process.

At this time the Metro School Board increased its basic order to two million square feet comprising 31 schools and one office building for construction during the period September 1969 - 1971.

Tenders were called on 9th July 1968 and closed 7th January, 1969. Tenders were restricted to prequalified bidders only. Sub-system tenderers, which were most typically consortiums of trade-subcontractors and manufacturers, were prequalified with respect to their financial status, production and installation capacities. The mid-term review half way through the tendering period evaluated their technical abilities. Of the sixty potential bidders who sought prequalification, forty-eight were prequalified, and thirty-six submitted forty-five proposals for ten sub-systems.

In February 1969 the Metropolitan Toronto School Board designated one bidder in each sub-system. Together these contractors under the direction of SEF as architects, and a management contractor, as construction coordinator, were required to construct a building to demonstrate the technical compatability of their sub-system proposals before receiving the contracts for the total program of 31 schools and 1 office building. An addition to the Eastview Senior Public School in Scarborough was selected for this purpose.

The SEF bidding system was based on a series of mandatory interfaces of sub-systems. A mandatory interface occurring when the parts of one sub-system had to touch, pass through or be connected with the parts of another sub-system in a finished building. Under the interfacing bidding system each sub-system bidder gave his price on the assumption of consideration by the owner, of at least two other bidders in each mandatory interface. The effect of this bidding method was to bring into being the first true open building system in construction history. To evaluate the bid, just over one million interface bidding combinations were considered, revealing 13,040 complete building systems, which met the SEF performance specifications. These systems ranged in price from about $18.00 per square foot gross for a building including foundations, carpet, built-in equipment and caseworks to $26.61 per square foot gross. The cost of $18.00 per square foot assumed that the most efficient building layout possible, would be used. After allowance was made for architectural design an SEF building cost was set at $19.10 per square foot gross.

This cost is applicable to elementary and intermediate schools and compares to the original project budget of $20.85 per square foot gross, representing an overall saving on the project of 8.39%.

The gross budget for SEF was $41.7 million, the value of sub-system proposals offered if tendered by traditional means would have been $52.00 million,,and the designated sub-system cost will be $38.2 million. In general terms the Metropolitan Toronto School Board obtained about 30% more value for 8.39% less cost than by traditional means.

I would expect the second SEF system to generate a similar improvement in value with about a 10% reduction in cost below the current cost of the First SEF Building system, or reach a price level about 25% below the current cost of traditional school construction in 1972-73.

Twenty-six firms of architects were retained early in 1968 to prepare sketch drawings for all schools in the program. These designs reflected the differing educational philosophies of the six Borough Boards of Education and the influence of varying site requirements. All designs were prepared within the 5'0" x 5'0" horizontal planning grid requirements of SEF, its standard floor to ceiling heights of 10'0", 14'0", 18'0" and 24'0" and standard roof and floor thickness of 4'0". Architects designed their buildings on the assumption of framed roof and floor structures offering primary structural spans of from 10'0" to 30'0" by 5'0" increments, with secondary structural roof and floor spans of from 5'0" to 65'0" by 5'0" and 10'0" increments, with a common live load for floors of 100 lbs. per square foot in structures upto 5 stories. The architects were also told to assume full air conditioning and carpeting, and 100%

relocatability of all interior walls and partitions, lights and ceilings, electrical and electronic services, air conditioning terminals, educational and storage caseworks and limited relocatability of the plumbing sub-system. The resulting sketch designs were published in SEF document T-1 and used for the establishment of quantities.

With the final designation of the successful sub-systems, the architects are now revising their designs to exploit the First SEF Building System fully.

In April 1969 general contractors were invited to seek prequalification to act as construction managers for the first 11 schools and one office building to be built under the program. In June the Borough Boards of Education each appointed one contractor to carry out their work in the 1969-70 (first year) of the SEF program. A similar invitation to contractors for the balance of the program will be made in 1970 for the 20 buildings to be built in 1970-71.

Metropolitan Toronto was faced with a series of major construction lock-outs and strikesfrom April to August. Upto the commencement of this construction industry shut-down, SEF had remained precisely on its original time schedule, drawn up at the beginning of 1967. We feel at this time that we are about six weeks behind schedule as a result of the strikes and lock-outs. With an end of the last strike on Sunday, we should be able to meet all our original program dates to complete the Roden Public School, the SEF test school, by February 15, 1970 and the remaining 12 buildings by 20th July, 1970. These will amount to about 750,000 square feet of building.

The total SEF program which is scheduled for completion by 20th July, 1971 will probably have the following composition:

1 addition - the SEF technical test structure Eastview S.P.S., Scarborough equivalent to 8 traditional classrooms.

23 elementary schools - including the SEF Test School. This school will test both the educational theories, and building system of SEF.

6 intermediate schools

2 high schools

1 education centre - office building

May I turn now briefly to some of the effects of the SEF building system program. Enquiries concerning the system have come from all major school boards in Canada, and a number of large boards in the U.S.

A second closed school building system made up from a mix of successful and unsuccessful SEF bidders is in an advanced state of development in Toronto. This system, a direct spin-off from the SEF performance specifications, should be announced shortly. Its promoters claim $40 million of construction interest in Ontario and Central Canada.

My firm, Robbie, Vaughan Williams Jacques Systems, of Toronto, Ontario and Albany, New York, has completed preliminary studies for an open building system for family housing. Similar programs for a wide variety of other building types are probable in the near future.

At the suggestion of my firm the Canadian Federal Government in association with the Royal Architectural Institute of Canada has initiated a study into generic planning grids, modules and performance specifications. Through this study it is hoped that rapid integration of a wide variety of building products and methods can be achieved, thereby creating a major overall improvement of the efficiency and quality of the building industry. With consequent benefit to all major building users, and the economy as a whole.

To speed the generation of open building systems I believe there must be nationwide markets available to the sub-system contractors, to ensure continuity of demand. In north America it would be to our enormous collective benefit if these constant market demands could be continental in scope. To ensure continuous and integrated markets for a revitalized building industry there must exist national, or better, continental building and fire codes, with common modes of interpretation. There must be a standard method of testing and labelling sub-systems and their compenents, a commonly accepted cost escalation method, and hopefully a standard form of building accounts, project and program procedure. I would expect that Canada will have a nationally applied building code within five years or perhaps less. Under the SEF program the Canadian Standards Association is developing a sub-system testing capability and labelling system, which it is hoped can become national within two to five years. Similarly a materials and labour cost escalation index is now operational as part of the SEF program, which combines the resources of the Dominion Bureau of Statistics with SEF's consulting economists. Again it is hoped to use this as the pilot for a national or series of regional open building system cost indices.

As part of the SEF program, Study A-1, is setting out a detailed administrative procedure for school construction in Metro Toronto. This has proved to be a most difficult study to advance due to its entanglement with a wide variety of interests and authorities. However by October of this year it should be complete in draft form for internal review by the School Board, and provide an eventual basis for major review of the feasibility of an industry wide standard method of project organization, in Canada.

I hope at this point you have some general idea of our activities at SEF, and the feel of the principles of the program, so far as the building system is concerned.

Break for Slides

For an architect and society the crucial issue of system building and its by-product industrialized building, is "can architecture be created from these means of building?"

The answer is, YES - system building, is just completely organized traditional building, and industrialized building is just system building with an extreme form of specialization in the areas of mechanisation, production, installation and sales management. So why all the concern about the possible sterile effects of systems building on architecture? I think the reason is very basic - it represents in every sense the turning of an era, and a resulting intuitive sense of impase felt by architects because of this fact. In order to develop the rational of my argument I must now take you on a philisophical excursion.

To me architecture is Man's most permanent expression of his life style. Through the medium of architecture, through the ages, Man has recorded the agonies and delights, triumphs and tragedies of his tumultuous evolution. The great works f architecture of the past have stood like beacons stretching back across the abyss of time, marking the special dignity which is the evolution of the human species. It should be noted that I do <u>not</u> subscribe to those philosophies which make a point of denegrading human achievement, for us all what we have wrought, is to our overwhelming collective benefit and betterment.

I would far rather enjoy the physical state of humanity with all its problems of conflict and pollution than be an ape, and pick fleas and fear the night. The problems of our environment that we have created, are well within our capabilities to restore.

I make these points to reinforce my overwhelming confidence in ourselves as men.

We are, I believe, on substantial average good rather than evil, intelligent rather than stupid, and unbelievably underdeveloped as a species.

Collectively we have not yet started using the capacities of our brains, and as a result an abundance of human capabilities lie undiscovered.

We live at this time at the crossing between the first two eras in the history of Man.

The first, when he sought to survive and learn to deal with the natural environment. The second, having acquired the first rudiments of an understanding of the control of Nature, how to evolve without the crude goad of the basic survival desire.

It has been suggested by historians that human evolution has moved in a series of cycles, where the flux from one cycle to the next is characterized by some identifiable change in life style, material discovery or other fundamental event. My proposals to you today are based on the speculation that Man is at the end of his first primary cycle of evolution and is entering the second.

Since his origin, Man has fought a battle with the natural environment to ensure the survival of his species. To focus his energies on this preoccupation he evolved the concept of theism. Theism in its turn provided a series of foci, to sustain Man spiritually through periods of appalling physical hardship, and disaster which could have been fatal to the species. These foci also provided the rational to eliminate those members of the species such as prophets, philosophers and non-conformists, who strayed too far from the accepted survival path. It is my view that this accepted survival path constituted the purpose and structure of the great formalized religions and social philosophies down to the present day. It also gave rise to the pyramidical form of social organization, which has been common to almost every human institution from the family to national government.

In essence I believe the first millenia of Man was concerned wholly and almost soley with the survival of the human species. It would appear that this one-

track concern started to fragment and change sometime in the last two thousand years or so, and has shown an almost explosive rate of change process in the last two hundred to fifty years.

I believe the event which triggered this accelerated change was the rise of a collective belief in Man that he could, in fact, influence and change the natural environment, that he was not entirely helpless before Nature. Although this change might be microscopic before the majesty of the Universe, the awesome potential of the existence of the possibility of Man initiated change to Nature, started the breakdown of his theist protection against the vaguaries of a hostile natural environment. It is possible that the domestication of animals and the establishment of agriculture started this basic change in the mind and spirit of the human species. The advent of the scientific-technological revolution increased the rate of change in human attitudes to explosive proportions, leading, in contemporary society, to attempts to make artificial life, and to eliminate all life.

It is possible that the special kind of strife which assails advanced industrial countries is the leading wave of this most fundamental change in the human species' mental processes. It is not surprising to find the social turmoil at its highest level in the United States, the most advanced society on Earth. It is possible that we are now at the threshold between the first and second eras of human existence. The threshold may be 50 years it may be several thousand years wide, we will never know.

Assuming that Man in the second era of evolution must fill a role where he recognizes that the unknown is infinite, that Man is born, lives and dies alone, which is what we mean by individualism. Having once engaged in the

activity of modifying nature, the responsibility for the outcome is not negotiable. Theism was our first invention to hold nature at bay while we conceived of the means of modifying it to our taste. The only resource we have to advance our evolution now is creativity. Where the first era of Man was concerned with conservation, the second in all probability must focus on expansion through the medium of creativity. Creativity is seen as the total use of the total capabilities of every human being.

In my view the great social problems which beset the United States today are, the unharnessed explosions of human creativity. Like uncontrolled atomic fision; such outbursts of energy have awesome power for destruction, yet like atomic power they can be harnessed. I would speculate that the simultaneous release and linkage of this individual creativity is the only means of bringing the contemporary stress of social change in the U.S. to acceptable levels.

It should also be noted by other countries, that the social upheavals of America are a preview of similar upheavals which will pass through every country on Earth, in time.

I have taken you on this philosophical excursion in order to support my belief that the future of society lies with the success of bringing-out, and applying the creative potential of the populace as a whole, from birth to death, that the problems of society cannot be solved by new laws, revised tax structures, or the directions of the thoughtful and informed few, but only by a revitalized public. A public of self-conscious individuals. I would like to add at this point that I am not attempting to give advice in this presentation but I am placing my point of view before this forum. The means must be found to exploit the creativity which lies buried in all members

of the populace. Means must be found of bringing out the human creativity which is lost through the lack of multi-generation contact, and is hidden below the vast overburden of dead social customs and outworn institutions. Human creativity is the fire in which the phoenix of the human species can accomplish rebirth.

You may by now be asking - What has all this purple prose got to do with architecture - or for that matter system building?

It has much to do with the future of architects, and spells the demise I hope, of architecture as it has come to be known aesthetically to the priestly minority, and a dawning perhaps of its genuine evolution as an art of Mankind.

For me, the hope of Man in every aspect of his endeavour is the exploitation, and flowering of his creativity.

Architects, I believe, have an almost unique task to spearhead, with all the energy that crisis brings; the universal birth of human creativity. It is because I feel so strongly about the critical need to bring about a massive and radical change in the views of all people, that I feel it is necessary to view contemporary architecture, and the aesthetic leaders of architecture with some bluntness.

Contemporary architecture is in my view totally bankrupt. What we as architects understand as modern architecture is understood and enjoyed by an occult

minority. I submit that this position is well borne out by a comment published in The Globe & Mail of Toronto on August 8, 1969, and taken from a paper to be presented to the Ontario Liberal policy conference latter this month. In this comment Mr. John C. Parkin, one of Toronto's most eminent architects, suggested that the public and its representatives should respect (and presumably follow) the judgement of "the thoughtful and informed few" in selecting sculpture and other art to adorn public buildings. I would suggest that this type of thinking is guaranteed to deepen the indifference of the public to the quality and state of its physical environment by rubbing in its face its incompetence to deal with such a trivial matter as the applied decoration for its own public buildings. Contemporary architecture is a preserve typified by aesthetic, functional and economic perversity, where the aesthetic dilletante of the physical environment has achieved unworthy eminence, a level at whichaesthetic self gratification and pontification can be the justification for environmental functional, spiritual and economic incompetence of such a proportion as to achieve the level of an art-form in its own right.

We read and hear how our architectural grandfathers of the 19th century ran away from the realities and opportunities of structural engineering, choosing instead the genteel trivia of reviving dead architectural styles. In the 1920's we anticipated industrialization and built industrialized architecture using traditional construction. Today when we have for the first time the means of real industrialized building, the means of producing a great environment for everyone rather than for privileged minorities and special groups, what do we do? We go back, not to the Middle Ages, not to Rome, but to Babylon.

We pour concrete by the immovable millions of tons. We produce grim, dank fortifications, or soulless iron boxes which simulate industrialization. We produce a priestly and priest ridden architecture, dominated by the dictates of the prima dona, setting the environmental tastes of society. This kind of dictation has a great deal in common with the kind of arrogant arbitrary decisions made by women's dress designers each year, where designs are produced that have little relationship to the shape of their clients, or the realities of their everyday lives.

To me the architect who presumes to know what is best for everyone environmentally is no longer in contact with human society. The architect who believes he can direct public taste in questions of environment is thoroughly misguided. The architect can and must become a resource to an environmentally conscious public, if he is to have a role in future society. If the architect does not take the man in the street into the design team for the environment of the future, it is probable that the architect will find himself filling a socially decorative role, and be by-passed by more realistic members of the building industry. Architects have come to believe that a built environment in which a great and lively humanity could exist must be made up only of quality architecture. Where such has been tried, the result is a trend towards a sterile human society. Vulgarity is an essential ingredient to human evolution.

Having been so insulting about our profession perhaps I could now be constructive. Widespread creativity is the secret of our tomorrow. The riddle is how to unlock this creativity from a society which has been trained for centuries to be creatively shy?

The release of general creativity can, I believe, be started by changing the attitude of laymen towards buildings and the creation of buildings. For one of Man's greatest areas of creative shyness surrounds his reverence for buildings, the arts of architecture and the minor arts of sculpture and painting. It is in these areas of architecture, sculpture and painting that the public has always deferred to the opinions of the expert, and consequently maintained its own creative imprisonment. Contemporary sculture and painting are substantially in the grip of a self perpetuating international cabal of art critics, gallery owners, curators and miscellaneous camp followers, who have a collective interest in maintaining these arts at a level of rational incomprehensability, and thereby defy public participation, understanding and probable outrage.

Many of the elequent aesthetic spokesmen of our profession have moved with some vigor for the past decade or more towards the fetid swamp, which envelopes most contemporary painting and sculpture, and would pull architecture in with the graphic arts.. Reducing all forms of finite artistic expression to the trappings of an aesthetic priesthood.

For me this process has ceased to be a legitimate development in the means of human expression, and has become a very dangerous threat to human expression, and development.

A counterveiling process must be started to redress the balance to achieve widespread human creative development. It would seem that only architects can initiate the processes necessary to bring about this creative regeneration through their attitude towards architecture and the design of buildings.

Once architecture is again a vital force in society, the regeneration of sculpture and painting will take place.

Architects can initiate the second era of human evolution, by showing, and involving the public in the process of building design evolution and change. The architect should encourage his client to become an environmentalist, while he provides the resource for this metamorphosis. By doing this, architects would add millions of new pairs of eyes to see the state of our physical environment; millions of brains to analyse it and millions of hands to bring about massive environmental rejuvenation.

Returning now for a moment to my original philisophical theme concerning man and theism, may I now connect the theist belief with the built environmental processes we have used and are still using.

At the level of the individual. Each of us has had bred into us a near absolute reverence for buildings. Building and buildings are the most important means, and one of the last lines of defense by which the human species defends itself against its natural enemies, and is the formalized means, through churches, temples and monuments, by which it deals with the unknown, by use of the theist process. Building and species survival are deeply connected in the collective spirit of Man. It would therefore seem reasonable to accept the proposition that our inbuilt reticence to deface, damage or interfere with buildings has much to do with our basic desire to survive. This reticence has been formalized by the evolution of economic pressures, and entrenched in the obligatory requirements of building leases, institutional house rules, and what has come to be known as "house pride". When we lease an apartment we are told that we cannot change the decorations, nail things to walls, rearrange the facilities to fit our life style

or customise the accommodation to our individual needs through the opening of walls or the addition of major space separations. Here a large number of apartment and house builders, who have done no social, anthopological or any other kind of research, nor ever intend to do any, mould not only the physical environment in which the vast majority of Americans and Canadians live, but also contribute in the most fundamental way possible to deter the evolution of the human species. The same accusation can be directed at a majority of the architectural profession with respect to the construction of educational and institutional buildings. I make this rather brash pronouncement in the belief that what is true of housing, and in a large measure of education, the provision of a fixed unchangeable physical environment, is the means which is frustrating major human advance. If the means are provided whereby the individual user can make a living and working environment to his specific taste and needs, both physically and spatially, the formal authority structures of society will give to the individual the belief that he is not dependent; is not helpless before unknown forces which he must placate; that he is blessed with remarkable powers of infinite variety, his creativity. The variety of environmental arrangements which would arise from a creative society is beyond the comprehension of the design profession and their formal clients.

Every individual must be convinced that he is, and has an absolute right to be an environmentalist. That architects, contractors, developers, professionally concerned with buildings are resources, and not some kind of omnipotent priesthood of the physical environment; that it is not only right but a necessary ingredient of species survival and evolution for everyone to become concerned with and active in the development of our physical and built environments.

Towards this objective of releasing creativity we sought to make the SEF building system totally flexible. Economic restraints forced the fixing of some elements having potentially long life. These elements include the building structures, exterior walls and plumbing facilities. We can remove and reuse the exterior wall panels and the plumbing facilities, but both would be substantial building operations. All other aspects of an SEF school are easily changed. We have noted in SCSD and a number of other instances the reluctance of users to exploit the flexibility their environment might give them. To attempt to offset this tendancy to just accept and adapt to an environment as found, by school users, we are making a film about the relationship of the user to the built environment with specific reference to SEF. This film will show the potentialities of the building system for individual environmental interpretation, and will encourage spatial and environmental experimentation beyond the formal characteristics of the building system when considering the user customization of environments.
I believe it would be very good if a paint could be developed which could be peeled from a smooth concrete wall, leaving no mark, thereby enabling the children to customise the exterior of their school, to their own taste each year, as a large scale project in developing outside environmental sensitivity.

This then is one means of releasing human creativity by persuading the individual that hecan, and is, free to mould his living and working environment, and should have a sense of responsibility for it.

The means to revolutionize the physical environment of North America, and through it bring creativity and a new way of life to this continent is ours as arch8tects to initiate.

A radical change in our view of our role is a first step. System building can be the vehicle.

Through system building the total skill and resources of the building industry can be harnessed. Industrialization of building can provide the means whereby truly inexpensive structures can become a reality.

Through system building and industrialization the cyclical renewal of buildings becomes an economic reality, and the many protestations we have made as a profession for an improved quality for our cities becomes a practical reality.

Architects are needed to guide the building industry into the age of system building. They are needed to show how products which have been produced through mass production processes can form the basis of a real architecture of the 21st Century; which uses rather than rejects the industrial process in building.

Great versitility and a base for a new architecture would exist through the development of a family of generic open building systems. These generic open systems are ones which have been produced to satisfy the needs of various major building types and which have been interrelated in their performance and differential characteristics, while at the same time using the resources of the building industry to its greatest efficiency.

It was a study to bring about this development that my partners and I proposed to the Canadian Department of Industry, Trade and Commerce, and which is now being jointly pursued with the Royal Architectural Institute of Canada.

As I commented at the Systems Workshop at the joint RAIC-AIA convention, in Chicago, this year the era of the discrete profession and professional society in building is over.

We now need a profession of Master Builders. This profession growing out of the needs of a reorganized building industry should provide an integrated professional service to design, manage and supervise the erection of a building. It would combine the professional services offered by the Architect, structural, mechanical and electrical engineers, with the job planning and expediting services provided by the general contractor.

In order to make the transition from the present fragmented state of the industry to the proposed arrangement it is necessary for general contractors to establish new companies specializing in job management. For these construction consulting companies to be formed into a professional group It would also be necessary for this group to establish qualifications of membership, a schedule of fees, terms of service and a code of ethics.

It is then mandatory for this new group, together with the architectural institutes and societies of engineers, to establish a joint and interlocked schedule of fees, terms of service and code of ethics, under which a construction consultant, architect, or engineer may lead the team.

In Toronto I have invited the Toronto Construction Association, Engineering Society for Ontario, and the Ontario Associate of Architects to come forward with such an interlocking code of fees and service by 1st January, 1970, in order that it might be test developed on the second phase of the SEF program. It will be most interesting to see what results occur.

Having once passed through the stage of integrating the existing professions; with the professional portion of building contracting would the new, or perhaps very old profession of Master Builder emerge? The members of which might be expected to have competence in at least two of the three basic skills.

I would expect two basic types of Master Builders to evolve.

The first working for a professional fee, and the second out of the first accepting total financial risk for a project. It might be expected that the first would operate in the field of public and institutional work, and the second in the private sector, and particularly housing. It is possible that these Master Builder firms could give many contemporary developers severe competition.

May I review with you in terminating these rather lengthy remarks the participation of the architectural arm of a firm of professional Master Builders in building - first a school, and secondly providing a general environmental consulting service.

I have assumed that it is a few years from now, and there are available to the building industry a fair range of open building system, sub-systems,

and that through integrated statutory processes these sub-systems have widespread availability.

In constructing a school, the Master Builder would work with the officials of the school system to establish the building shell, and standard of servicing. This work being developed through the projects initiation budget. Once occupied by teachers and students the school would be progressively evolved using an evolution budget. By this means it would enable the building designers, to mould the building to the actual users needs, through a type of "family doctor" arrangement, which would continue for the life of the building.

In the case of normal family housing of the "systems" future it should be possible to rearrange the room layouts of dwellings with ease. It should also be possible to remove and replace whole sub-systems, such as electrical or heating systems as they become obsolete through cyclical renewal, without the extensive building work normally associated with these processes today. Smaller firms of architects or Master Builders could recover large volumes of consulting that have slipped gradually to interior decorators in providing an ongoing environmental consulting service to assist the public in exploiting new sub-system product lines as they become available.

In conclusion may I suggest that with the advent of the open building system, that constant change in the interior layout of buildings becomes a fact. Time therefore becomes one of the prime ingredients of architecture, ending the process to this date when architectural space was finite space - even-though it might be interpenetratory. A new architecture of spatial mobility

is required which finally recognizes the most important ingredient of architecture ---PEOPLE.

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