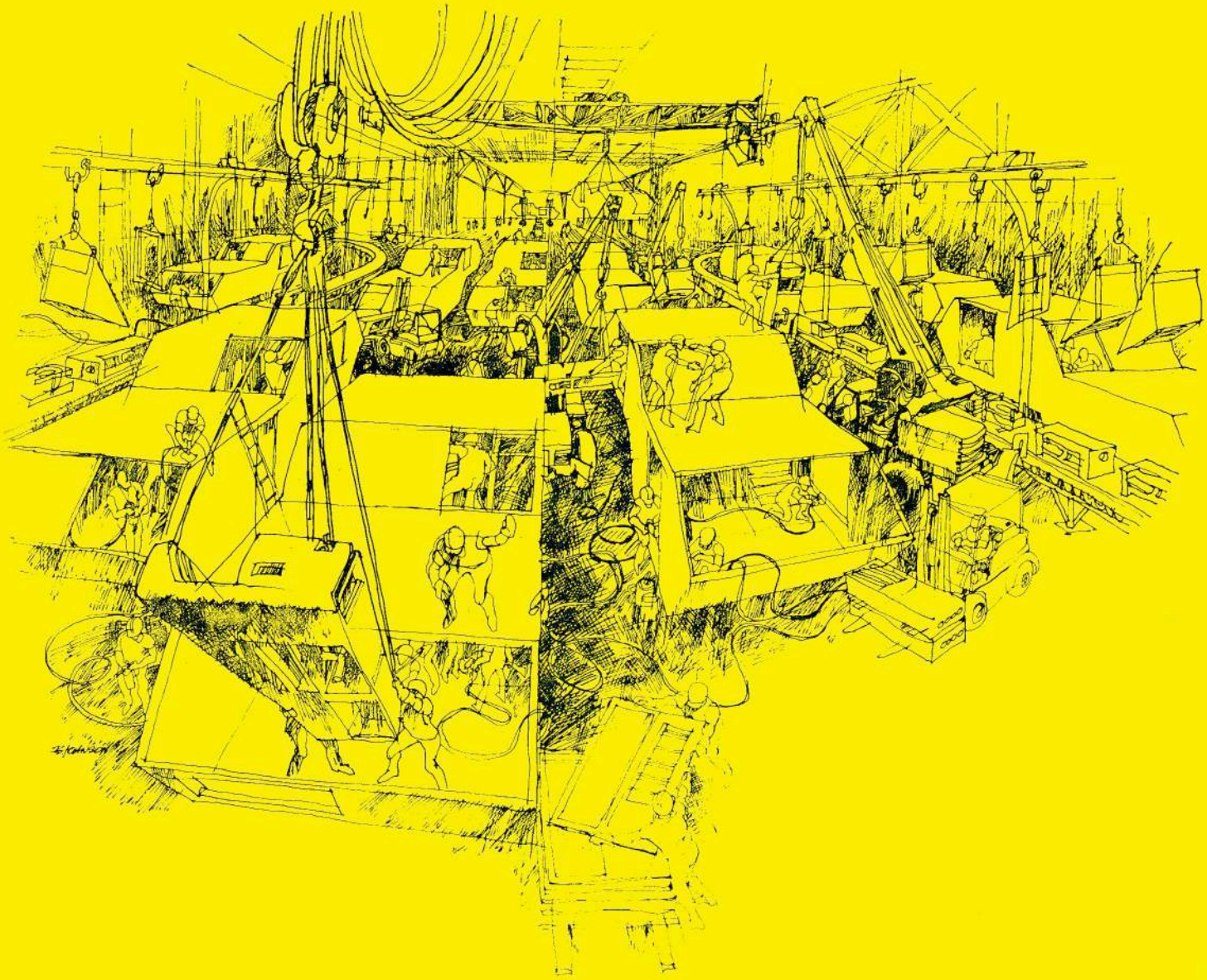
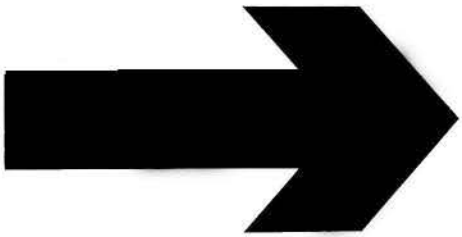
Architecture Canada

November/Novembre 1968 Number/Numéro 11 Volume 45 Journal RAIC/La Revue de l'IRAC





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Student Contributing Editors

The nine Canadian Schools of Architecture have been invited to nominate student contributing editors to *Architecture Canada,,* and to date three have been named, Peter Dandyk for Waterloo, Norman F. Hotson for Toronto, and Ronald Rayside for McGill. The "Schools" section of *Architecture Canada* will now be available as a forum for the exchange of ideas and opinions between undergraduates in the schools of architecture and as point of contact with architects in private and government, etc. practice. The object is to improve communications between the Institute and the practitioners and those now preparing for careers in the profession.

Hospital Architecture Exhibit

Architects in Canada are invited to exhibit hospital projects in an exhibition of hospital architecture at the Convention-Exhibition of the Association of Hospitals of the Province of Quebec at Place Bonaventure, Montreal, from May 14-16. Entry forms have been mailed to RAIC members and must be returned by January 3, with the registration fee of $10.00. Material must be received for preliminary screening February 20 and material must be shipped to arrive in Montreal on April 26th. Members of the architectural Advisory Committee are: Dr Jacques Gélinas, Sous-Ministre, Ministère de la Santé et du Bien-être, Québec; Roger Lepage, Directeur général adjoint, Hotel-Dieu de Lévis; Patsy Colangelo, MRIC, Montréal, Paul-Marie Côté, FIRAC, Chicoutimi; Peter Dobush, FRAIC, TPIC, CUQ, Montréal, Chairman. Exhibit postal address is 2055 Peel St., Suite 700, Montreal 110.

African Bank Competition not Approved

The UIA advises that it has not given its approval to a competition for an African Development Bank Competition at Abidjan, Ivory Coast because the competition "does not offer any guarantee and is in district contradiction on all points of view to international regulations." The competition therefore dones not have RAIC approval and members are advised not to participate.

1969 Reynolds Award Nomination

Nominations for next year's $25,000 Reynolds Aluminum Award may now be made. Nomination forms (submission deadline February 3rd) and data binder (submission deadline February 25) are obtainable from the American Institute of Architects, 1735 New York Ave. N.W., Washington D.C. 20006 D.C.

Toronto Architect Wins Film Prize

"Distances and Hidden Rooms", a movie made by Toronto architect Gerald Robinson, won first prize at the National Film Board Festival of Canadian Films in October. The Hidden Rooms are located in the Toronto subway system and the film is described as an erotic and sensous response to a sterile environment. The Distances are traversed through tunnels of images of other lives: subways will never be the same. The sound track consists of early romantic love poetry of Ted Plantos, fused into an electric score by composer John Mills-Cockell of Intersystems. The film is distributed by Film Canada, 1 Charles St. East, Toronto 5.

Building Code for the North

A document of value to those concerned with construction not only in the Northwest Territories and Yukon Territory, but also in northern parts of provinces where permafrost is encountered, is the new "Building Code for the North", with a special supplement on the technical aspects of construction, prepared by the Division of Building Research, NRC, Ottawa, (NRC 9945, Price $1.00). The east-west line across the accompanying map shows the southern limit of permafrost in Canada.

Annual Meetings

Alberta Association of Architects, Voyager Hotel, Banff, January 23, 24, 25, 1969.

Nova Scotia Association of Architects, Sword and Anchor Inn, Chester, N.S., February 8, 1969.

Ontario Association of Architects, Royal York Hotel, Toronto, February 20-22, 1969.

Has Downtown Still a Future?

An international congress on the theme "Has Downtown Still a Future" will take place in Stockholm from May 19-23, 1969, under the sponsorship of "Town Planning and Distribution," a new international association formed in Brussels last year to promote cooperation and exchange of information between all persons concerned with the problems of commercial town planning. For further information write the association at 61 rue Montoyer, Brussels 4.

Planning Study Course in U.K.

A two week study course in urban and regional planning will be conducted under the auspices of the British Council in Glasgow and vicinity from March 22 to April 3 1969. Fee is £85. Write British Council, 80 Elgin St., Ottawa.

New Portland Cement Edition

A new edition of "Design and Control of Mixtures" is now available from the Portland Cement Association, 116 Albert St., Ottawa 4.

Films on Art and Architecture

The 1968 catalogue of Films on Art including 109 on architecture, architectural decoration and archeology, is now available from the Canadian Centre for Films on Art, PO Box 457, Ottawa 2.

Coming Events

Mies van der Rohe Exhibition, National Gallery, Ottawa, January 25-February 23. (Only Canadian showing).

Alfred Neumann, 1900-1968

This last October, Architect Alfred Neumann died in Quebec City. No longer with roots in the cities of Europe or the Middle East where he had taught and worked, Professor Neumann came to Canada and spent his last three years teaching at Laval University. As a tribute to him as a teacher, his students bought him a plot of ground for his burial here in Canada where they wished him to remain.

It was in 1955 as a new graduate that I first met Alfred Neumann in Switzerland at a CIAM Congress. I later accompanied him to Paris where he kindly showed me the atelier he worked in under Auguste Perret at 25 bis Rue Franklin. I also accompanied him to other Perret buildings and later to the Place Voges and into the gardens of Palais Royale where the French aristocracy used to mingle. In this brief association I had come to greatly admire him as a teacher and a man.

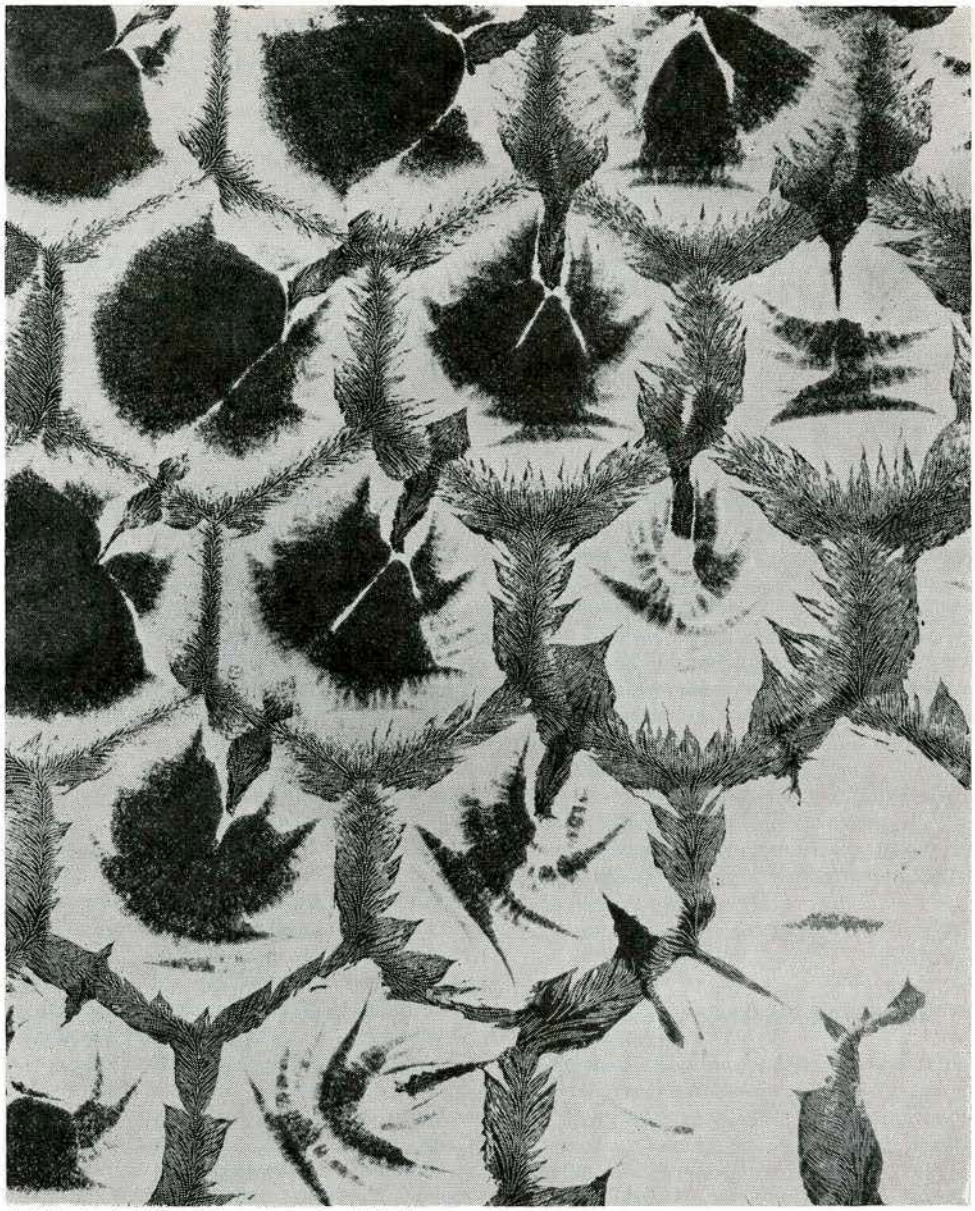
Born in Vienna in 1900, he had studied at the Akademie where he received the Peter Berhens prize in 1925. During his time in Vienna and in Paris he came to know Adolf Loos, Piet Mondrian and Auguste Perret. In 1927 he worked in the private office of Peter Berhens on department stores for Frankfurt A.M. and Zagreb as well as dwelling type developments. Under Auguste Perret he was sent to Algiers on several projects for the government. In 1930 he was associated with Lubetkin and Ginsberg as well as maintaining his connection with Perret.

At the time of our meeting in Switzerland he was the Dean of the Faculty of Architecture at the Israel Institute of Technology and subsequently produced the works for which he will be remembered as an architect whose influence we are still to realize. One of his works illustrated here and on pages 34 and 38 with his article on *Irrational Factors in Building Industrialization,* is Ramat-Gan in which Zvi Hecker was an associate.

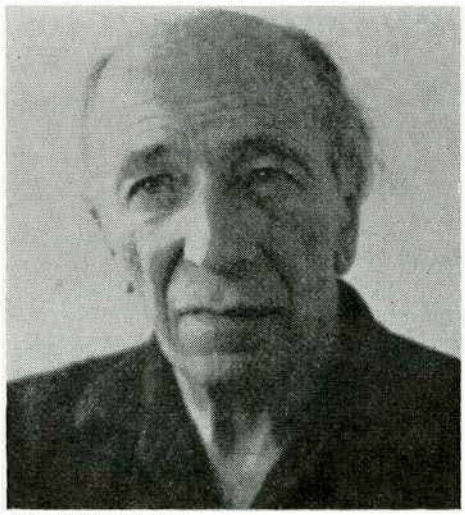
On the few trips that Professor Neumann and his wife took to Toronto both my wife and I spent many fascinating hours listening to his conversation and his philosophies. It is seldom one has the chance to meet a truly great man and benefit so much from brushing against his ideas.

Although few of his projects were realized and he died feeling unfulfilled, the results of his struggle and research into building forms will have important implications for the future of architecture. He was a gracious gentleman and one of the last of the group of modern architects of the 1920's who were themselves great individualists.

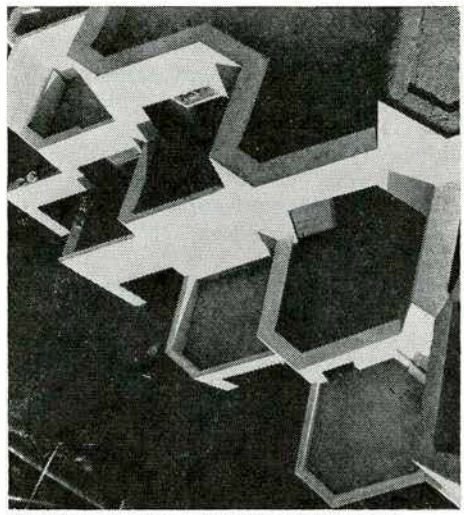
Peter Goering, MRAIC, Toronto



A Tribute to Alfred Neumann by J. Zvilna



Alfred Neumann



Dubiner Building Apartment House in Ramat-Gan, Israel Neumann and Hecker Architects

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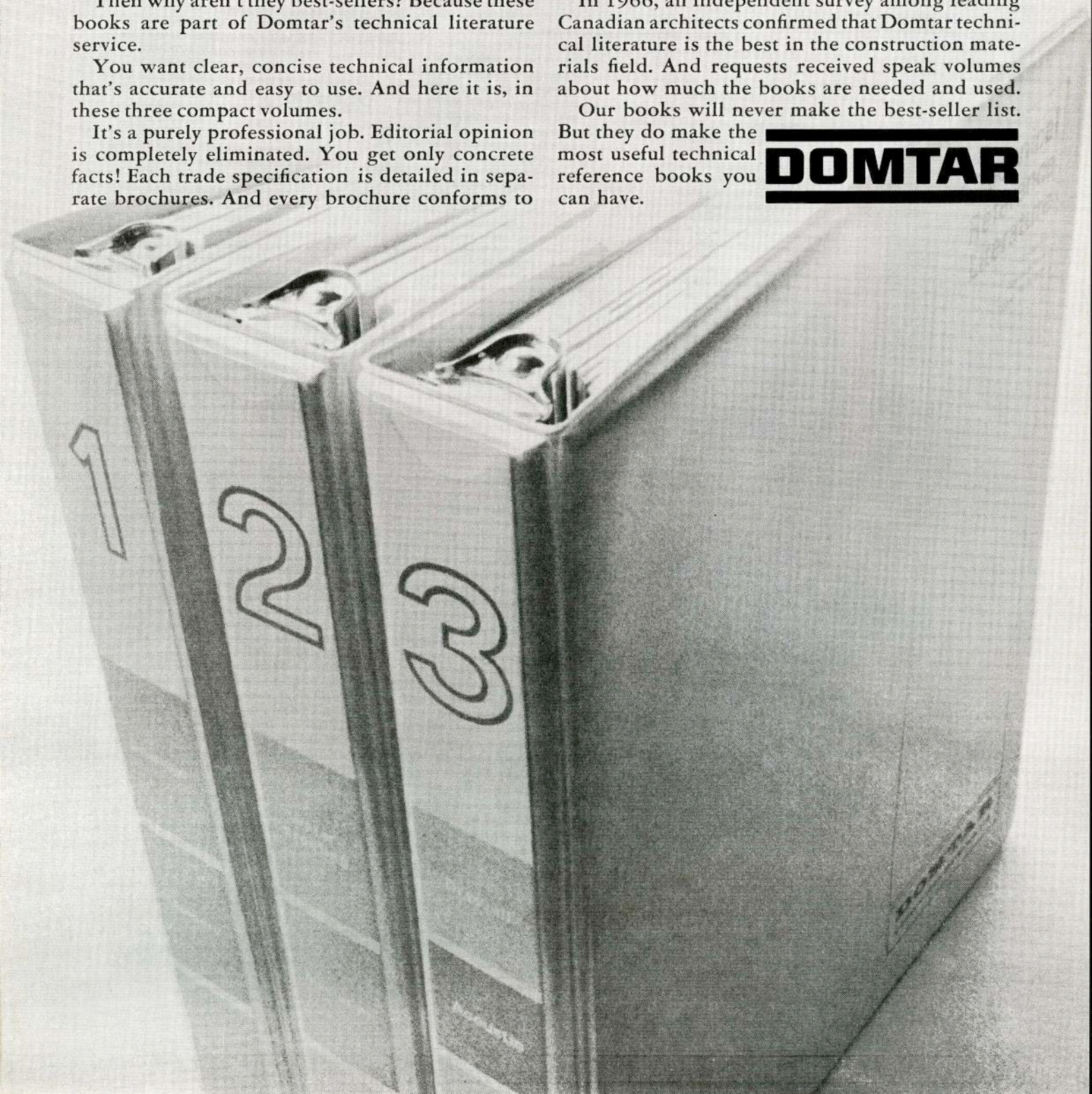

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1969 Convention

Communiqué 2

RAIC/AIA Joint Convention, 1969, Chicago

Three days of seminars and workshops related to the immediate concerns and problems of the architectural profession will feature the RAIC/AIA, first international joint convention in Chicago from July 16-20, 1969.

There has been an encouraging early response to the circular letter sent all members by RAIC Headquarters, asking for an expression of interest in group transportation arrangements to Chicago. From Toronto, HQ has received 96 replies, from Winnipeg 43 and from Montreal 41. These are the three selected points of departure for charter flights to Chicago. Vancouver has sent 16 replies also, and more are expected from other parts of the country.

The theme of the Convention is the "Short Range Goal" of the profession and the purpose of the seminars is to define and discuss the different aspects of the theme.

It is planned to have an "Urban" presentation on June 25 based upon reports presented by visiting critic teams – a Canadian three-man team to visit Chicago and prepare a critical planning report, and an AIA team to visit Montreal.

June 24 will be "Design Day" with emphasis on the urban environment. Workshop topics will be: Involvement and Leadership; Quality of Urban Life; Transportation; Economics of Building and Family Shelter in the Next Five Years.

June 26 will be "Business-Professional Practice Day" and Workshop topics will be: Liability – Professional Responsibilities; Fees-Compensation; Educational Process; the Problems of the Smaller Practice; Changing Forms of Practice (the multi-discipline team).

The June 27 subject will be the "Technology of Practice" with sessions on Systems; Information Retrieval; Product Technology for Systems; Construction Management; Programming.

All convention events will be held at the Palmer House Hotel and, with the exception of the College of Fellows Convocation and the business sessions of each Institute, all program events will be held jointly.

Federal government participation will take the form of a Department of Industry, Trade and Commerce display, plus sponsoring the attendance of architect members of the Department's advisory committees to serve on seminar panels, etc.

L'IRAC/AIA Assemblée Conjointe, 1969, Chicago

Trois jours de séminaires et de sessions d'études se rapportant aux intérêts immédiats et aux problèmes de la profession d'architecture, marqueront la première convention internationale de l'IRAC et de l'AIA, tenue à Chicago du 16 au 20 juillet, 1969.

Une réponse encourageante a été reçue à la lettre circulaire envoyée à tous les membres de l'IRAC, par le Siège Social demandant une opinion d'intérêt sur l'organisation du transport en groupes, à Chicago. Le Siège Social a reçu de Toronto 96 réponses, 43 de Winnipeg et 41 de Montréal. Ceux-ci sont les trois points de départs sélectionnés pour voyages aériens à Chicago. Vancouver a aussi envoyé 16 réponses et plus encore sont attendues d'autres parties du pays.

Le thème de la convention est "l'Objectif de la Profession dans un Avenir Rapproché" et le but des séances est de définir et discuter les différents aspects du thème.

Le 25 juin, il est proposé d'avoir une représentation "Urbaine" basée sur des rapports présentés par les équipes de critiques visiteurs. Aussi, un groupe de trois hommes canadiens doit visiter Chicago et préparer une critique sur l'aménagement et un groupe de l'AIA doit visiter Montréal.

Le 24 juin sera le "Jour du Dessin" ayant pour sujet principal, l'environnement urbain. Les sujets d'interlocutions seront: La Participation et La Direction; La Qualité de la Vie Urbaine; La Transportation; Economies sur la Construction; et le Logement Familial dans les cinq prochaines années.

Le 26 juin sera consacré aux "Affaires et la Pratique d'Architecte" et les sujets d'interlocutions seront: Engagement – Responsabilitées Professionnelles; Barèmes des Honoraires; Développement Professionnel; Les Problèmes des Petites Agences; Formes changeantes de Pratique (l'équipe de discipline multiple).

La discussion du 27 juin sera "La Technologie de la Profession" avec séances sur Systèmes; Relèvement de l'Information; Technologie des Produits employés dans les Systèmes; Organisation de la Construction; Programmes".

Tous les événement de la convention seront tenus à Palmer House Hotel et, avec l'exception de la Convocation du Collège des Fellows et des Sessions d'Affaires de chaque Institut, tous les programmes seront tenus conjointement.

La participation du Gouvernement fédéral prendra la forme d'une exposition préparée par le Ministère du Commerce et de l'Industrie et en plus, le Gouvernement doit se porter garant de l'assistance des architectes qui sont membres des comités consultatifs au Ministère, pour servir comme témoins aux discussions, etc.

If there's a word to describe Leif Jacobsen it is fussy.

If there's a word to describe his designs it is expensive*.

Should you be watching a Leif Jacobsen craftsman at work (and you are hereby invited to do so) you would see why his prices are the way they are.

To begin with Leif Jacobsen is intolerant of compromise. He encourages his staff to be just as fussy.

Let the example of the 190 chair illustrate why an uncompromising point of view tends to nudge the prices up a bit — and at the same time gives you full value for your (or your client's) dollar.

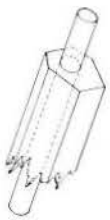
This is the Jacobsen 190 chair with steel legs.

Its attractiveness and function have got it invited into Top Dog offices where comfort is paramount, and into hospital waiting rooms where toughness and hard wear are important. Over 100 have been shipped to Geneva, Switzerland and 10 to the Canadian Embassy in Djakarta. They couldn't find anything as good at the same price locally or from anywhere else in the world.

This is the Jacobsen 190 with wooden legs and a secret. It is frequently sold in this delicate configuration. And here is where Jacobsen fussyness pays off.

With a chair of this design you can't make a wooden base strong enough to last and still have it look good. Some try. But nobody can. So rather than compromise either the design or the sturdiness, Jacobsen builds a secret into the chair. The wooden legs are actually solid slim wooden sleeves over unbreakable steel shafts.

Jacobsen reports that he has never heard of, or seen, any other chair made this way. The steel base with the wooden sleeves give the chair the lightness the design demands but the sturdiness you demand. It is virtually unbreakable.



This is a normal plywood shell for a chair of this type. Since it's a 3/8 moulded ply, it's flexible. It tends to work and bend, and ultimately loosen up. 5/8 ths inch ply also has this annoying habit.

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If, by chance, you consider the Jacobsen fussyness more of a virtue than a sin have them quote your current project. You'll find the quote a bit high but not that high.

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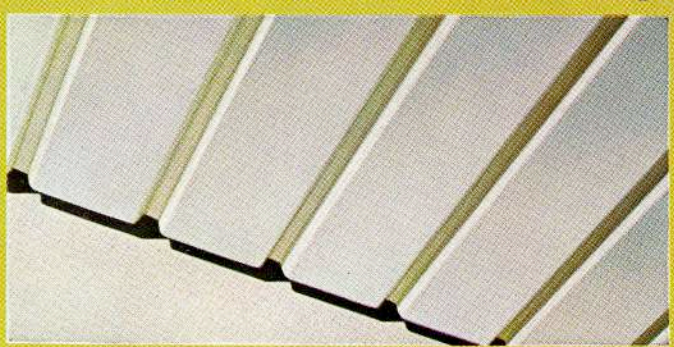

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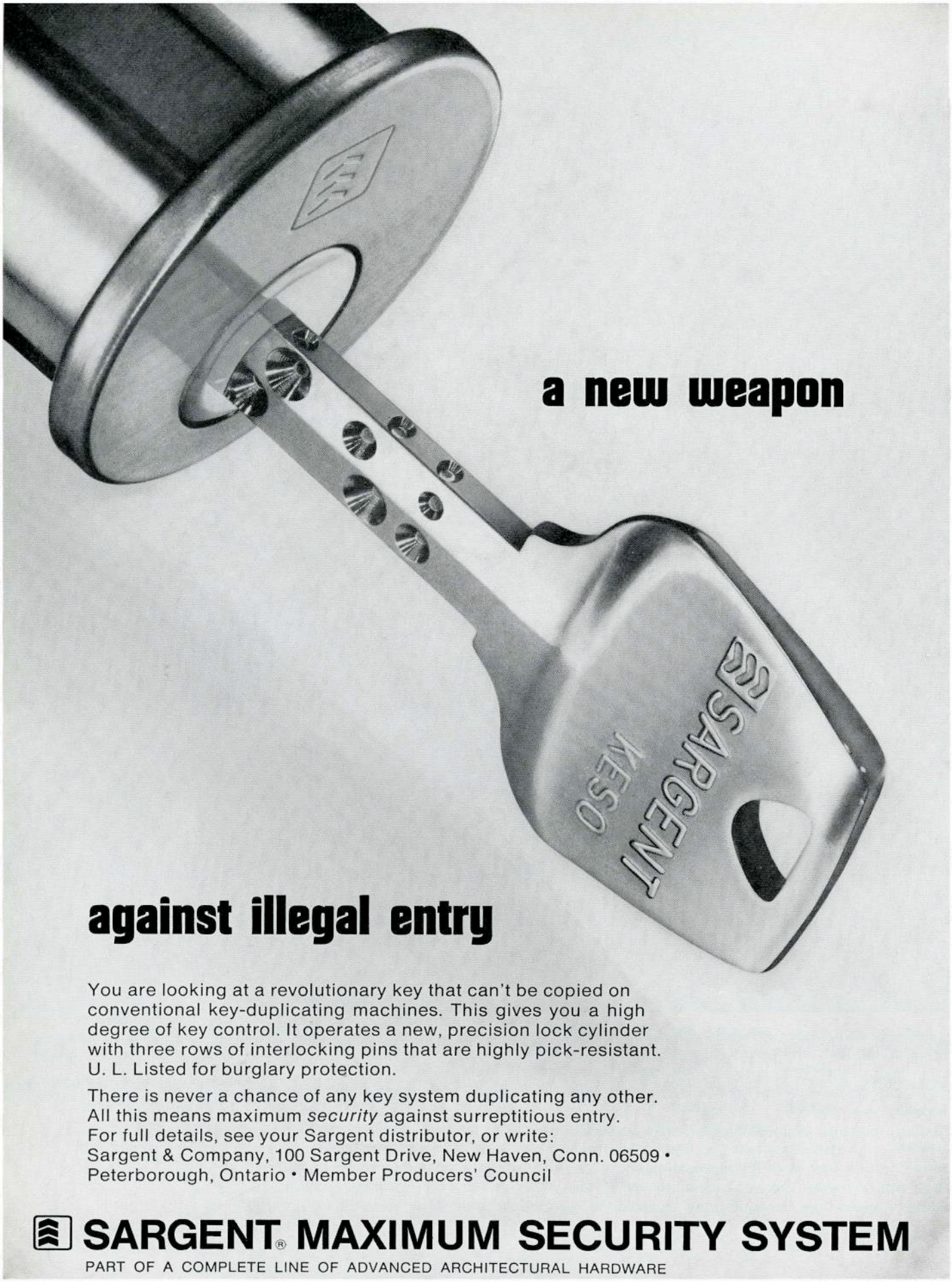

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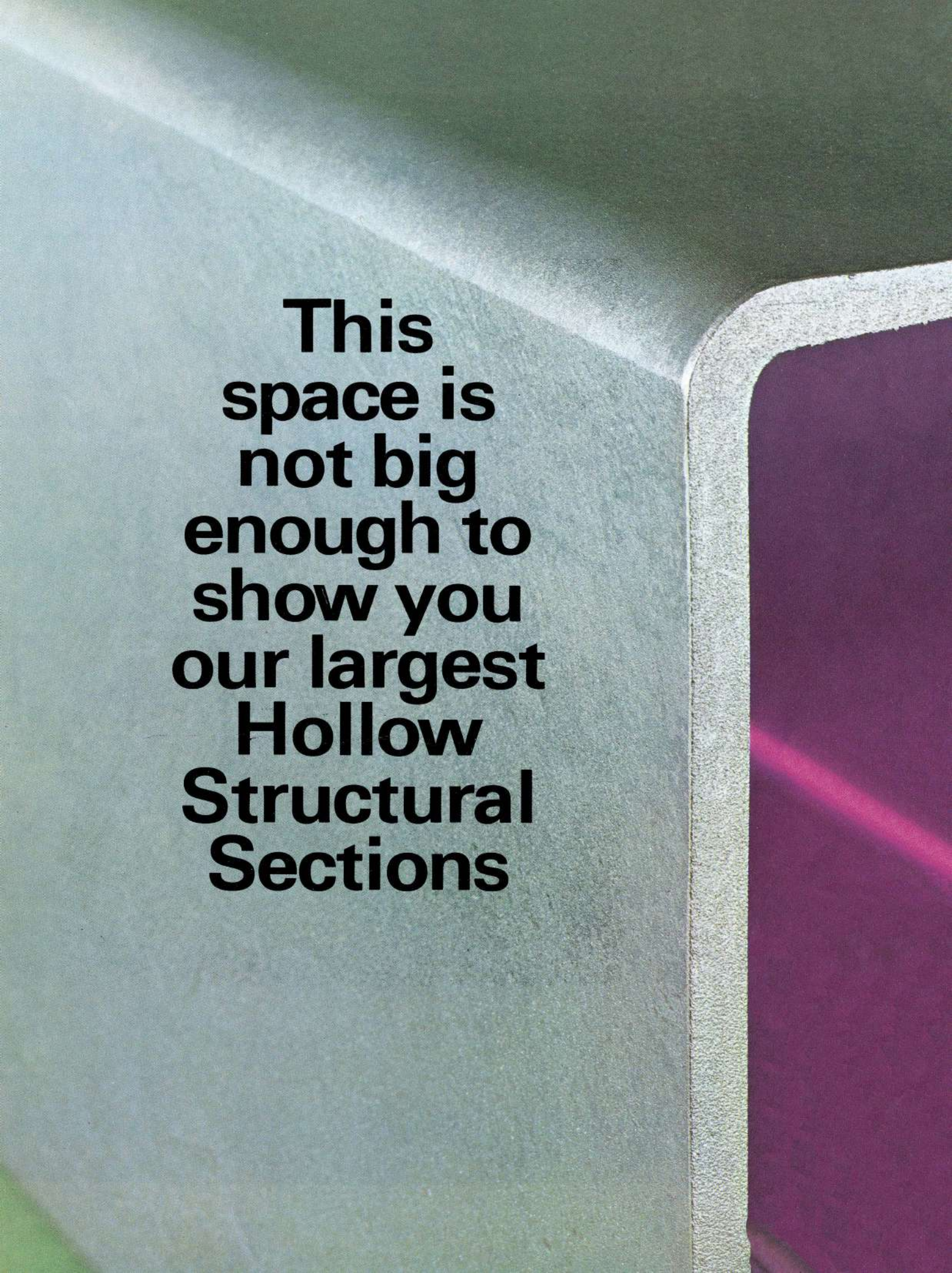
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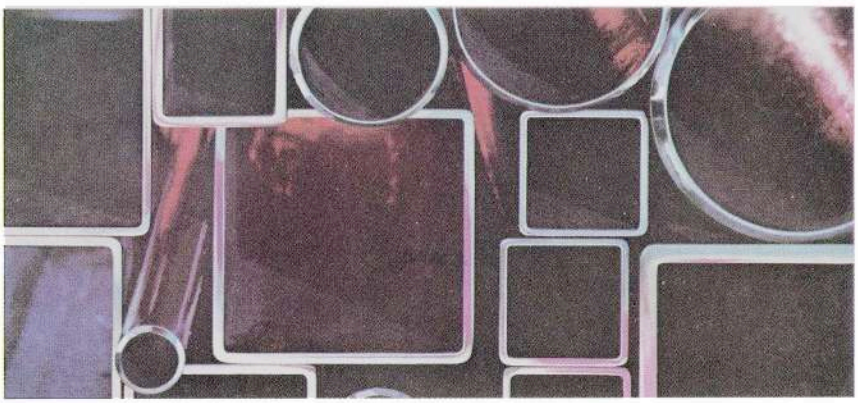

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Another big step forward by Stelco! From a previous maximum in Hollow Structural Sections profiles of 4" x 4" we now offer an extended range of sizes up to 48" periphery, with numerous increments in both squares and rectangles.

All the design versatility and strength-to-weight efficiency of Hollow Structural Sections — in rounds, squares or rectangles — can be applied through these larger sizes to such constructional requirements as columns, space frames, trusses, beams, towers, bridges, marine works . . . and by industry to truck or trailer frames, railway cars, racking, agricultural implements, machinery, conveyor systems . . . the possibilities are unlimited.

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Engineering data, together with advice on design, fastening methods and jointing techniques, are available from Stelco's Sales Engineering Department, or through any Stelco Sales Office.

For design literature on Hollow Structural Sections, write to Stelco's Department "A", Wilcox Street, Hamilton, Ontario.

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Something special in plywood

The architects who designed the addition to the John Wilson Elementary School at Innisfail, Alberta, wanted to create "the feeling of something special" in the new library. They succeeded by using a fir plywood radial folded plate roof system.

By its very difference from the standard flat classroom roof, the folded plate roof of the library helps to create the desired special feeling. The library is an octagonal area and the roof spans about 49 ft. Each of the eight folded plates is 23 ft. long and 10½ ft. wide, tapering to 2½ ft. at the centre.

Fir plywood solved a design problem at Innisfail. How about yours? Send for a free copy of Fir Plywood Folded Plate Design. Write on your company letterhead to: Plywood Manufacturers of B.C., 1477 W. Pender St., Vancouver 5, British Columbia.

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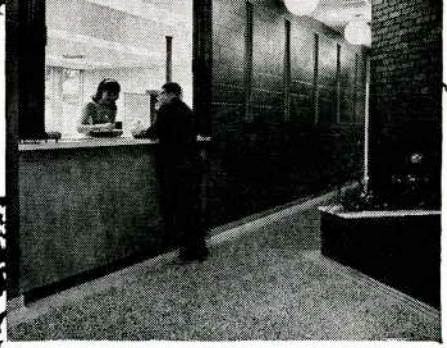
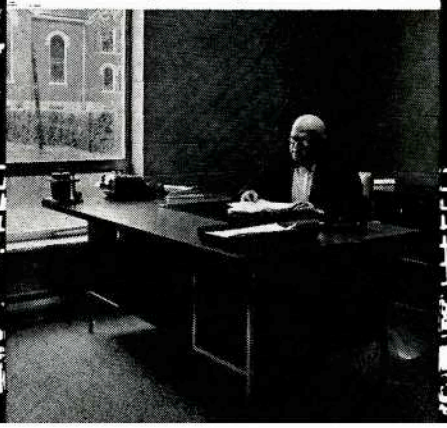
Essex Municipal Building, set among trees on the main street.



Main lobby. A fan-forced heater creates a warm welcome.



Mayor Edmund A. Michael has only one word for comfort in the new building—"delightful".

Heat pump brings economical day-round, year-round, comfort to Essex Municipal Building

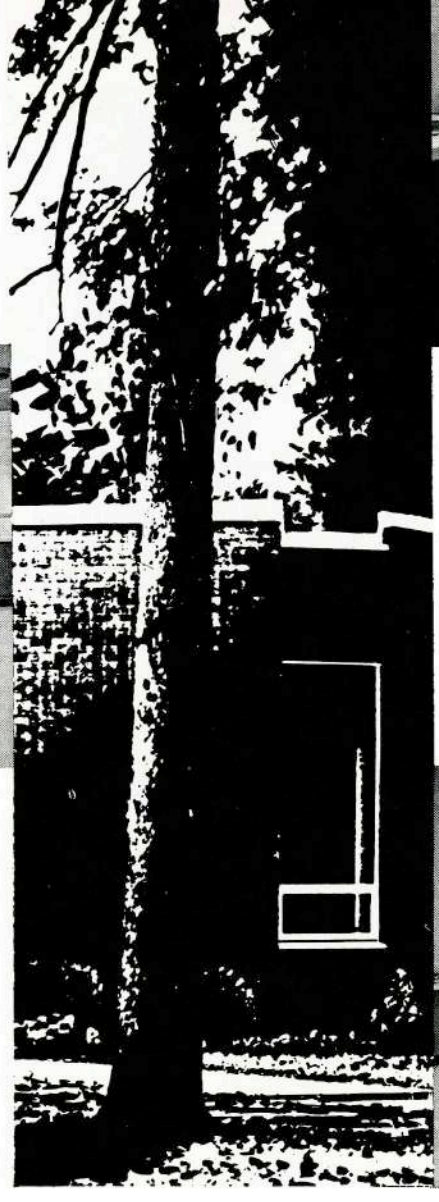
Architect William J. Hilliker of Windsor has designed two electrically-heated municipal buildings in Essex County; one at Amherstburg, the other at Essex. In each, he found the heat pump the most economical and effective way of meeting the special comfort control requirements of the building.

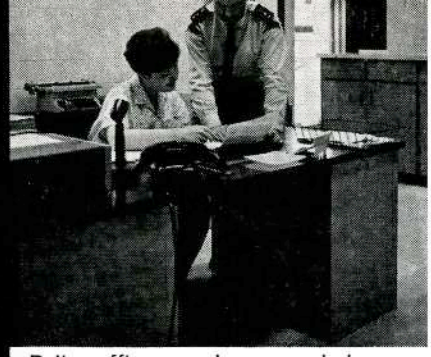
At Essex Municipal Building, dedicated in October 1967, the climate control system has to serve the Police Department, open round-the-clock; the general offices, which keep standard office hours; and the Council Chamber and committee rooms, which only need to be fully heated when meetings take place.

Primary conditioning air from the

electr

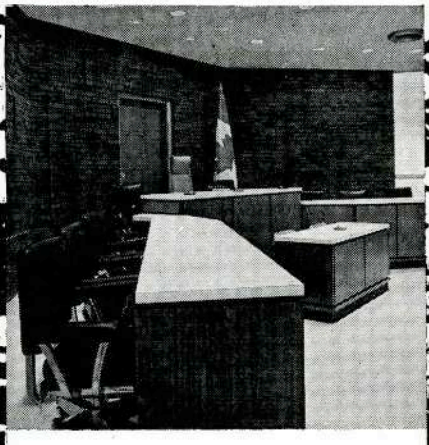
18-5126





Police offices can be warmed at night without affecting other rooms.

Council Chamber. Ventilated, warmed and cooled by the heat pump. Supplementary heating by wall-mounted units under individual thermostatic control.



General office. Precise temperature control creates the best possible environment for work.

heat pump, distributed through ceiling diffusers, ventilates, warms and cools every part of the building.

Secondary conditioning is by baseboard convectors, except in the Council Chamber and lobby, where wall-mounted electric heaters are used. All secondary units are individually controlled by thermostat.

The result is a highly flexible comfort control system which allows each part of the building to call for extra warmth as needed, without affecting any other part. Incidental benefits are a clean, uncluttered appearance to the building, both inside and out; some useful extra floor space; low maintenance demands; and long expectation of life for the equipment used.

The heat pump has proven to be an ideal solution to the complex year-round conditioning requirements presented by many modern buildings. Apart from its ability to provide heating and cooling from one compact unit, it has operational advantages over other systems and even, as at Essex, can be lower in capital cost. Heat pump installations are featured, among others, in Ontario Hydro's Electric Heating Reports, available on request from Commercial and Industrial Sales, 620 University Avenue, Toronto 2.

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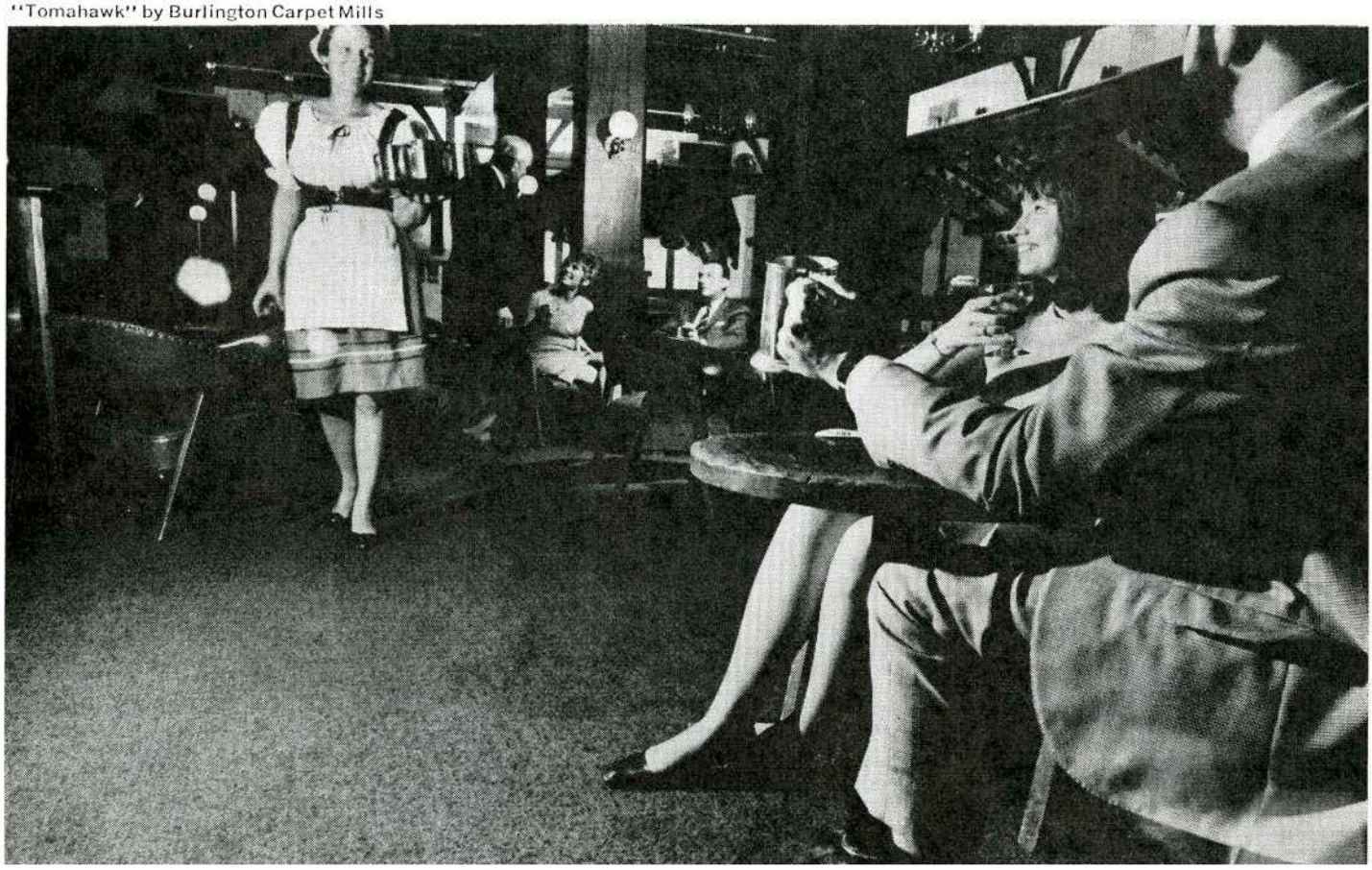
ontario hydro

"Tomahawk" by Burlington Carpet Mills



The Skyline Hotel in Toronto knew what it was doing when it put down carpeting of Du Pont Nylon.

Saving money.

In the 'Pub', a popular bar at the Skyline Hotel as in all high traffic catering establishments spills happen. Acoustic flooring made of Du Pont Nylon is engineered to resist stains and results in lower maintenance and replacement costs.

A national study done to compare maintenance costs between acoustic flooring and resilient flooring showed 67.1% reduction in costs. In the samples compared, annual maintenance of 1000 square feet of acoustic flooring amounted to $86.40 as opposed to $262.25 for resilient flooring.

Du Pont Nylon also gives many years of good wear. So in the long run acoustic flooring made of Du Pont Nylon pays for itself. But it has more going for it than saving money. Du Pont Nylon specified in the right colour and construction, can provide the most serviceable floor finish as well as quietness, safety, warmth and luxury.

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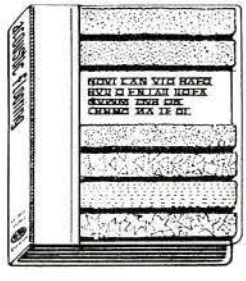

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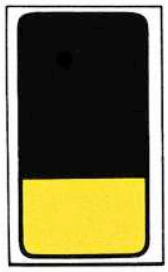

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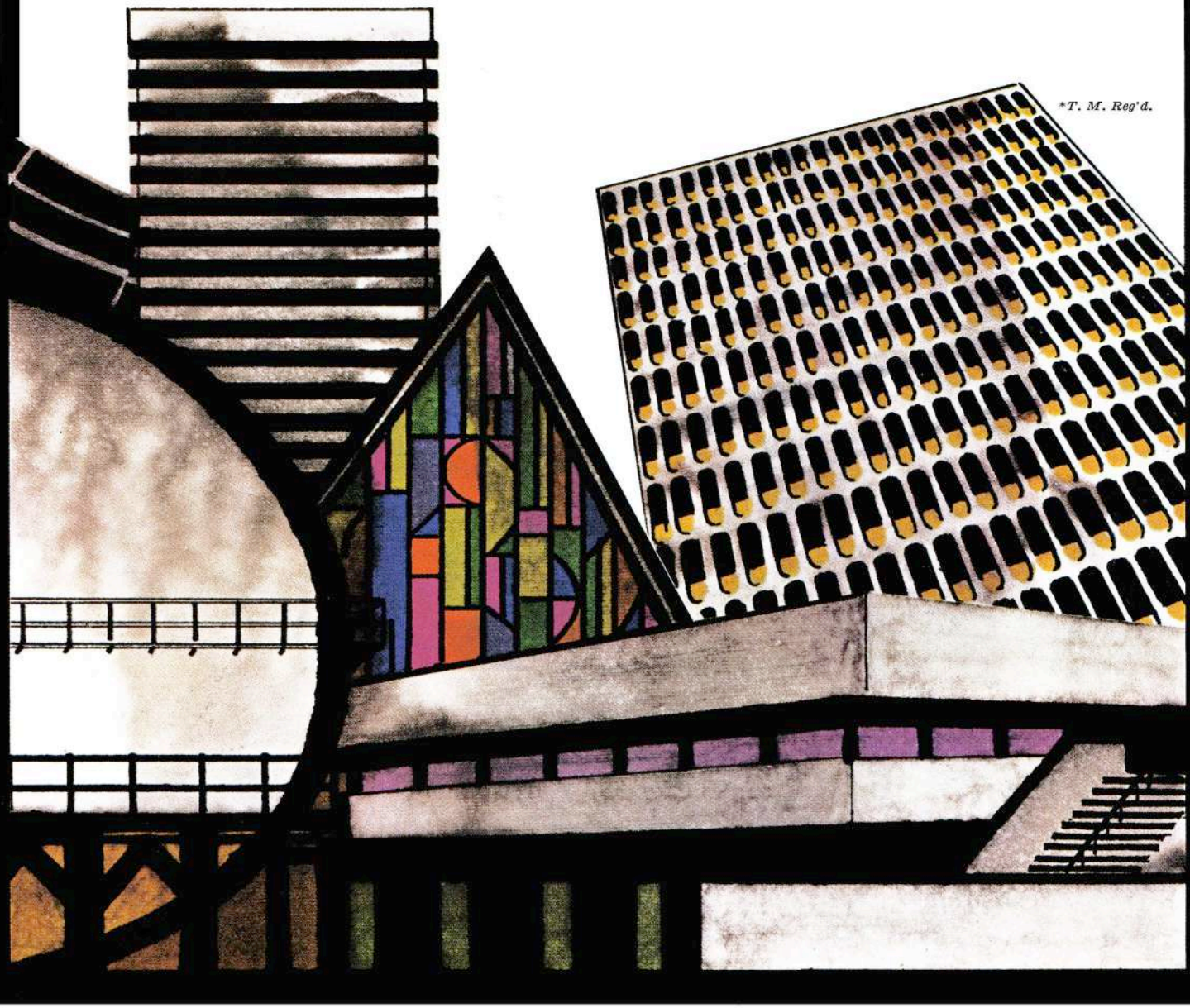

*T. M. Reg'd.

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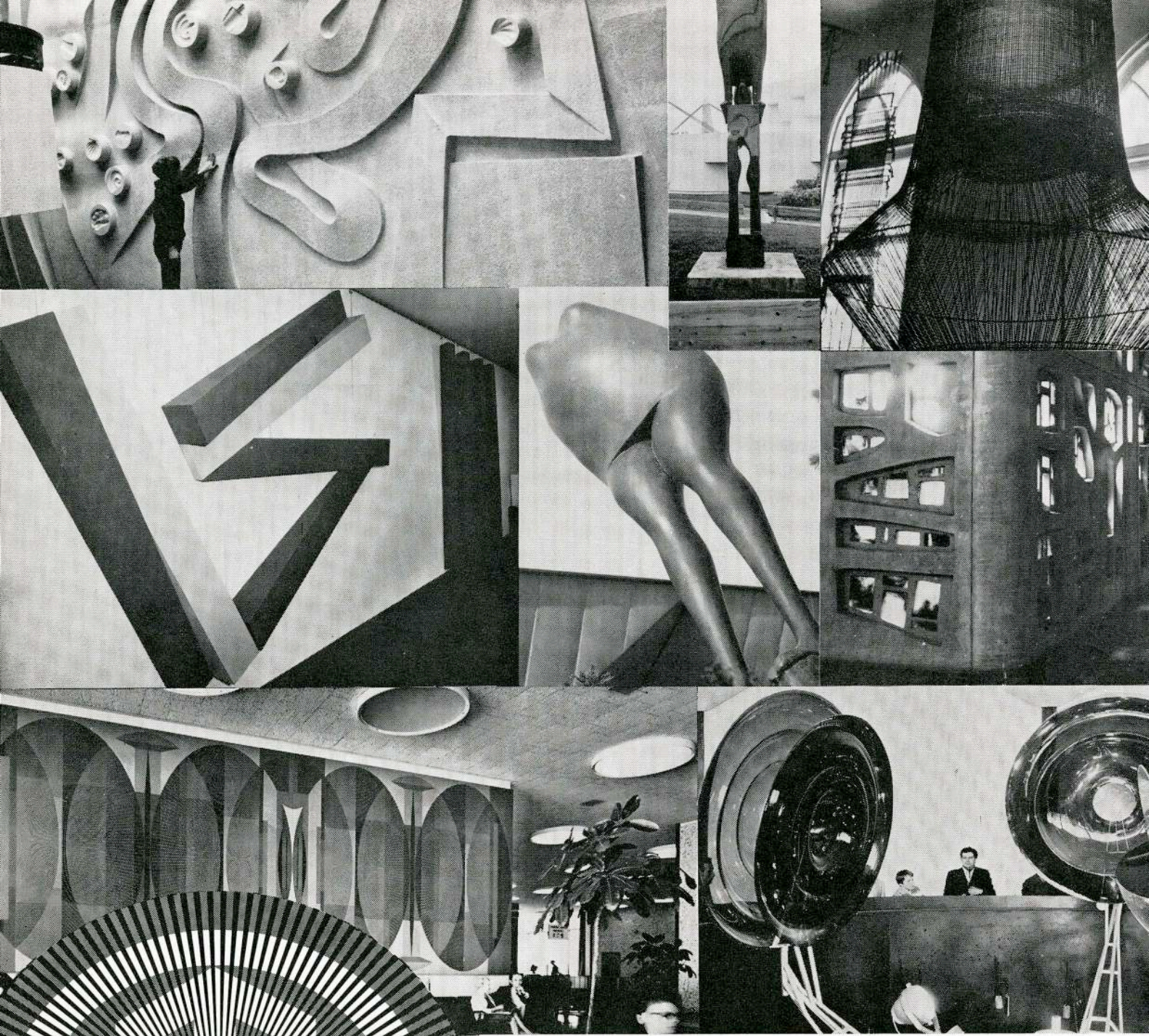

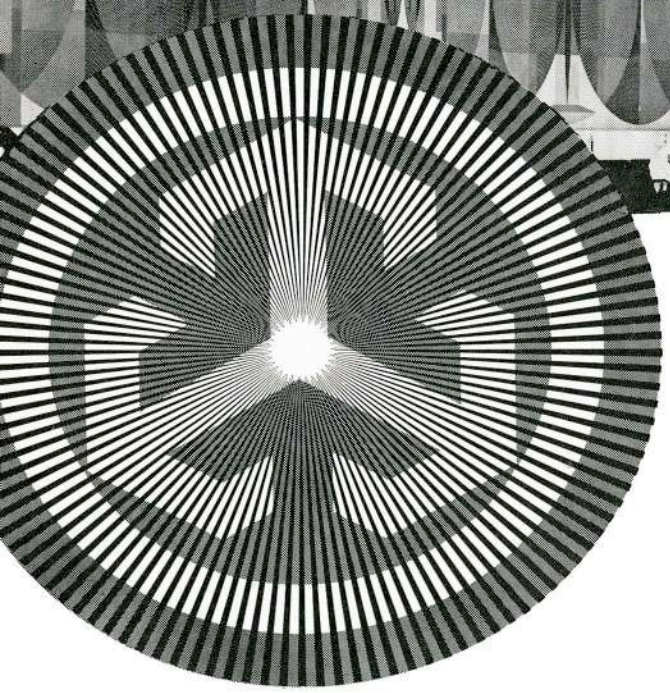

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Allied Arts Catalogue Number 2 is off the Press

- 14 large color plates
- 182 illustrations
- 41 new artists and some new images

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Servicing the Arts for Architecture

"God (and Canada Council) helps those who help themselves."

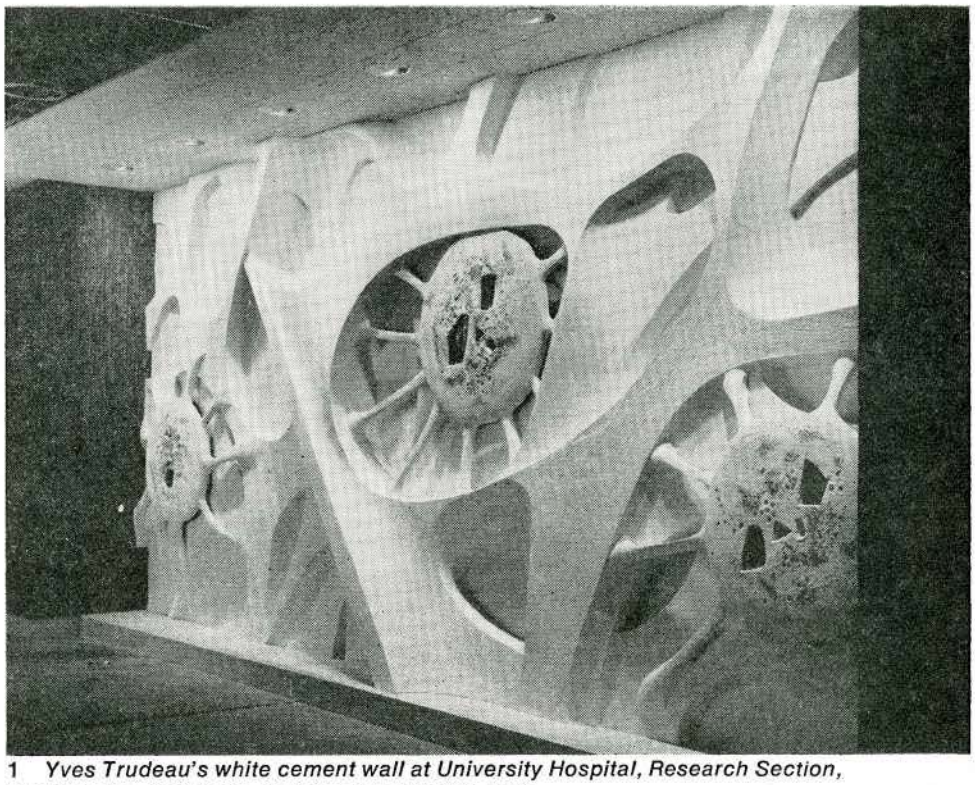
Press Release: A Canadian publishing experiment in 1966 has become a success story. The experiment by the Royal Architectural Institute of Canada in publishing an authoritative catalogue of art for and in architecture has resulted in this working tool for architects becoming part of the Canadian scene. In publishing Volume 2 of the Allied Art Catalogue a fact has become acknowledged. Volume 2 has come about as a result of a steady demand for more of the same.

When the RAIC instituted the Allied Arts Column four years ago and subsequently supported the natural growth of the liaison work of the Allied Arts Department of Architecture Canada, hard-headed visionary action was taken to rectify an appalling state of servicing between the professional artist and architect.

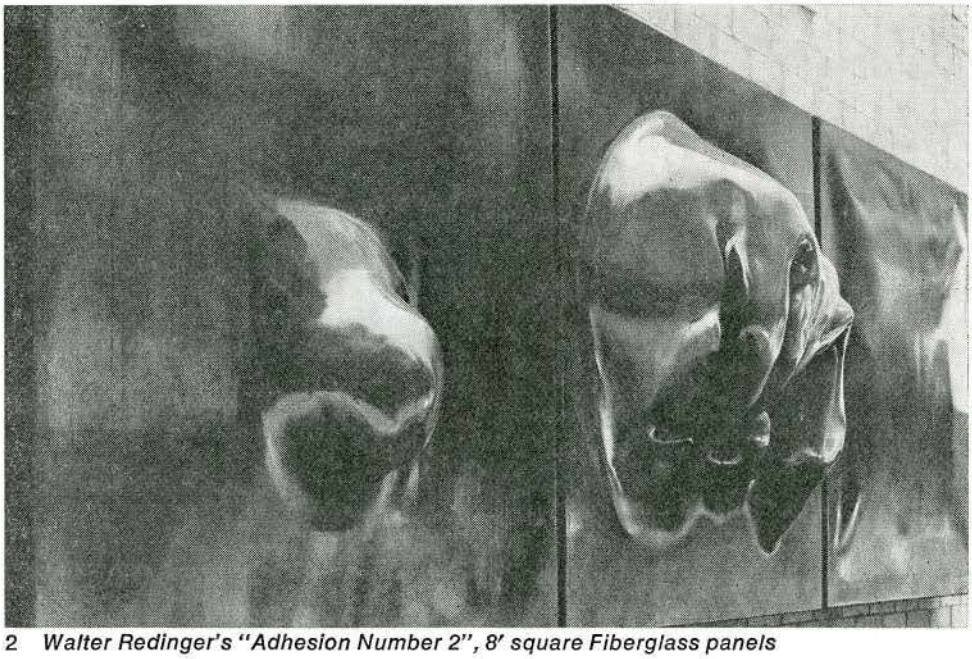
The architect generally, for whatever reason, was not part of the small esoteric group associating with and cognisant of the top professional contemporary world of art.

With a shift of emphasis in architecture from a condition of no-art (or non-art done by the obliging artisan) to that of serious consideration of creative art with, or complimentary to architecture there was revealed a serious schism between both professions. The free wheeling society of professional artists (where professionalism may be defined as an attitude towards production rather than a licence to practice by qualification) showed a remarkable indifference to public relations and liaison. The architect in acknowledging this hard fact, in a world where he was used to his right to commission being delicately courted, had the sense to induce Mohammed to come to the mountain by creating liaison and servicing for the professional artist within the RAIC structure. That "idea" is now a practical working service department. It has become an ever ready source of information on competent creative talent to a widening audience of universities, laymen, schools and corporations and public works departments commissioning artists for architectural work.

This initiative only points the way for future action for others. The catalogues, files and



1 *Yves Trudeau's white cement wall at University Hospital, Research Section, Sherbrooke, Architects, Belanger and Tardif, 1968*



2 *Walter Redinger's "Adhesion Number 2", 8′ square Fiberglass panels*

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uses concealed fasteners
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3
Jack Bush's painting "Striped Tower" at Scarborough
Peinture de Jack Bush, "Striped Tower" à Scarborough
4
Plexiglass Sculpture by Peter Kolisnik, solid black and transparent grey.
Plexiglass sans titre, noir opaque et gris transparent

dynamic servicing are a direct challenge to all the galleries and so called art societies, to look to their outmoded structures and really seriously consider what kind of services exist in Canada for professional artist-designers. If they cannot reconstruct their outmoded policies then they must cease to exist as recipients of funds or dues in the name of professional artists.

The government has spent thousands, probably millions by now, in promoting the Design Center through the Department of Industry in Ottawa. One would have thought that information on the artist-designer for architecture would be naturally included as a dynamic section of the service bureau. Not so. Perhaps it is time for the Office of the Design Adviser to seriously consider the inclusion of "fine artist-designers" as well as industrial designers in their classification systems. They are both productive "form makers" in the struggle for Canadian identity.

It is a challenge to all those who "spiv" on the artists image either as professionally paid servants or as sympathetic voluntary helpers to see that the creators they so admire are handed true service rather than second rate patronage.

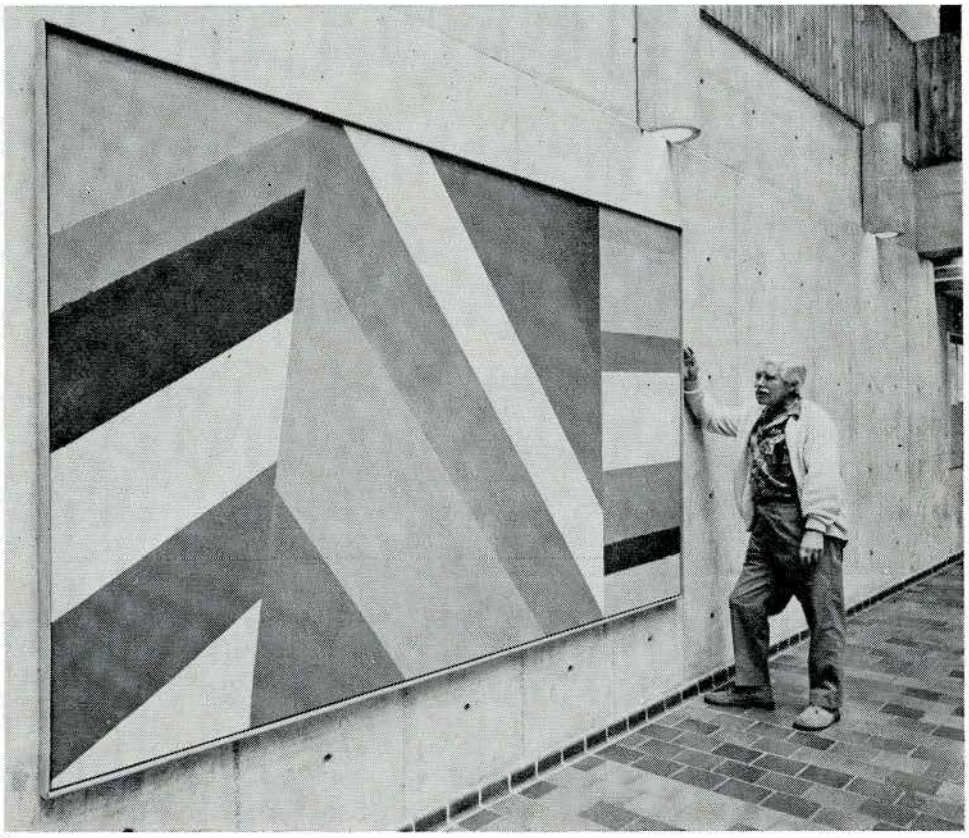
To avoid autocracy there is a real need for several authoritative publications and reliable bureaus if information is in the best interest of the top creative artists of this country. What we need to help liaison are continuous sources of selective visual facts, the who, the where and the "know how" in the commissioning and purchasing of art especially, for public places.

Catalogue Number 2, 1968!

In the meantime the architectural profession through the RAIC presents with pride – Catalogue No. 2.

The RAIC having initiated the act, it is up to every registered architect by personal purchase of a copy for his own shelves, to endorse his faith in his Institute's contribution towards cultural liaison in the arts.

We present to you some visual extracts from the catalogue. After that it is *over to you to support the venture.*
Anita Aarons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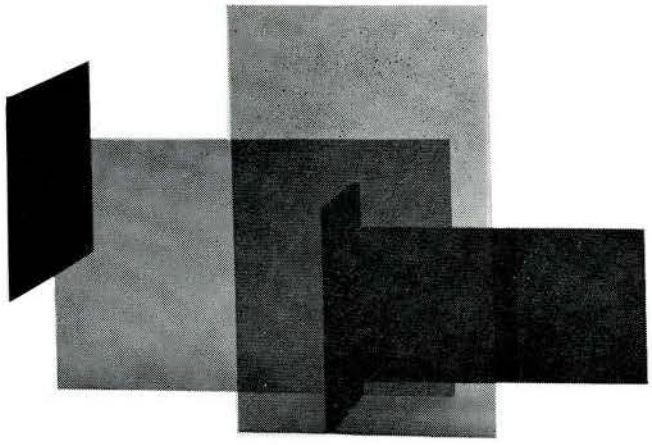
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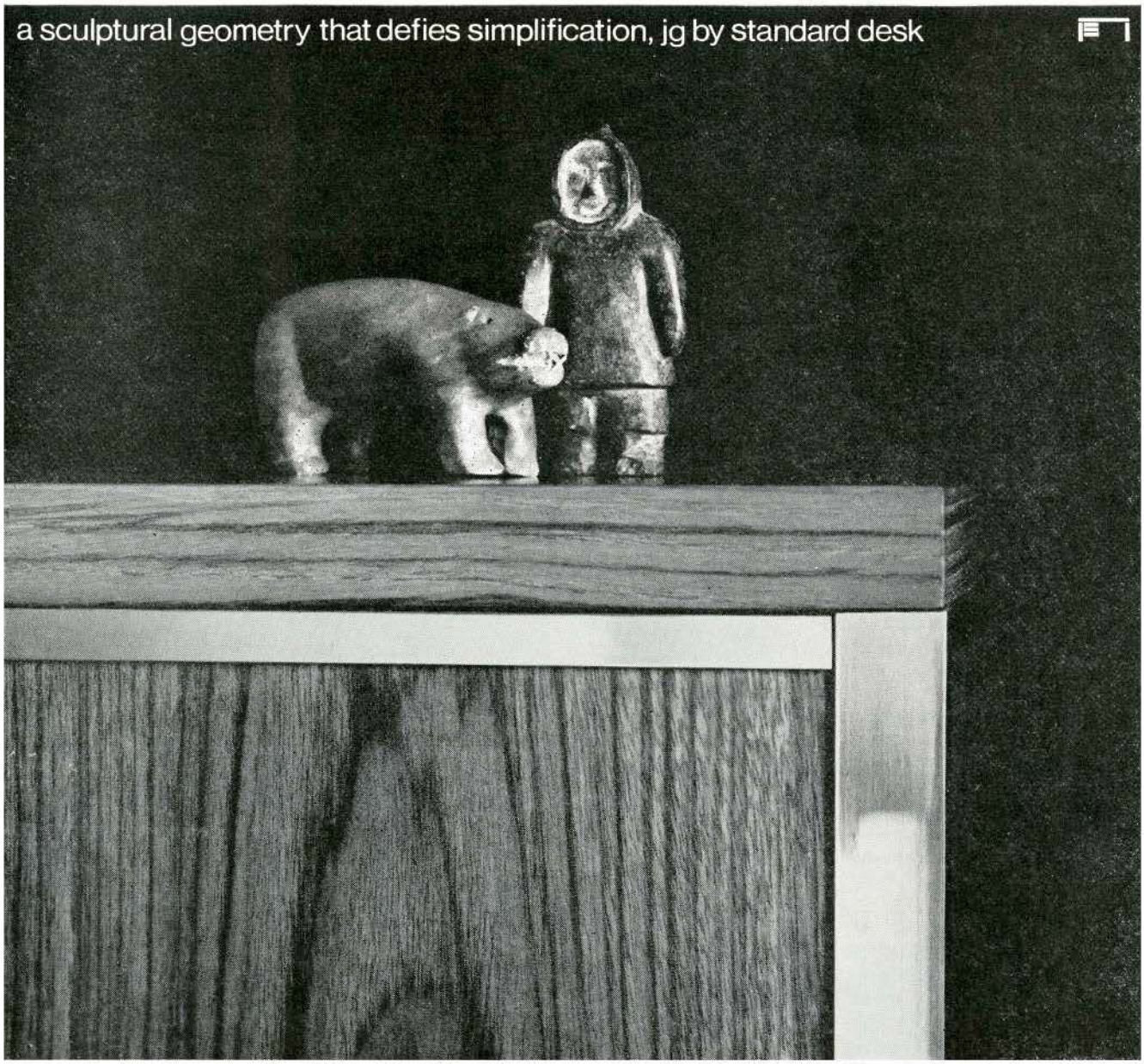

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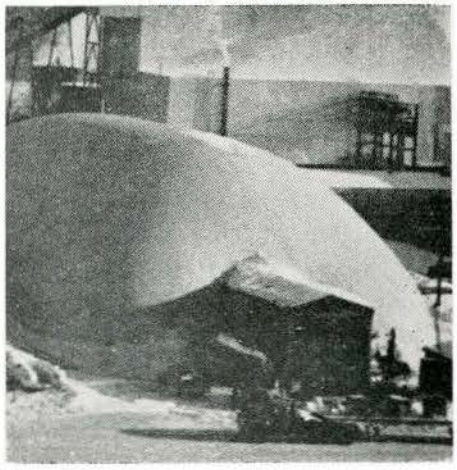
A press release we have just received from *Mountain Meadows Developments Ltd.* starts thus:
"Plans for the largest and one of the most imaginative residential subdivisions in Western Canada were unveiled in Kelowna today!" The evidence for this extravagant claim of "most imaginative" is thin – in the first instance the method of planning the project, (if it can be called a method) by subdivision, hardly augers well. Planning by surveyor? Also in the press release is this juicy piece of social theory: "The Dilworth Estates program envisages the opening of residential development lots for people in all circumstances; those of modest income, those with much *more economics potential who want to settle on the areas with a commanding view of the countryside, (our italics)* retired people, and others who may wish to group together for various purposes. How's that for an imaginative way to plan for maximum returns? Push the poor below.
On the credit list are Promotion and Sales Manager, Solicitors, Auditors, Trust Company and Engineers. No Planners! No Architects!
The last, and conclusive piece of evidence for this "imaginative subdivision" is a photograph(1) of a model of the scheme, for which approval has not yet been obtained. The imagination displayed to date seems to consist of running roads along contours, (for the most part, anyway) in concentric rings, and lining them with houses. On the hills are high rise, in the valley the shopping center. Oh for a buyer's market.

Another press release, this one more charming was received from Nippon, P. R. Counsellors, Inc., Tokyo, Japan. It begins thus:
"Pavillon of Japanese Tradition, Tokyo, Japan, Aug. 5 – Since the biblical Tower of Babel, architects have had a hankering after the sky." And we know what language problems they had.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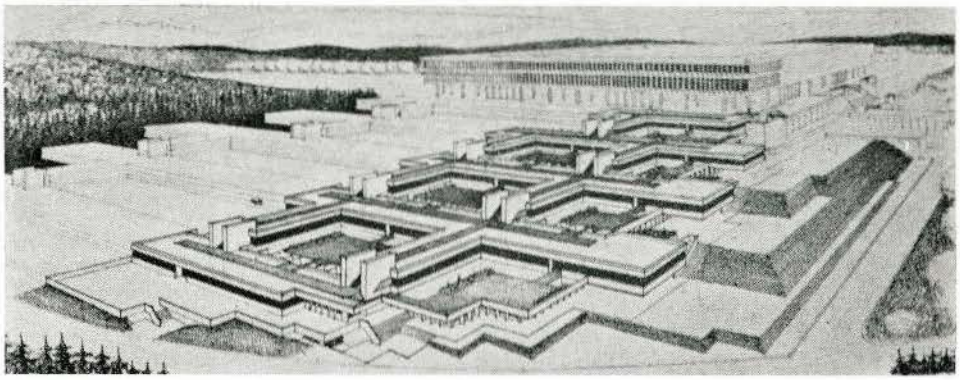
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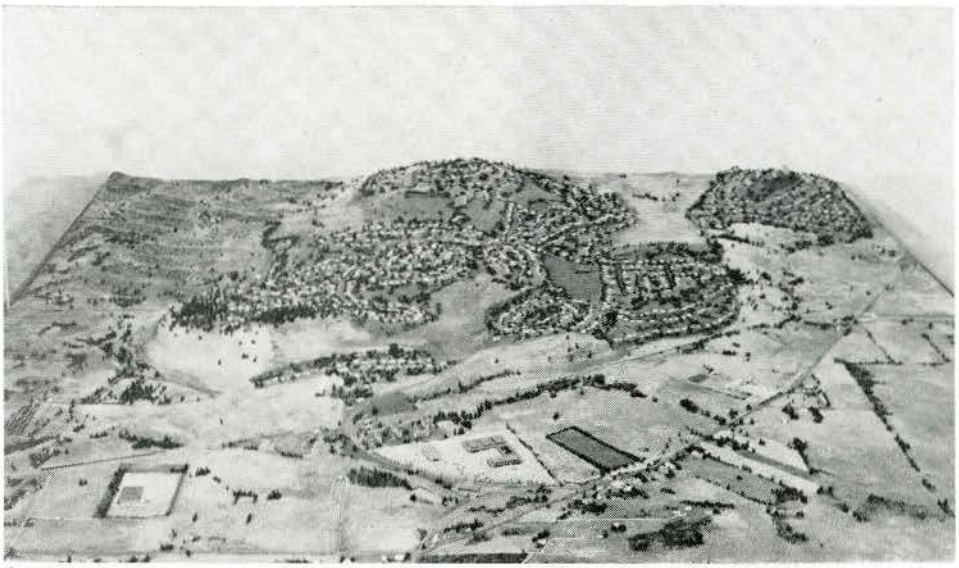
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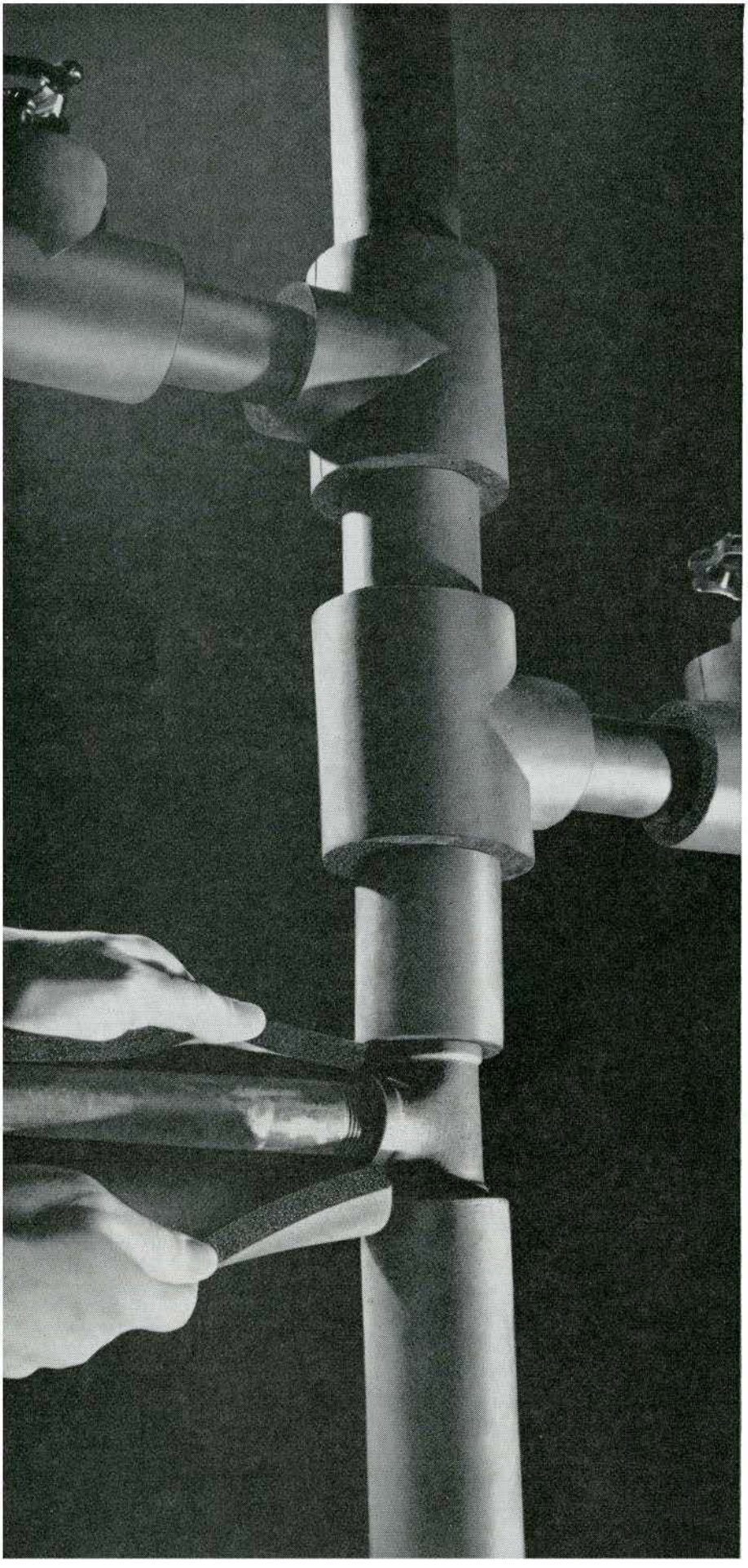
Construction of a $3,600,000 classroom block and $4,600,000 extension to the science complex at Simon Fraser University **(2)** will start immediately. It is expected the new facilities will be in operation by the fall of 1969. The classroom block has been designed by Erickson and Massey.

"This giant vinyl-coated heavy duty nylon fabric 'bubble' **(3)** served double duty at the Great Canadian Oil Sands Ltd. complex in Northern Alberta during and after construction. Under the cover, construction work and concrete pouring was uninterrupted by winter blizzards. Equipment was stored, and at plant opening 600 guests were seated for a barbecue lunch. The bubble measures 100' wide by 200' long." *Canadian Plastics – June, 1968.*

AJD and BM



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Book Reviews

The City Region in Western Europe

Robert E. Dickinson
General Publishing, Toronto, 1967, 306 pages, $2.50

This book studies the nature and influences of the city and region from the aspect of human ecology and geographical relationships. Professor Dickinson's writing is clear and well illustrated with examples from cities in Western Europe. The abridgment of his original work, "City and Region", has led to the omission of certain sections and chapters on the United States. The reader may feel the need for further examples and contrasts outside Western Europe.

The theory of centrality and the hierachy of cities is an interesting concept, but as the writer points out, "The real meaning of a city, however, can only be grasped in terms of the country in which it is situated." This comment is substantiated by his examples of the city – regions in Britain, France and Germany.

At a time when so many people are becoming aware of the problems of expanding cities and urban renewal, it is worth while studying the causes and effects of our present city structures. More architects are being involved in large projects which can no longer be isolated from the context of urban and environmental planning. A seemingly simple problem has become an extremely complex one, and the search for its solution is centrifugal encompassing the city, the region and even the nation. The influences and effect of an urban community extend beyond its boundaries and traverse artificially constructed administrative areas, which tend to confuse and stifle comprehensive planning. This is the main theme of Robert Dickinson's book.

The majority of the work is written without bias although Professor Dickinson obviously favors the philosophies of Lewis Mumford and in his conclusions he agrees with the idea of neighborhood units and a cluster of reasonable sized town forming a "regional city" focused upon a "mother city".

Conrad Loban, MRAIC, Calgary

The Fragmented Metropolis, Los Angeles 1850-1930

Robert M. Fogelson
Saunders of Toronto Limited, 1967, 362 pages, $11.95

Los Angeles must be cited more often than any other city in discussions on the failures of North American town planning. The reason for the planners' obsession with Los Angeles is partly the magnitude of the planning errors committed by the city but is mainly due, in my opinion, to the refusal of the Los Angeles apologists to admit that they have made errors in the first place.

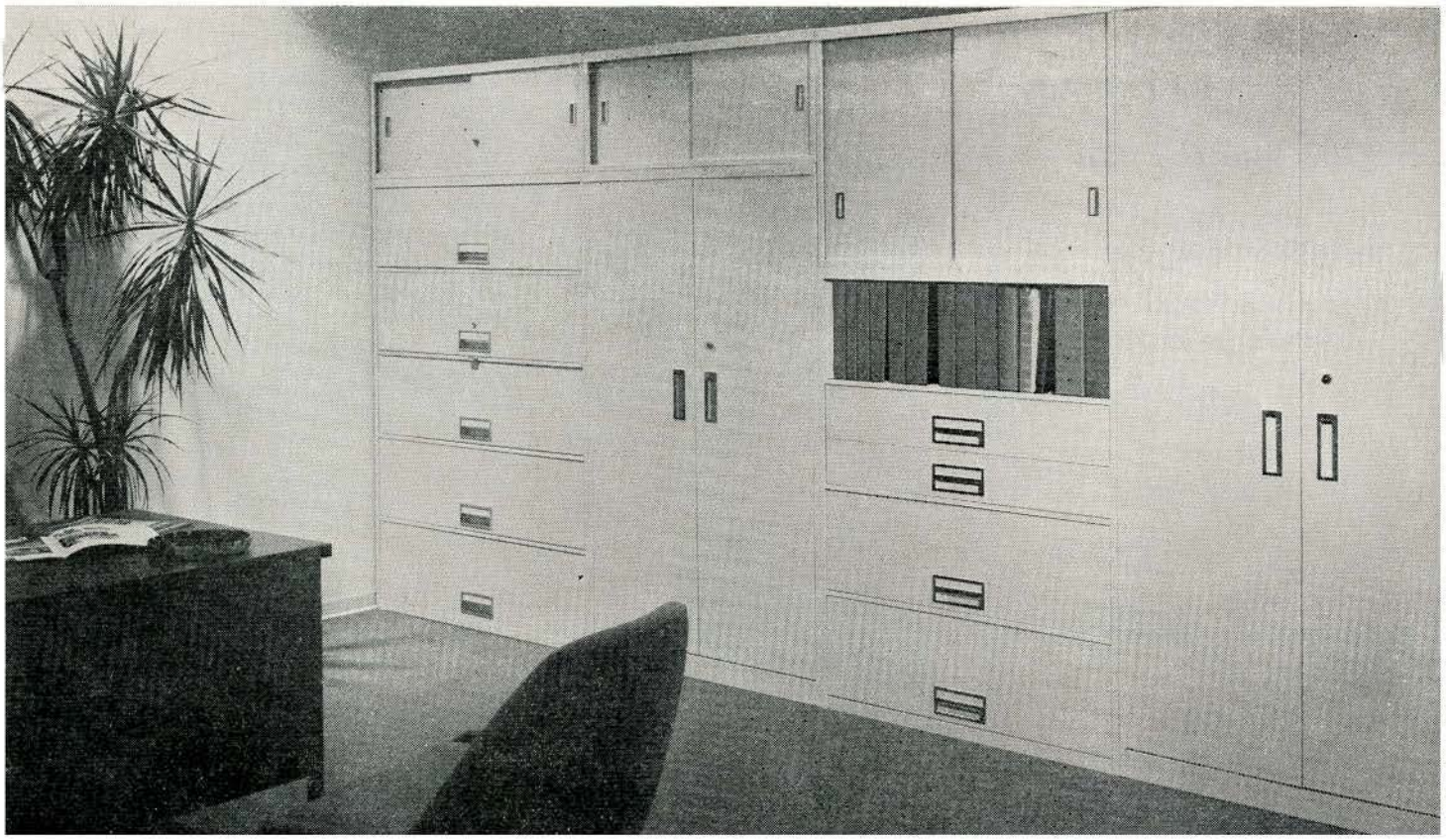
This book by Robert M. Fogelson acts as an antidote to the chorus of criticism that has been heaped on the city mostly by commentators who have not understood the origin of the Los Angeles problem. Rather than condemning all that has happened Fogelson sought to understand why it happened; what conflicting forces, political, economic and sociological have served to shape the city. It would seem to me that this type of objective analysis is particularly essential now for architects to remind them that all their dreams of total environment are likely to remain just dreams if they do not understand how communities function and evolve.
Fogelson divides his book into two stages. In part one he documents the history of Los Angeles, describing its origins as a pueblo and tracing its rise until 1930. In part two he concentrates on the practical aspects of the city growth and shows how the city authorities repeatedly failed to grasp opportunities from their neglect of their embryonic rapid transit system to their unfortunate choice of a civic center plan.

Yet in this final chapter "The Simple Life" he states his belief that the fundamental reason that Los Angeles did not become a great metropolis was because of the inhabitants chronic nostalgia for a rustic simple bygone world represented by their never ending search for a pastoral suburbia. But this is a form of myopia that still bedevils just about every corner of the American dream and explains so much from their preoccupation with colonial architecture to their adventures in Vietnam.

My main disappointment with the study is that Fogelson ended, to all intents and purposes, with the year 1930. While I agree that the pattern of fragmentation was established by this time surely the full realization of what this would mean in terms of a viable and healthy social community was not fully evident until the fifties and sixties. The drama of a huge city strangling itself in a net of freeways, automobiles and parking lots has been one of the most fascinating aspects of urban development in the last twenty years.

Nevertheless this is an interesting and important book.

P. G. Hemingway, MRAIC, Edmonton



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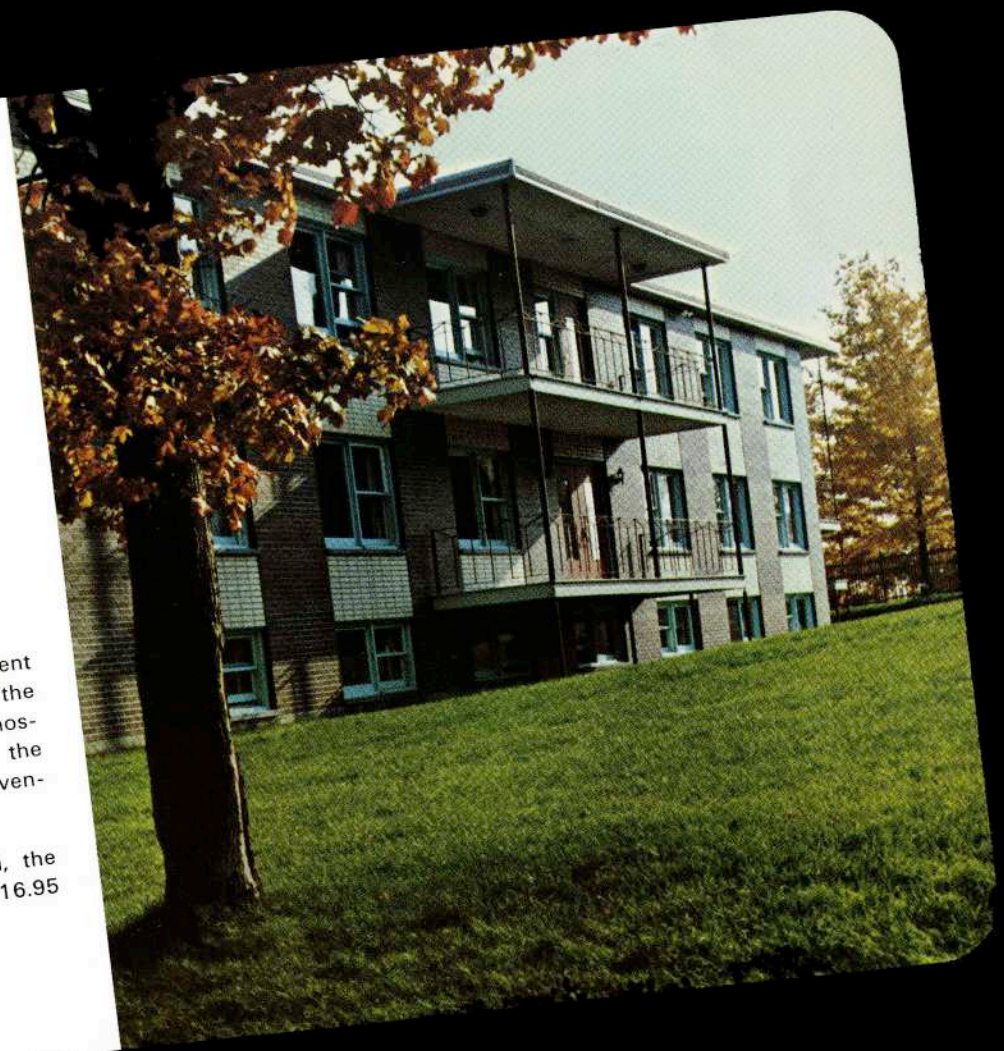

. . . the all-electric concept is a most efficient solution to the problem of comfort for the aged. Each room is equipped with a thermostat allowing each resident to control the temperature to his liking without inconveniencing his neighbours.

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Résumés

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La Construction industrialisée
Moshe Safdie, MIRAC

La construction modulaire est à la mode! Le public et les politiciens croient que les "systèmes de construction modulaires industrialisés" constituent la panacée magique de nos problèmes urbains. D'après moi, les systèmes de construction veulent dire trois choses: une méthode de construction technique très organisée; un système environnemental; un moyen rationel non arbitraire ayant affaire au procédé du dessin. L'industrialisation de la construction n'est après tout qu'un outil vers une fin – un certain environnement. Il faut donc séparer l'évaluation des outils et du produit – l'environnement; trop souvent nous les avons confondus. Quel est le potentiel de la construction industrialisée? La grande demande et les améliorations possibles dans l'organisation de la main d'oeuvre à tout niveau semblent offrir une base d'investissement profitable étant donné la planification et la coordination de l'administration. Sans doute il y aura des forces sociales qui s'y opposeront et même peut-être des pouvoirs politiques; quant aux influences psychologiques empêchant l'acceptation par le public, certaines forces publicitaires contre-psychologiques pourraient en venir à bout. Une fragmentation de l'industrie gênera également son succès. Un système de construction bien organisé aura raison des prix élevés des terrains résultant dans un complexe à un prix plus raisonnable. L'ingénuité peut tout accomplir lorsqu'il en résulte de gros profits.

Mais pourquoi l'architecture considère-t-elle un tel changement? D'abord, *l'accroissement de la population* nécessite l'accélération de la construction, donc, l'industrialisation et la mécanisation. Ensuite, la *réalité politique* – des solutions environnementales doivent s'appliquer à toute la population non seulement à certains groupes –la technologie contemporaine est une exigence obligatoire pour construire davantage. Puis, la *concentration régionale* de la population en immenses villes, donc le besoin de construire des environnements à plus grandes densités. Et enfin, la *densité* est la plus grande force influençant les systémes urbains et de construction. Ça coûte plus chère de construire un environnement à grande densité qu'à basse densité ayant des aménités égales. Il faut considérer la construction en tant qu'une division complexe de l'espace en trois dimensions, pas en tant que bâtiments sur terrains individuels. Ce n'est que la technologie qui nous permettra de construire un environnement à haute densité avec toutes les aménités attendues – à part le fait que plus de 50% de notre population ne peut pas s'offrir un logement convenable.

Maison Appartement, Ramat Gan, Israel
Architectes, Neumann et Hecker

L'Industrialisation de la construction ne veut pas dire forcément la préfabrication. C'est la réorganisation d'une industrie où tous les procédés sont intégrés dans un seul procédé dans une organisation coordonée – une usine, la main d'oeuvre permanente où une grande partie de la construction est accomplie – comme, par exemple, la 'cellule spatiale'. Celà veut dire également qu'une autorité corporative peut investir dans la recherche, qu'une industrie peut amortir le coût du dessin d'un produit sur un grand nombre d'unités, que ceux dessinant le produit dessinent aussi les outils et la machinerie qui le produisent et que l'investissement dans les frais d'outillage sera amorti logiquement. Mais l'industrialisation ne garantie pas un environnement convenable – voir l'URSS. La question la plus critique est si nous serions capables de créer un environnement riche, varié, offrant des choix à l'individu, permettant l'expression individuelle dans les limites des organisations à grande échelle, de la production en série, la fabrication répétitive et la planification contrôlée. Le bilan du potentiel de la technologie dans notre environnement doit être fait par rapport à nos capacités d'y faire face en tant que dessinateurs.

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Des Facteurs irrationnels dans l'Industrialisation de la Construction
Alfred Neumann

Un bâtiment ou une ville est une structure, un système de structures; une structure est largement indépendante de ses éléments de construction. L'Industrie du bâtiment traite des éléments de construction avant tout, pas avec l'environnement total. Donc, les recherches en construction doivent devenir des recherches en structure; même les recherches des systèmes dans l'industrialisation de la construction se montrent trop restreintes pour inclure l'architecture et toutes ses implications du comportement humain irrationnel. On arrive à conclure que l'architecture vient toujours en priorité en tant que la structure la plus générale. Tant que ces rapports fondamentaux entre l'élément et la totalité ne sont pas recherchés suffisamment, tout essai en coordination et en normalisation sera en vain. La priorité de la totalité architecturale est, la clef à une industrialisation efficace, non pas la sommation des éléments qui produit l'architecture de l'absurde. A présent, tout le domaine indique un développement irrationnel rendu même plus grotesque par la rationalité des détails. L'industrialisation n'est ni la panacée pour tous les maux de l'architecture ni l'instrument diabolique pour détruire les valeurs traditionnelles. Son seul critère est si oui ou non elle s'adapte à la créativité dans l'environnement humain. Il faut nous débarasser de bien des restrictions économiques imposées sur le procédé de l'industrialisation – l'architecture ne résultera jamais des méthodes de production les moins chères. Son économie se comprend en termes humains et en la projection à longue vue.

Quant au produit industriel, on l'accepte soit pour ses valeurs esthétiques réelles ou supposées (la perfection fonctionnelle) ou on le rejète pour son manque de qualités esthétiques (le romantisme du passé) ou on prend position entre les deux. L'industrialisation a été développée là où on – a le moins besoin – dans les bâtiments administratifs – au lieu d'être appliquée là où on – a le plus besoin – le logement. Aux pays en développement les techniques traditionnelles de construction ont été perdues et une nouvelle "non-architecture" – les bidonvilles – est apparue employant les déchets qui résultent des produits industrialisés et qui constituent probablement le plus grand volume de construction dans le monde. Ce qu'on voit moins clairement c'est le style bâtard produit au Canada par le revêtement des vieilles bâtisses avec des matériaux industriels. Malheureusement, l'industrialisation ne consiste qu'en l'individualisation d'un produit – le choix d'éléments industriels dans l'architecture pas pour leurs valeurs rationnelles mais pour leurs qualités émotives. La production de la construction industrielle fait face au problème de la planification, ou le manque de planification, la question étant si oui ou non on devrait procéder à une planification totale de toute la production; en pratique, ceci empêche le progrès et crée la banalité bureaucratique sans laisser de place à la créativite. Le critère ultime est l'harmonie de l'environnement. La planification des éléments de construction industrialisés est un moyen non pas une fin en soi. La structure d'une construction s'enmèle aux éléments rationnels; la surimposition d'une structure entièrement rationnelle, telle que dans la planification, déforme la logique structurale et produit ces bâtiments mulâtres typiques de la bureaucratie du logement universelle. L'ordinateur ne peut que renforcer cette bureaucratie.

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Les Systèmes générateurs de Systèmes
Christopher Alexander

Deux idées se cachent dans le mot système: l'idée du système en tant que totalité et l'idée d'un système générateur. En tant que totalité, le système n'est pas un objet mais une façon de regarder un objet. Il centre sur quelque phénomène de holomorphose pouvant être compris seulement comme étant le produit de l'interaction de ses parts; les propriétés les plus remarquables sont celles qui déterminent la stabilité qui est la caractéristique la plus importante du système. En parlant de système, si nous pouvons constater le comportement holomorphologique des parties constituantes d'un objet, leurs interactions produisant ce comportement et la façon dont ces interactions produisent l'holomorphose, nous pourrons donc faire l'abstraction du comportement holomorphologique de l'objet. Nous verrons ainsi le système en tant qu'abstraction sans regarder les choses elles-mêmes. En insistant trop rigidement sur l'idée qu'un système est un modèle abstrait nous pourrions être amenés facilement à trop abstraire – comme, par exemple, lorsqu'un analyste de systèmes considère un bâtiment – il décrit les acoustiques, le chauffage, la structure, etc., comme des systèmes et n'identifie pas les systèmes humains et sociaux plus intéressants parce qu'il est incapable de les décrire en termes explicites. D'où s'écoule deux leçons: ne pas appeler quelque chose un système vous ne pouvez pas identifier le système abstrait dont vous parlez; apprendre la première leçon mais sans que celà vous pousse à faire d'abstractions faciles. Ce point de vue des systèmes vous mènera à vous rendre compte que les caractéristiques les plus importantes des êtres humains sont les résultats de leurs interactions avec d'autres, que la santé des villes est produite par l'interaction des parties interdépendantes y compris les théâtres et les taudis. C'est un point de vue moderne et discipliné du sens du merveilleux.

Un système générateur ne voit pas un seul objet; c'est un assemblage d'éléments ayant des règlements qui déterminent comment ces éléments peuvent être combinés comme, par exemple, le système démocratique qui pose certains règlements quant à la nature de la représentation, le choix des représentants, etc., et en principe doit générer la liberté et un bon gouvernement. Toute combinaison d'éléments ne suivant pas les règlements est dépourvue de sens ou fausse. Un système de construction est un système générateur: il fourni des éléments – colonnes, poutres, panneaux, etc., – qui doivent être assemblés suivant certaines règles. Presque tout système en tant que totalité est généré par un système générateur. Si nous voulons créer des choses qui fonctionnement comme des "totalités" nous devons inventer des systèmes générateurs pour les créer. L'homme en tant que dessinateur se préoccupe du dessin et de la construction d'objets qui fonctionnent en tant que totalités; la plupart des caractéristiques dont a besoin une ville pour supporter la vie sont des caractéristiques holomorphologiques et afin de les assurer il nous faut inventer des systèmes générateurs dont les éléments et règlements créeront les caractéristiques holomorphologiques nécessaires de leur propre accord. Le dessinateur moyen se considère un dessinateur d'objets mais si on suit l'argument présenté ici, il nous faut conclure que le dessinateur doit devenir dessinateur de systèmes générateurs – chacun capable de générer beaucoup d'objets. Les systèmes de construction conçus jusqu'ici ont produit des bâtiments sans les caractéristiques nécessaires des systèmes holomorphologiques; dans un bâtiment fonctionnant convenablement, le bâtiment et ses occupants devraient constituer une totalité sociale et humaine, ce qui n'est pas le cas actuellement. Il ne suffit pas de créer des systèmes de construction; il nous faut un nouveau genre de système de construction plus subtile capable de générer des bâtiments garantis de fonctionner comme systèmes holomorphologiques dans le sens humain et social.

Industrialized Buildings

Moshe Safdie, MRAIC

Modular construction has become a fashionable term. Even Life Magazine is featuring articles on the subject these days. From the one extreme of ignoring building as systems, we have come around to the other extreme where our politicians and the public are grasping at the words "system, industrial modular building" as the magic cure-all to our urban problems.

Building systems mean to me three things in one. A building system is a highly organized technical method of construction; a building system is also an environmental system, and thirdly, the term building system suggests a rational unarbitrary way of dealing with the design process itself.

Building systems, or the industrialization of building, is after all only a means to an end – a tool towards achieving a particular environment. We must therefore separate in the discussion of this subject the assessment of the tools from the assessment of the bi-product, the environment. What materials can be used to make modular houses; in what sizes; to what height; shipped in which way and assembled with which tools, are highly relevant questions of the means. What environment results with what amenities and what kind of space, identity, privacy, and choice are the end. Too often recently, we have totally confused the two. In this issue, we will attempt to deal with both subjects, starting with the questions of means.

I asked the Chief Engineer of a major Canadian manufacturing industry who has been exposed recently to the building industry, to express his views on the potential for industrializing building. How controversial is the subject in itself, and to what extent is industry sensitive to its implications can be gathered from the fact that the management of his company requested that his remarks remain anonymous. He states:

"I would contend that prices of sophisticated machinery, such as aircraft, locomotives, automobiles and home appliances, have been restrained, or even reduced by some measurements, because of their manufacturers' consistently high investment in tools and machinery. Such companies never hesitate to pour enormous resources, both financial and human, not once but year after year, into material research and process refinement. Raw material is therefore converted into end-product with ever-lower direct labor content at every level. This implies, of course, optimum interchangeability without, in the case of consumer durables, denying a proper choice to that consumer.

It appears to me that the construction industry might adopt an analogous philosophy. Possibly it is inherently less profitable, and funds aren't generated fast enough to acquire all this plant. Possibly the handicaps of variable terrain – as opposed to a flat shop floor – and at least some outdoor working conditions make a true analogy impracticable. But the high demand for the product and apparent massive improvements possible in the organization of direct labor (once again at every level) seem to me to offer the opportunity for at least the beginnings for a profitable investment. As a first step, planning and coordination of management would seem to be amenable to the talents encountered in the durable goods industry, from my limited observations.

There are social forces that will be against reorganizing construction processes, I'm sure, and maybe even political forces; these arise whenever labor content is threatened. There may well be psychological forces to obstruct customer acceptance of housing turned out of a highly-tooled and expertised industry; on the other hand, it is my intuition that proper counter-psychology in marketing could negate this. Certainly, the world-wide acceptance of automobile transportation must have involved psychology.

Much of the industry I'm familiar with has been successful because of the concentration of management and money among relatively few competitors – sometimes (and disparagingly) called an oligopoly. So it follows, to my mind, that any fragmentation of the construction business, either vertical or horizontal, would be another handicap, but one that could be overcome by courageous entrepreneurs.

As for land values, I predict that the high-cost land component would tend to be overcome by the properly-tooled and therefore low-cost housing component. The result would be a more steadily-priced complex.

There is no limit to what ingenuity can accomplish when (and usually only when) prompted by an opportunity for high-profits. I know of no reason why housing doesn't qualify as a candidate. I suspect that if it hasn't already, it will soon."

Why Change?

Why, after several decades of remarkable self-contentment has the architectural profession and the building industry started paying lip service to a major re-structuring of their industry? There are several forces bringing about this change which can be briefly mentioned.

Numerical: The numerical growth of our population in urbanized areas means we must build at a faster rate than before. Our present methods can't cope with the accelerated rate. Population growth does not, contrary to popular belief, imply the need for greater densities, but it does mean that we must build more, faster, and our limited resources of skilled building-trade labor forces industrialization and mechanization.

Political: Whereas we have always been able to deal with environmental problems with a variety of different standards for different groups of the population according to income, race, or both, it has now become a political reality of our time (and about time) that environmental solutions must be applicable to the total population. Hence, solutions limited to minorities such as the

post-war suburban booms, become obsolete if they are statistically incapable of being applied to the total population. As Buckminster Fuller, the Karl Marx of environment has shown, there is a direct relationship between environmental standards and the efficiency of building space, which is to say advanced technology is a mandatory requirement for building more for more.

Regional: The metropolitan city is a bi-product of powerful, economic and social forces; it is an expression of the inter-dependence of industry and commerce on each other and on major population concentrations. It is also an expression of the social preferences of our time: people want vast choices of amenities – recreational, cultural, services, etc. and it takes millions of people to support these institutions. A bi-product of the metropolitan city is the need to build environment at greater densities.

Density

In a regional city of ten million people, a city predominantly housing people at one family per acre would be three miles wide and four thousand miles long. That poses some problems.

A city at an average density of ten families per acre would be three miles wide and four hundred miles long. That is manageable. We can build mass transit today that would span this distance in one hour. The distance travelled in one hour has always limited the size of cities.

At fifty families per acre, we have a city three miles wide and 20 miles long. That is promising.

Density is the most powerful force affecting both urban and building systems. What we are experiencing today is the impact of the realization that it costs more to build high density environment than low density environment for equal amenities. To produce the size of a garden, acoustic separation, privacy, public circulation, and space qualities of a Levittown house in a multi-storey structure is a major technical problem which may cost twice as much to achieve per square foot. To achieve a comparable environment in a multi-storey structure, it becomes necessary to consider construction as a complex three-dimensional sub-division of space and not individual buildings on separate lots. So, as we build more densely, we must introduce technology in order to permit us to hold our own ground for the amenities which we now take for granted. And this, in terms of political realities, means that the amenities which we take for granted must be provided to all. This is to say nothing of the fact that, even as things stand today, over 50% of our population cannot afford to purchase "decent" housing within the purchasing power of their income.

Industrializing building does *not* necessarily mean pre-fabrication. It is the organizational re-structuring of an industry in which raw material manufacturing, component manufacturing, design, research, development, assembly, and marketing are integrated into a single process within a co-ordinated organization. It may also mean pre-fabrication. In terms of immediate and foreseeable effects, it certainly does mean putting a substantial portion of the construction process into a factory, with a permanent labor force continuously employed. One way of putting the construction process in the factory is to manufacture 'space cells' which permit for electrical, mechanical, and finishing components to be installed on the assembly line. (The structural shell represents only 25% of the total cost, so prefabrication of the structure is of minor significance.) Space cells can then be shipped and assembled on site.

Organizational re-structuring of the industry means that a single corporate authority can spend substantial sums of money on basic research e.g. :– Dupont's $50 million for Corfam, Boeing's (with the U.S. Government) $1 billion for the SST, etc. It means that industry can amortize the design costs of a product over a large number of units (e.g. 5% of the cost of the house for its design by an architect, 10,000% of the cost of a car for the design of a single model). It also means that those designing the product are also designing the tools and machinery for making it. The economics of manufacturing are balanced against those of servicing and other relevant costs; and finally it means that the investment can be amortized logically.

The evidence for the need to industrialize building is overwhelming, but the threat to our environment of this process is underestimated. Industrialization does not guarantee a decent environment; the USSR has proved this so dramatically. It can mean monotony, deprivation of individual expression, and identity.

I believe that the most critical issue of environment today is whether we will be able to create, within the discipline of large-scale organizations, of mass production, of repetitive manufacturing and of controlled planning, an environment which is rich, varied, which offers choice to the individual; which permits for individual expression to emerge beyond the repetitive and the organized. The balance sheet of the potential of technology in our environment must be weighed against our ability to cope with it as designers.

In this issue, Christopher Alexander speaks of "Systems Generating Systems", Professor Alfred Neuman of the "Irrational Factors in Building Industrialization" and Ann Tyng on "Urban Space Systems as Living Form".

Irrational Factors in Building Industrialization

Alfred Neumann

We were all shocked to hear of Professor Alfred Neumann's death during the printing of this issue. One of the great men of architecture today is no longer with us. Alfred Neumann's work spans from the generation of Perret, Loos, Oud, and Le Corbusier to the present when the three-dimensional city is about to become a reality. His work was that of a true radical, equally radical today as it was forty years ago. Alfred Neuman worked and taught in many countries: Central Europe, South America, Siam, Israel, and Canada. Architecture in Israel as in many other countries was becoming complacent and self-satisfied, a stylistic ritual that ignored climate and transplanted foreign values to the Middle Eastern soil. Neumann through his buildings showed a compassion for the indigenous environment and the depth and potential of his "morphological" architecture. More than any architect of his time, Neumann was aware of the impact of the realities of building and thinking three-dimensionally; his buildings are truly the sub-division of space. M. S.

The first post-war congress of CIAM (Congrès Internationaux d'Architecture Moderne) took place in Bridgwater, England in 1947. It was mainly concerned with reconstruction problems. Modern architecture had by that time become a respectable movement, and had spread from the continent to overseas countries. With the change of generation, England had accepted the doctrines of modern architecture and was putting them diligently into practice in her reconstruction work.
During the congress, I accompanied Le Corbusier on a visit to an industrialized building plant in Bristol, in fact, a recently converted airplane plant. The plant was producing fully equipped individual houses at the rate of a couple of houses a day. Corbusier followed with great interest the manufacturing process and admired the ingenuity of the details. But he did not spare his criticism for the environmental implication of the product. He was shocked by the prospect of having the landscape covered by a suburban sprawl. The one family house was still the accepted standard in England. There was a discrepancy between the layout of settlements and the changing technology in the production of houses. Architects had not yet learned to converge these two independant lines of architectural thinking.

In those days, Courbusier was preoccupied with his idea of the "unité d'habitation" which was being realized in Marseille. He advocated collective housing with industrialization of the building components but with a free composition of the whole. Corbusier was, and still is, criticized for his alleged lack of humanism. But it is often overlooked that Corbusier is being criticized for other peoples' realizations. He himself never really got an opportunity to show his concept in its totality. The plan of St-Dié, which was the most perfect presentation of his ideas, remained unrealized.

A building or a town is a structure, a system of systems. A structure is to a large extent independent of its constituting parts. Building industry deals before all with building components, not with the whole environment which is not the sum of its parts. Thus, building research has to become structural research.

At the graduate course of the School of Architecture at Laval University, we paid due attention to the ideas inherent in the various outlooks on structuralism. At the moment, this might seem highly abstract, but it is certainly directly connected to architectural practice in as far as industrialization of building is concerned. Even systems research seems too narrow to embrace the highly complex phenomena of architecture with its many implications on irrational human conduct. After a long round about way one arrives again at the priority of architecture as the most general structure.

As long as those basic relationships between part and whole are not sufficiently investigated, all attempts at coordination and standardization will be in vain. The priority of the architectural whole is the key to efficient industrialization, not the summation of parts which leads to the architecture of the absurd. At present the whole field shows an irrational development, rendered even more grotesque by the rationality of the details.

Industrialization is neither a panacea for all the woes of architecture nor a devilish instrument for the destruction of traditional values. Its only criterion is whether it adapts to creativity in the human environment. We have to get rid of many of the economic restrictions imposed upon the process of industrialization. The key projects of our period are simply meta-economical. Architecture will never be the outcome of the cheapest production method. Its economy is only seizable in human terms and in long range projection.

Industrialization has most developed where it is least needed–in administration buildings. Housing has remained nearly untouched by it. In developing countries only an insignificant portion of buildings will be constructed with industrially produced parts. The traditional building techniques are lost and a new non-architecture has appeared using the masses of waste material which accompany the handling of industrial products. Shanty towns, bidonvilles, are today the necessary complement of industrialization of building.

Industrial elements in architecture are not chosen for their rational values but for their emotional excitement qualities. They are usually combined with outright regression forms: picturesque stone walls with wide glass windows, fire-places with air-conditioned interiors. At present, industrialization means individualization of the product. The linearity of the assembly line cannot cope with the demands for human environment.

One of the problems industrial building production faces today is planning or no planning. There is obviously always a certain amount of planning involved. But the question is whether to proceed to overall planning of the whole production. The theoretical advantages are obvious: better coordination, less waste, etc . . . But, in practice, total planning has been braking progress and creating bureaucratic dullness. There are no more loopholes for creativity. This is too high a price to be paid. The ultimate criterion is whether the environment can be harmonized. Planning of industrial building parts is a means, not an end in itself. Building is not a rational process, although its structure is interwoven with rational elements. The super-imposition of an entirely rational structure, as it is done in planning, deforms the structural logic and produces those hybrid buildings which are a sign of housing bureaucracy all over the world. The computer, or any other brain prothesis in the hand of building bureaucracy, will only strengthen their position,

Systems Generating Systems

1 There are two ideas hidden in the word system: The idea of a system as a whole and the idea of a generating system.

Christopher Alexander

1 *There are two ideas hidden in the word system: The idea of a system as a whole and the idea of a generating system.*

The word system, like any technical word borrowed from common use, has many meanings and is imprecise. This lack of precision in a technical word might seem dangerous at first; in fact it is often helpful. It allows new ideas to flourish while still vague, it allows connections between these ideas to be explored, and it allows the ideas to be extended, instead of having them cut short by premature definition and precision.

The word "system" is just such a word. It still has many meanings hidden in it. Among these meanings there are two central ones; the idea of *a system as a whole,* and the idea of a *generating system.*

These two views, though superficially similar, are logically quite different. In the first case the word "system" refers to a particular holistic view of a single thing. In the second case, the word "system" does not refer to a single thing at all, but to a kit of parts and combinatory rules capable of generating many things.

2 *A system as a whole is not an object but a way of looking at an object. It focusses on some holistic phenomenon which can only be understood as a product of interaction among parts.*

Let us consider some examples of holistic phenomena which need to be viewed as systems.

The great depression is an obvious example of a holistic phenomenon. We cannot understand the depression, except as a result of interaction among rates of consumption, capital investment and savings: the interactions can be specified in the form of equations: if we follow these equations through to their conclusion, we see that under certain conditions they must always lead to a depression.

The stability of a candle flame is another example of a holistic phenomenon. Why does it maintain approximately the same size and shape throughout its flickering? In this case, the "parts" are flows of vaporized wax, oxygen, and burnt gases – the processes of combustion and diffusion give the interaction between these flows – and these interactions show us at what size and shape the flame will be approximately stable.

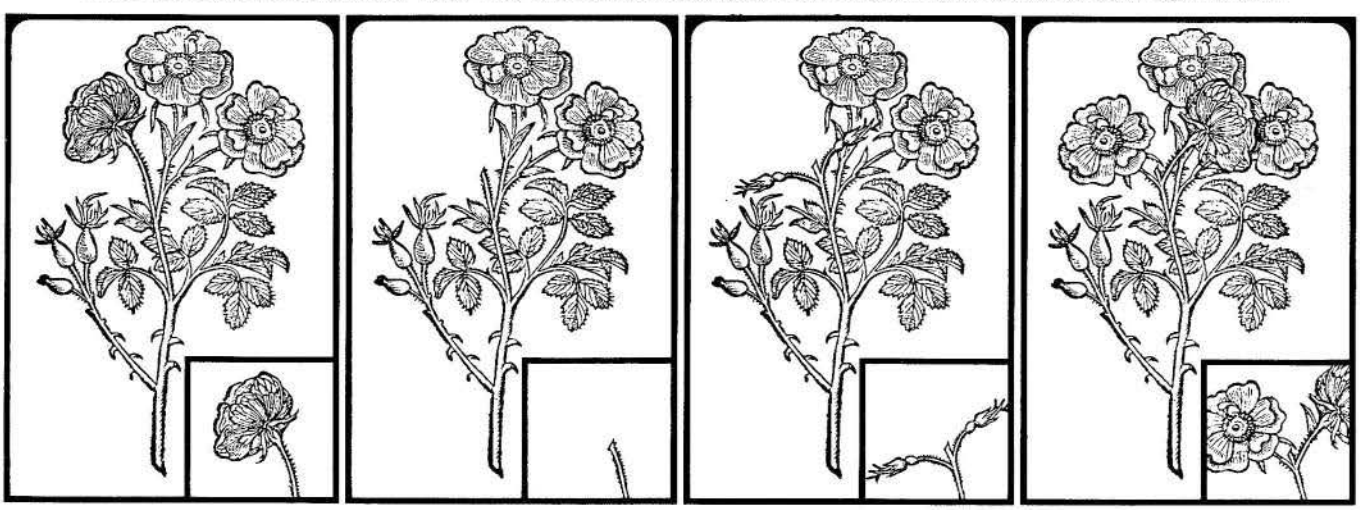
The strength of a rope is another example of a holistic property. This strength is a result of interaction among the individual strands, caused by the twisting of the rope: untwisted, the rope's strength is governed by the weakest strand: twisted, the strands act together and increase their strength.

Another example of a holistic property, is the relation between input and output in any computer. In the toy computer called Thinkadot, a ball dropped into one of three holes, comes out on one of two sides. The output side is not determined by the input hole, but by the input hole and the internal state of the machine, which is itself determined by the sequence of past inputs. In order to understand this behaviour, we must understand the machine as a whole, considering the past inputs and the internal states, as parts, and the way that different sequences of inputs and internal states create specific new internal states and outputs as interactions.

Another kind of holistic behaviour is that instability which occurs in objects that are very vulnerable to a change in one part: when one part changes, the other parts change also. We see this in the case of erosion: cutting down trees robs the soil of the roots which hold it together, so that wind and water can strip the soil of all remaining plants, and make a desert. We see it again in the death of the traditional farm: when the combine harvester replaced traditional harvesting, the entire balance of scale economies was destroyed, the little farms collapsed, and gave way to giant farms.

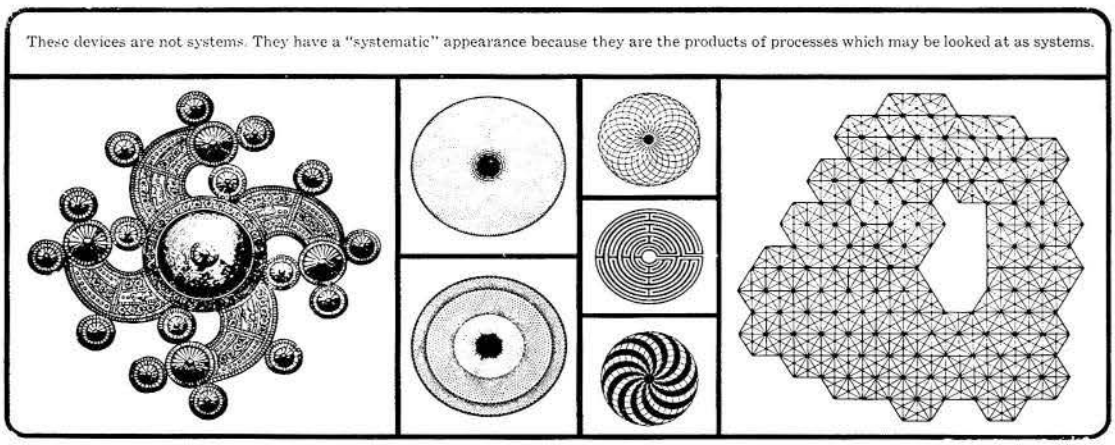
Let us summarize the content of these examples. In every case we are confronted

Some self-regulating systems, when they lose components, grow new components to maintain their equilibrium.



(a self-regulating system is a self-regulating system is a self-regulating system)

2 A system as a whole is not an object but a way of looking at an object. It focusses on some holistic property which can only be understood as a product of interaction among parts.



with an object which displays some kind of behaviour which can only be understood as a product of interaction among parts within the object. We call this kind of behaviour, holistic behaviour.

The central point of the whole argument can be stated very simply. *The most important properties which anything can have are those properties that deal with its stability.* It is stability which gives a thing its essential character. The strength of an arch, the even burning of a flame, the growth of an animal, the balance of a forest ecology, the steady flow of a river, the economic security of a nation, the sanity of a human individual, the health of a society: these are all, in one way or another, concerned with stability.

Stability, no matter in which of its many forms, is a holistic property. It can only be understood as a product of interaction among parts. The essential character of anything whatever, since it must at heart be based on some kind of stability, must be understood as a product of interactions within the whole. When we view a thing in such a way as to reveal its character in holistic terms, we speak of it as a system. In order to speak of something as a system, we must be able to state clearly: 1. The holistic behaviour which we are focussing on. 2. The parts within the thing, and the interactions among these parts, which cause the holistic behaviour we have defined. 3. The way in which this interaction, among these parts, causes the holistic behaviour defined.

If we can do these three, it means we have an abstract working model of the holistic behaviour in the thing. In this case, we may properly call the thing a system. If we cannot do these three, we have no model, and it is meaningless to call the thing a system. The idea of a system is synonymous with the idea of an abstract model of some specific holistic behaviour. We may speak of the economic system in a country, because we can construct a system of equations which reproduce important holistic phenomena like depressions or inflation. If we couldn't do this, it would be meaningless to speak of economic systems.

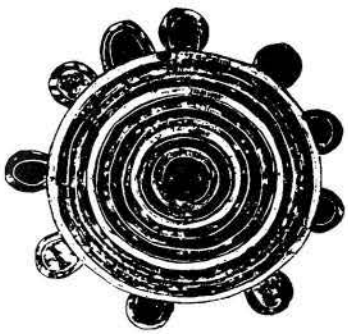
We must not use the word system, then, to refer to an object. A system is an abstraction. It is not a special kind of thing, but a special way of looking at a thing. It is a way of focussing attention on some particular holistic behaviour in a thing, which can only be understood as a product of interaction among the parts. Everything under the sun may be viewed as a system: a man smoking a cigarette may be viewed as a system; so may a leaf drifting in the wind; so may a brick; so may mankind on earth. But it only becomes a system if we abstract from it some special holistic property, which we cannot explain except in terms of interactions within the whole. Without a specific statement of what holistic behaviour we have in mind, what interactions among what parts cause this behaviour, and how they do so, calling a thing a system is no more than saying: "This is a pretty complicated thing, and I don't understand it very well."

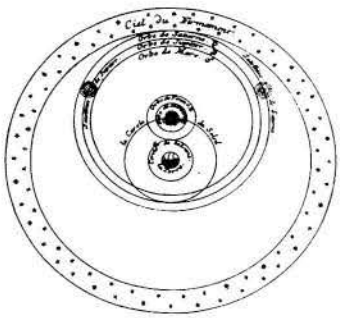
The idea that a system is an abstraction, needs emphasis. Think of a flower as a system. If we want to understand the fact that the flower buds, and swells, and blooms – that we must certainly do by looking at the flower as a system. In this case it is the interaction among the parts, which creates the behaviour of the whole. But the same flower, has other properties which are not helped at all by thinking of the flower as a system: If it is used as a projectile, then its trajectory cannot be explained as a result of interactions among its parts: and if it is given as a gift, there is nothing that the flower does, no matter how complex the situation, that needs to be understood as a result of interactions among the flower's parts. The idea of a system is helpful only in understanding kinds of behaviour which result from interactions among parts.

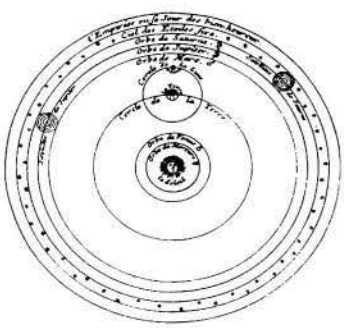
Furthermore, even though we call a thing a system when we try to view it as a whole, this does not mean that we ever really view the thing in its entirety.

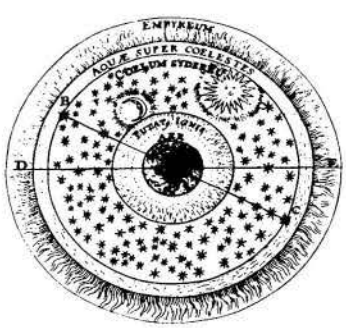
When we look at an airline from a systems point of view, we may focus on its scheduling – and we shall learn that because the airline only has a limited number of aircraft, the schedule of a flight from New York to Chicago turns out to be dependent on the schedule of another flight from Minneapolis to Salt Lake City. In this instance, we are looking at the airline "as a whole," because we are looking at the interactions among parts, but we are not concerned with the last button on the last mechanic's cap. The notion of "whole"

The ways in which man has viewed the solar system have resulted in many ideas about its structure. A single set of objects may be thought of as a system in a number of different ways.









3 A generating system is not a view of a single thing. It is a kit of parts, with rules about the way these parts may be combined.

refers only to the breadth of vision, not to the inclusion of detail: it is still abstract.

Most often common language obscures this very badly. When we speak of the solar system, or a hi-fi system, or an airline system, or of a plumbing system, the words are used in such a way as to suggest that the "system" is synonymous with the objects. But just occasionally the word is used correctly, even in common language. For instance, when we speak of the Ptolemaic system as opposed to the Copernican system, in each of these cases the word "system" is used correctly: it refers to an abstract way of looking at the interaction among earth, planets, sun and stars – not to the objects themselves.

The discipline of abstraction has one drawback. Occasionally we are confronted with phenomena which are clearly the products of interactions – but the interactions are so complex that we cannot see them clearly, and we cannot make the effort of abstraction successfully. Take for instance, the baffling complexity of a seagull landing, or of an ecstatic, screaming, laughing girl. In these cases a too rigid insistence on the idea that a system is an abstract model, might easily lead us to abstract out some facile inessential system – at the cost of the wonder which is really there.

This is exactly what happens when a systems analyst looks at a building – manages to describe the circulation, the acoustics, the heating and the load bearing structure as systems – and fails to identify the most interesting human and social systems, because he can't describe them in explicit terms.

Thus there is a second lesson to be learned. The first lesson said: Don't call a thing a system unless you can identify the abstract system you are talking about. The second lesson says: learn the first lesson, but don't let it railroad you into making facile abstractions.

When we are confronted with a complex thing, we often begin with nothing more than a feeling or a "sense" that it functions as a system. Driven by this feeling, we then try, painstakingly, to abstract out just that holistic behaviour which seems essential, and those interactions which cause the behaviour. This is an active process. It begins with feeling, and sensing, and only turns to thinking later. Start with some aspect of life so interwoven that you feel in your bones it must be a system, only you can't state it yet – and *then,* once you can feel it clearly, then try to pin the system down, by defining the holistic behaviour you are discussing, and which interactions among which parts create it. But feel it clearly first, before you try to think it.

The Systems Point of View Will Change Your Whole View of the World

The systems point of view is not neutral. It will change your whole view of the world. It will lead you to realize that the most important characteristics of human individuals are products of their interactions with other people. It will lead you to realize that the life of nations – though these nations may seem self-sufficient – is produced by interactions in the whole world, and that they only get their strength from their position in this larger whole. It will lead you to see that the health of cities, is produced by interactions among interdependent parts, including houses, cafes, and theaters, yes, but also equally including slums and graveyards.

The system viewpoint is a modern, disciplined version of the sense of wonder. It is that view of things which man takes when he becomes aware of oneness and wholeness in the world.

3. A generating system is not a view of a single thing. It is a kit of parts, with rules about the way these parts may be combined.

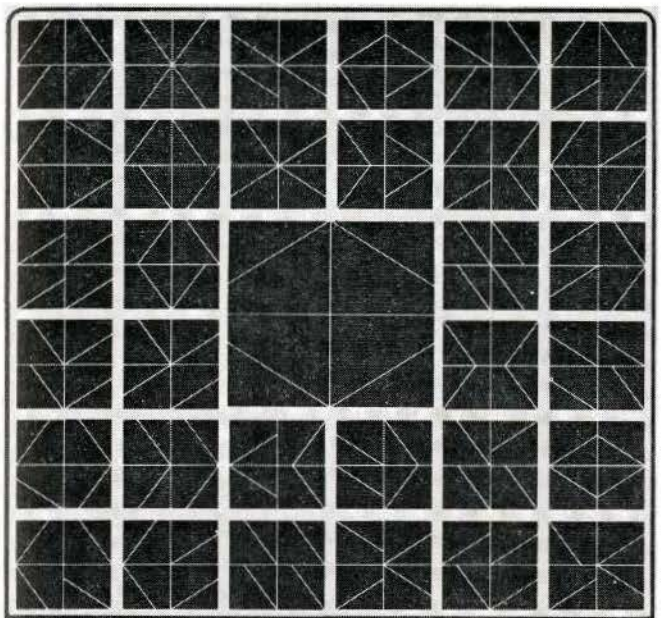
This is a different use of the word system from the first one. In colloquial English we often use the word system to mean "a way to do something": that's what a betting system is; that's what the Montessori system is; that's what the democratic system is. Each of these systems is, at heart, a system of rules. A betting system tells you how to place your bets, the Montessori system lays down rules to be followed by children and teachers in nursery school, the democratic system of government lays down certain rules about the nature of representation, the choice of representatives, and the conduct of elections. In all these cases, the rules are designed to generate things. A betting system supposedly generates winning bets, an educational system generates well educated pupils, the democratic system supposedly generates freedom and good government.

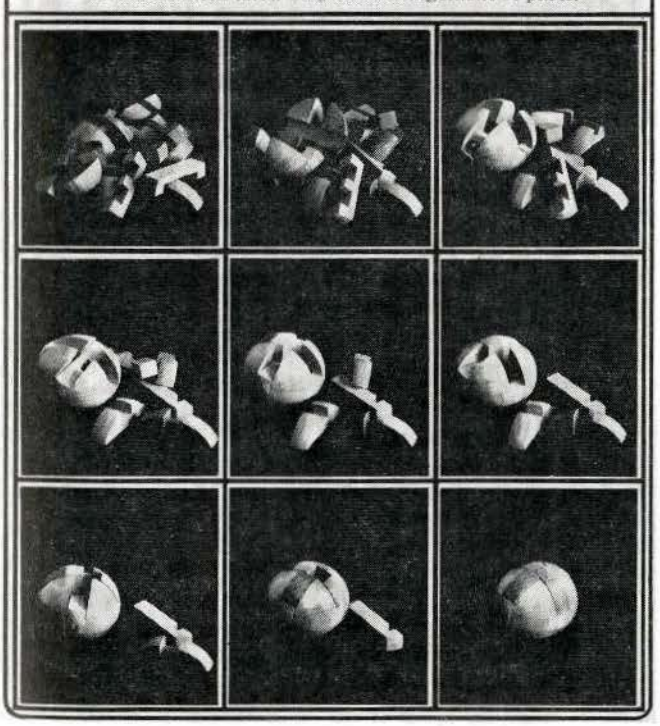
We may generalize the notion of a generative system. Such a system will usually consist of a kit of parts (or elements) together with rules for combining them to form allowable "things." The formal systems of mathematics are systems in this sense. The parts are numbers, variables, and signs like $+$ and $=$. The rules specify ways of combining these parts to form expressions, ways of forming expressions from other expressions, ways of forming true sentences from expressions, and ways of forming true sentences from other true sentences. The combinations of parts, generated by such a system, are the true sentences, hence theorems, of mathematics. Any combination of parts which is not formed according to the rules is either meaningless or false.

A generating system, in this sense, may have a very simple kit of parts, and very simple rules. Thus the system of triangles which may be put together to form a square, is a generating system. Its rules generate all the ways of putting these triangles together to form a square. It is typical of a system that the rules rule out many combinations of the parts. Thus these triangles could be put together in an infinite variety of ways – but most of these ways are ruled out, because the outside perimeter is not a square, and this thing is not connected.

Another example of a generating system, is the system of language. Here we have rules at several different levels. At one level, the letters are the parts, and there are rules which govern the way that letters may be put together to form words. In English there could be no word beginning with Rx. The rules of phonology prohibit it. At another level, the words are themselves parts, and there are rules which govern the kinds of sentences which may be made from words.

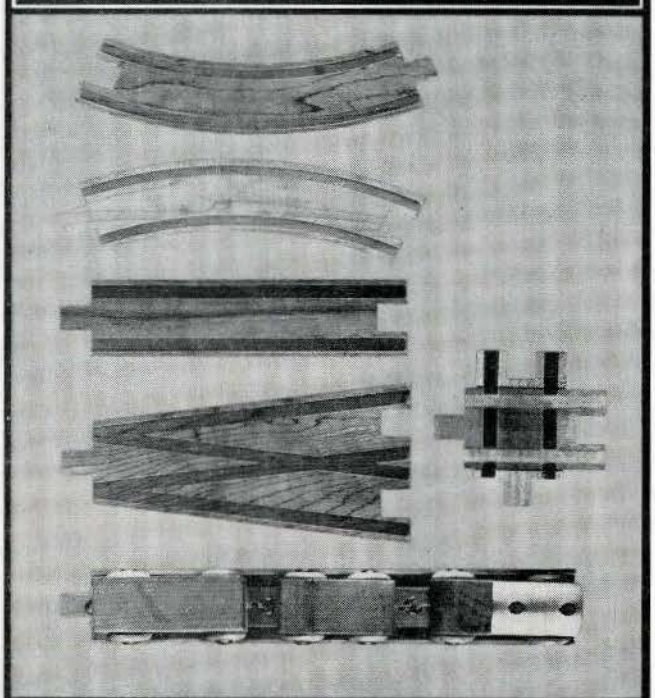
Perhaps the most interesting and important generating system in the world, is the genetic system. Every animal in the animal

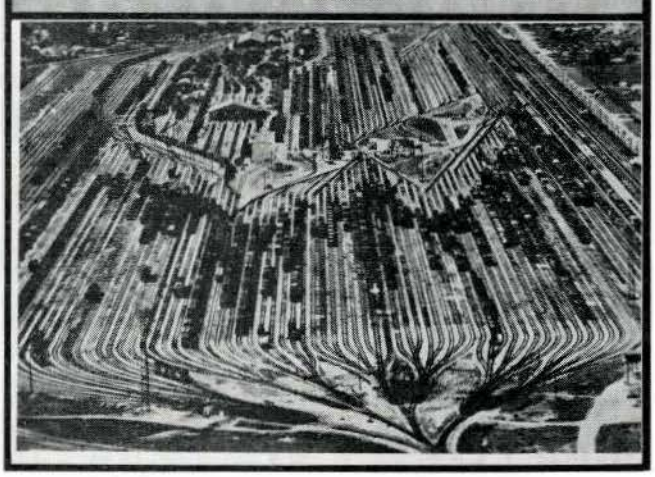




Two Kits of Parts. (above) The rules of combination allow many arrangements of parts. (below) The rules of combination allow only one arrangement of parts.

A railroad switch-yard is (1) generated by a kit of parts which must be assembled according to a set of rules and (2) works as a system designed to make up and break down trains.





4 Almost every "system as a whole" is generated by a generating system. If we wish to make things function as "wholes" we shall have to invent generating systems to create them.

kingdom is generated by a set of chromosomes specific to that animal. Each chromosome in turn is generated by four bases (like a necklace which uses only four kinds of bead). The four bases form a kit of parts which generates the chromosome. These chromosomes themselves provide the rules for building amino acids (another kit of parts), proteins from amino acids (another kit of parts), cells from proteins (another kit of parts) and then builds the animal from cells. The kit of parts formed by the four bases, and the rules of combination, indirectly generates every animal there is. A building system is a generating system in this sense. It provides a kit of parts – columns, beams, panels, windows, doors – which must be put together according to certain rules.

4. *Almost every "system as a whole" is generated by a generating system. If we wish to make things which function as "wholes" we shall have to invent generating systems to create them.*

There is a relationship between the two ideas of system which have been defined. Almost every object with behaviour that depends on some "system as a whole" within the object, is itself created by a generating system.

Take an obvious and simple case: a hi-fi system. Its purity of performance can only be understood as a product of the combined effect of all the various components, working as a whole. The same hi-fi system is also generated by a generating system: the kit of all the parts on the market, and the rules governing the electrical connections and impedance matching between these parts.

To take a more complicated case: the railroad switch-yard. It plainly functions as a whole. In order to understand it as a device for breaking up and making trains, we must focus on the sequence of switches, and on the fact that the length of track in front of the switches depends on the length of track behind the switches and on the length of trains. At the same time, the switch-yard is also plainly generated by a generating system. The pieces of track, switches, couplings, cars, together with the rules for putting them together, form a kit of parts which generates properly functioning switchyards.

The most complicated case of all, and the clearest, is that of an animal. A landing seagull certainly needs to be seen as a system: so does almost everything else that seagulls do. At the same time, this seagull is created by a generating system: the genetic system. An animal is *both* something which needs to be seen holistically, and generated by a generating system.

The relationship between holistic systems and generating systems is easy to understand. If an object has some holistic property caused by interaction among parts – then it is clear that these particular parts and these particular interactions, will only come into being if the parts have very constrained relationships to one another. The object then, must be generated by some process which assembles parts according to certain constraints, chosen to ensure the proper interaction of these parts, when the system operates. This is exactly what a generating system is.

The generating system need not be conscious (as in the case of the switch-yard), nor even always explicit (as in the genetic case). Sometimes the processes which make up the generating system are integral with the object being formed – thus the candle flame is generated by chemical processes which are the same as those processes which then maintain the system's equilibrium and make up the interacting parts, when we view the flame as a holistic system.

A Lesson for Designers

It is true then, that almost every "system as a whole" is generated by a generating system. This axiom contains a remarkable lesson for designers. Man as a designer is concerned with the design and construction of objects which function as wholes. Most of the important properties a city needs to support life, for instance, are holistic properties.

Our axiom means this: To ensure the holistic system properties of buildings and cities, we must invent generating systems, whose parts and rules will create the necessary holistic system properties of their own accord.

This is a radical step in the conception of design. Most designers today think of themselves as the designers of objects. If we follow the argument presented here, we reach a very different conclusion. To make objects with complex holistic properties, it is necessary to invent generating systems which will generate objects with the required holistic properties. The designer becomes a designer of generating systems – each capable of generating many objects – rather than a designer of individual objects.

A final word of caution. As we have already seen, a building system is an example of a generating system. It is a kit of parts with rules of combination. But not every generating system necessarily creates objects with valuable holistic properties. The generating system which makes squares out of triangles is an example. It is a perfectly good generating system; yet the objects it produces do nothing: they have no holistic system properties whetever. In the same sense, those building systems which have so far been conceived, make buildings, but they do not make buildings with any really important holistic system properties. In a properly functioning building, the building and the people in it, together form a whole: a social, human whole. The building systems which have so far been created do not in this sense generate wholes at all. While it is inherent in the generating system of an animal that the finished animal will work as a whole, it is *not* inherent in any of today's building systems that the buildings they produce will work as social or human wholes. Creating building systems in the present sense is not enough. We need a new, more subtle kind of building system, which doesn't merely generate buildings, but generates buildings guaranteed to function as holistic systems in the social, human sense.

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Urban Space Systems as Living Form, Part I

Organic Principles for Man-Made Geometries-Asymmetry/Proportion/ Hierarchies

Anne Griswold Tyng

A condensed version of Anne Tyng's theory of form "Symmetric Form and Asymmetric Process" is being published by Macmillan in "Synergetics" a book on Buckminster Fuller and "neighbouring disclosures of contemporary colleagues"

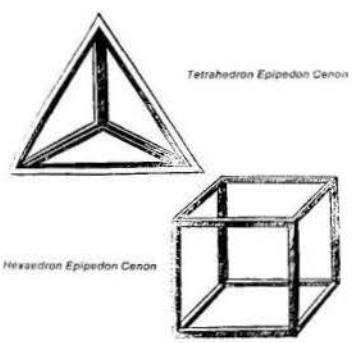
At this moment in evolution, living man knows that he has evolved from forms that are *not* "living", and he has within his reach the possibility of giving life to inanimate forms. He can give life to forms which through his own creativity are extensions of himself – at the scale of electron-microscopic D N A, the synthesis of the molecule of genetic replication, and at the scale of urban structure, the synthesis of forms which include the vitality and equilibrium of man's highest civilized institutions and the genetic processes of collective life.

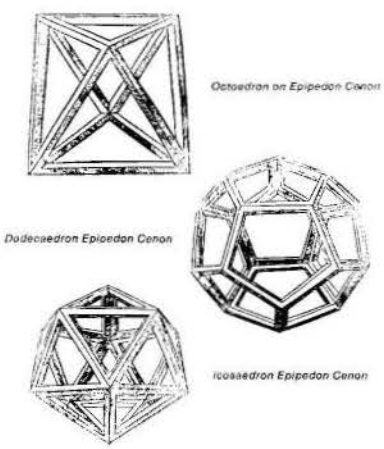
Just as the house that man builds as "static" form must enclose and meaningfully integrate the "kinetic" patterns of human activity and relationship, so, at the threshold of another hierarchy of form, man's conscious and creative manipulation of urban structure can include and synthesize the dynamic tensions and complex interlacing of speed and scale, change and growth which are the collective life of the city.

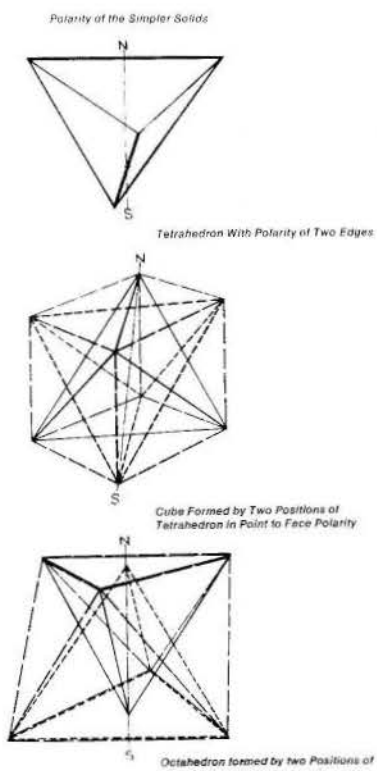
Proposed urban space systems need the dynamic flexibility and variety which can be derived from organic forms through their fundamental principles of asymmetry, proportional principles of scale both for internal and external growth, and hierarchical levels of form organization which can include complexity within simplicity (or simplicity within complexity) and "kinetic" forms within "static" forms (or "static" forms within "kinetic" forms.) Within what appears as complex categories of form there exists a unity of principle, so that, in addition to our understanding of the geometries of forms in all their differentiation, we need to find the principles of synthesis which can integrate the dynamic forces of movement with the energies of change and growth into an overall functioning unity of balanced tensions – "kinetic" forms interlaced and included in a higher order of form which is "static". The prevailing theme of this "static" order is equilibrium – a momentary balancing of forces in the historic evolution of the density configuration of cities.

"Kinetic" systems may be defined as those more dynamic forms expressing the city's movement systems, while "static" systems might be defined as more "balanced" forms which can include "kinetic" systems within their order. At a smaller scale within a "kinetic" system may also exist a "static" system which, as individual buildings or building units, may generally be thought of as being in the realm of architecture. However, it is quite apparent that it is a matter primarily of scale and that the total problem of urban design is very much the province of the architect. It is a *form-making* and *form-synthesis* problem in which the whole range of statistics – social, legal, political, financial, structural and environmental – are the ingredients, but the architect is the artist-engineer form-giver through his understanding of *space* in all its dimensions, his sensitivity to *scale* in asymmetric links of proportion and his ability to *synthesize* complexities within unity through hierarchies of form integration.

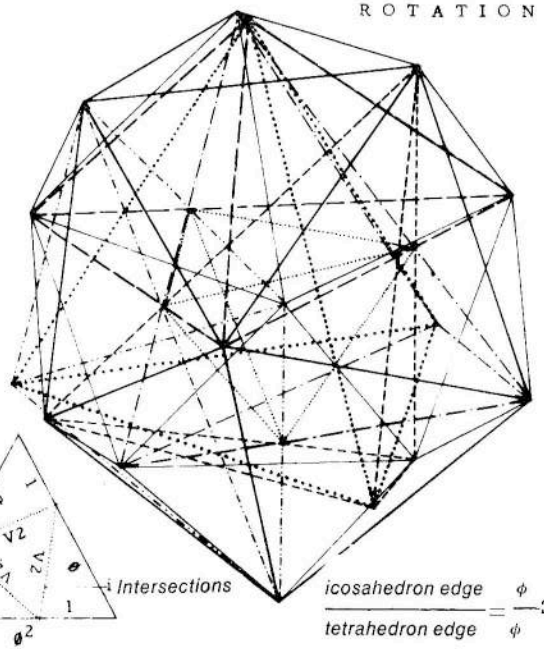
Understanding the potentialities of a number and variety of space systems is only a small part of the problem and the superimposition







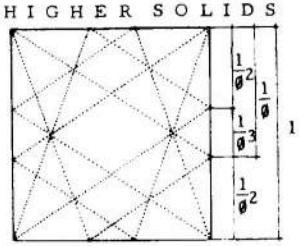
ROTATION IN THE HIGHER SOLIDS



$$\frac{\text{icosahedron edge}}{\text{tetrahedron edge}} = \frac{\phi}{\phi^{-2}}$$

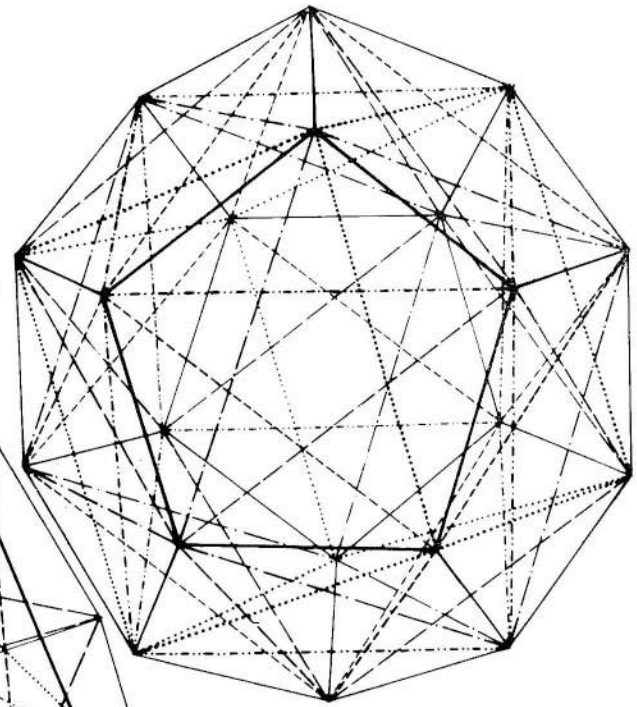
$$\frac{\text{inner tetra edge}}{\text{outer tetra edge}} = \frac{V2}{2V2}$$

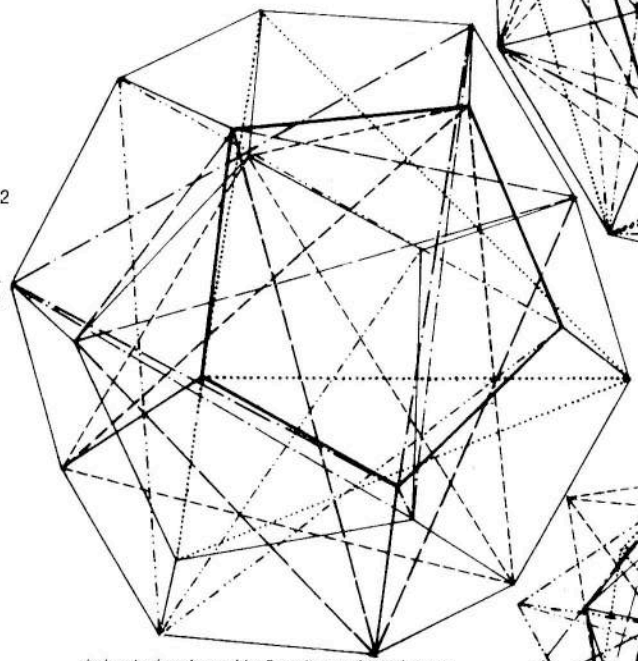
Icosahedron formed by 4 positions of tetrahedron in rotation-base planes of 4 tetrahedrons intersect in the same way as the 4 triangles below, with edges divided in the Divine Proportion. 'vestigial' polarity is found in the intersections forming a small inter tetrahedron and in the extremities forming a large outer tetrahedron, each with point to face polarity with the other.



Dodecahedron formed by 5 positions of cube in rotation-intersections divide all cube edges in Divine Proportion —

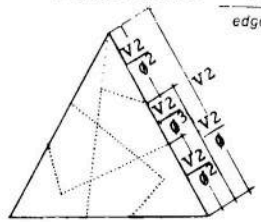
$$\frac{\text{edge of cube}}{\text{edge of dodecahedron}} = \frac{1}{1/\phi}$$

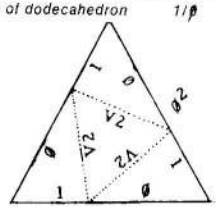


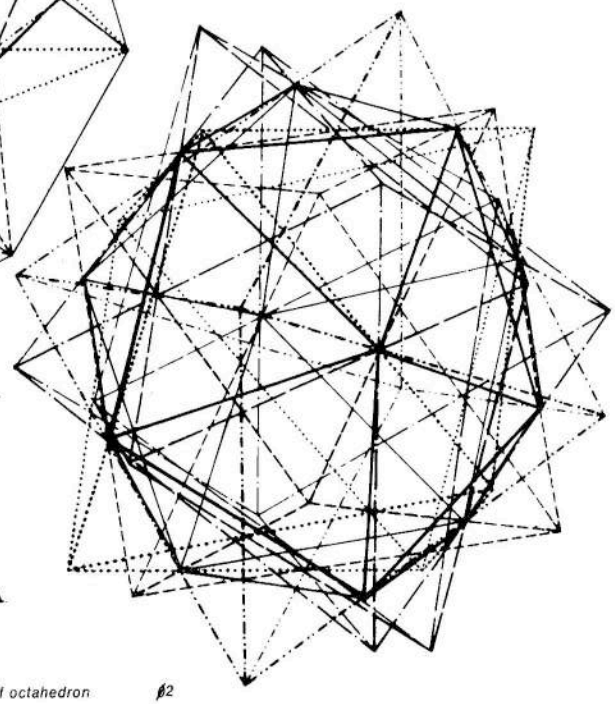


dodecahedron formed by 5 positions of tetrahedron in rotation-intersections divide all tetrahedron edges in Divine Proportion —

$$\frac{\text{edge of tetranedron}}{\text{edge of dodecahedron}} = \frac{V2}{1/\phi}$$

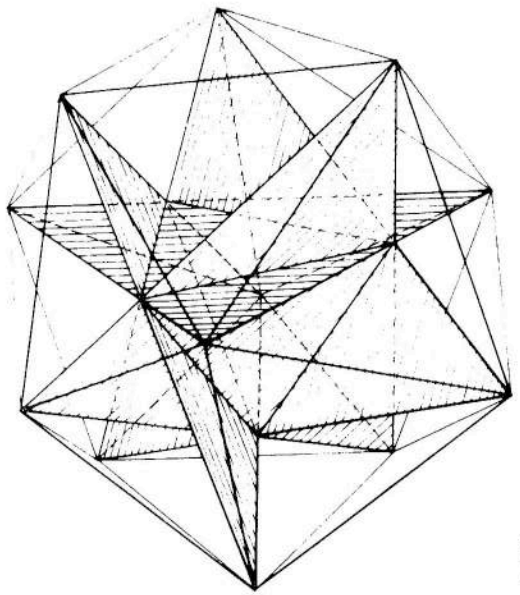






Icosahedron formed by 5 positions of octahedron in rotation-icosahedron vertices occur at Divine Proportion intersections of octahedron edges-octahedron vertices form icosidodecahedron—

$$\frac{\text{edge of octahedron}}{\text{edge of icosahedron}} = \frac{\phi 2}{V2}$$



Icosahedron formed by 4 positions of equil: triangle in rotation-icosahedron also formed by 3 Golden Rectangles.

1 Buckminster Fuller had lectured on and illustrated relationships of close-packed spheres as proposals of atomic configurations in 1949, printed as 'Item O' prepared by N. Carolina State Sch. of Design students in 1955. Linus Pauling's 'Close-Packed-Spheron Theory' of the nucleus of the atom appeared in *Science* October 1965.

of such systems by themselves is too limiting and rigid. But the simultaneous existence and meaningful integration of many such systems in a hierarchical organization can provide both the equilibrium and the internal vitality which are the unique qualities of living forms.

In 450 B.C., in his search for internal order, Empedocles proposed as the building blocks of everything fire, air, earth and water. On mathematical grounds Plato, in his *Timaeus,* determined the "exact" forms of the smallest parts of these elements as the five shapes we now call the Platonic Solids; fire the tetrahedron, earth the cube, air the octahedron, water the icosahedron and as the symbol of the cosmos, the dodecahedron. This intuitive concept is given a measure of validity today when we know that the relationships of form expressed in these five Platonic Solids are involved in the way in which "fundamental" particles – protons and neutrons – are built up into atoms of about a hundred different elements (according to Pauling's Close-Packed-Spheron Theory and Fuller's proposals of atomic close-packing[1]) and are involved in the way in which different arrangements of these atoms form the building blocks of a million or so different forms of matter, both natural and synthetic.

Asymmetry

In studying the five Platonic Solids and the relations between them, I have established a geometric progression from *simplicity to complexity of symmetric forms linked by asymmetric process.* Each of the four stages in this cycle represent configurations of minimum energy in self-balancing three dimensional systems which I call *symmetric form* and the transformations occurring between these four stages I call *asymmetric process.*

The four stages of symmetric form in this progression I call *bilateral, rotational, helical* and *spiral,* with each stage seen as *the motion of simpler forms defining the outline of more complex shapes.* The polarity of a tetrahedron can be expressed in the polarization of two of its four edges (as Fuller has suggested). One tetrahedron in two positions, which have a point to face *polarity,* can establish the corners of a cube. Two other positions of a tetrahedron, also in *polarity,* define the corners of an octahedron. These three simpler Platonic Solids – the tetrahedron; cube and octahedron, represent the *bilateral* forms of the geometric progression.

The cube in five positions – in rotation – defines the twenty corners of the dodecahedron and five positions of the octahedron – again in *rotation* – establish the twelve corners of the icosahedron. The tetrahedron in four positions with *rotational* ordering also defines the twelve corners of the icosahedron, and in addition, one corner of each of the four positions extend beyond the icosahedron to form the corners of a larger tetrahedron – disclosing a "vestigal" polarity in this arrangement. These more complex of the Platonic Solids – the dodecahedron and icosahedron – represent the stage of *rotational* forms in the geometric progression, and in the way they are formed express Divine Proportion ratios (1:1.618) in their relations to the simpler solids. In these figures which generate the dodecahedron and icosahedron all the edges are divided by other edges in the Divine Proportion.

The "fourth dimensional" extension of these *rotational* forms along an axis perpendicular to the radius of rotation, expressing again the tension of *polarity,* define the *helical* forms of the progression. Since both of the *rotational* forms have pentagonal symmetry, the plan of their *helical* extensions is based on the decagon with its side in Divine Proportion to its "radius". The vertical extension of each turn is in Divine Proportion to the side of the decagon making a Divine Proportion progression – vertical turn $= \phi$, horizontal turn $= \phi^2$, and radius $= \phi^3$.

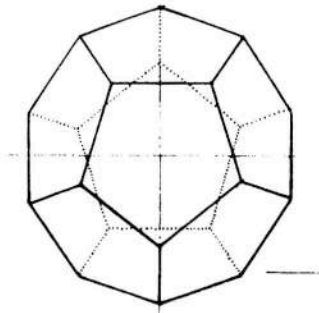
A proportional increase in the radius of rotation of the *helical* forms, expressing *rotational* tension, results in *spiral* forms, the fourth stage in the cycle. Again the only ratio which satisfies the condition of a logarithmic spiral in which width of turns increase at a fixed ratio to length is the Divine Proportion. These geometric examples of polarity and rotation in *bilateral, rotational, helical* and *spiral* form, provide us with precise examples in the formative process from simplicity to complexity. We can also see the gradual intensification of structure which leads from the rigid incompressibility of the tetrahedron of *bilateral* form to dynamic *rotation,* to flexible flow of *helix* and to coiled resiliency of the *spiral.* As I shall indicate, this transformation from the "static" cube to the "kinetic" spiral has a parallel in the development of complexity and movement of forms in urban structure.

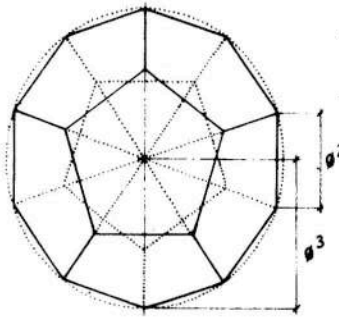
From this fundamental concept of *symmetric form and asymmetric process,* I have found that only *4 edge dimensions,* or triangulating factors, are needed to form *3 symmetric triangles* and their *3 asymmetric gnomons* or "growth" triangles. These 6 triangles can form the five Platonic Solids and the asymmetric relations between them. They are: *the equilateral triangle and its gnomon* with two of its edges in the Divine Proportion and the other equal to the diagonal of the half-square triangle; *the half-square triangle and its gnomon* – the triangle which is half the Golden Rectangle divided diagonally – with two sides in the Divine Proportion and its diagonal equal to the side of the pentagon; and *the fifth-pentagon triangle and its gnomon* – the tenth-of-a-decagon triangle – both of which have sides expressing a dialogue of Divine Proportion relationships.
Thus these three triangles are the *static* or *symmetric forms,* each with its own "growth" form, its *gnomon* or link in the *asymmetric process,* that triangle which can be used to make larger or smaller sizes of the three symmetric triangles and also function as a link between the three families of form – *the square, the pentagon* and *the equilateral triangle.* The great variety of three dimensional combinations of the three families of form, the ease of transition in vast ranges of scale and the potential for the development of complexity of forms within simplicity (or of simplicity within complexity) are all available to the maker of forms in the simple "alphabet" of *3 basic triangles* and *their 3 gnomons.* Flexibility as a creative tool, ease of transmission of three dimensional symbols to the builder and dimensional clarity available for engineering computations, prefabricating techniques and computer data are inherent in this fundamental concept of *symmetric form* and *asymmetric process.*
To be continued in the December issue.

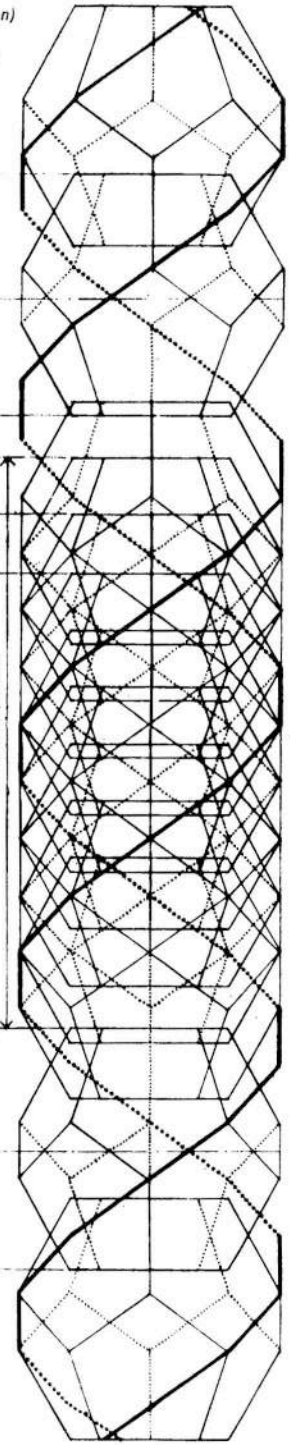
Helical Extension of Rotation

Helical extension of dodecahedron (or icosahedron) along the axis perpendicular to axis of rotation can define double helix similar to the structure of D N A molecule

plan below of even numbered turns

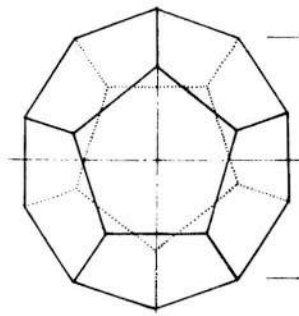






Rotating dodecahedron forms decagon with 10 turns/circumference - in each turn a Divine Proportion progression-vertical increment of turn ϕ
horizontal increment of turn ϕ2
radius of turn ϕ3

plan below of odd numbered turns



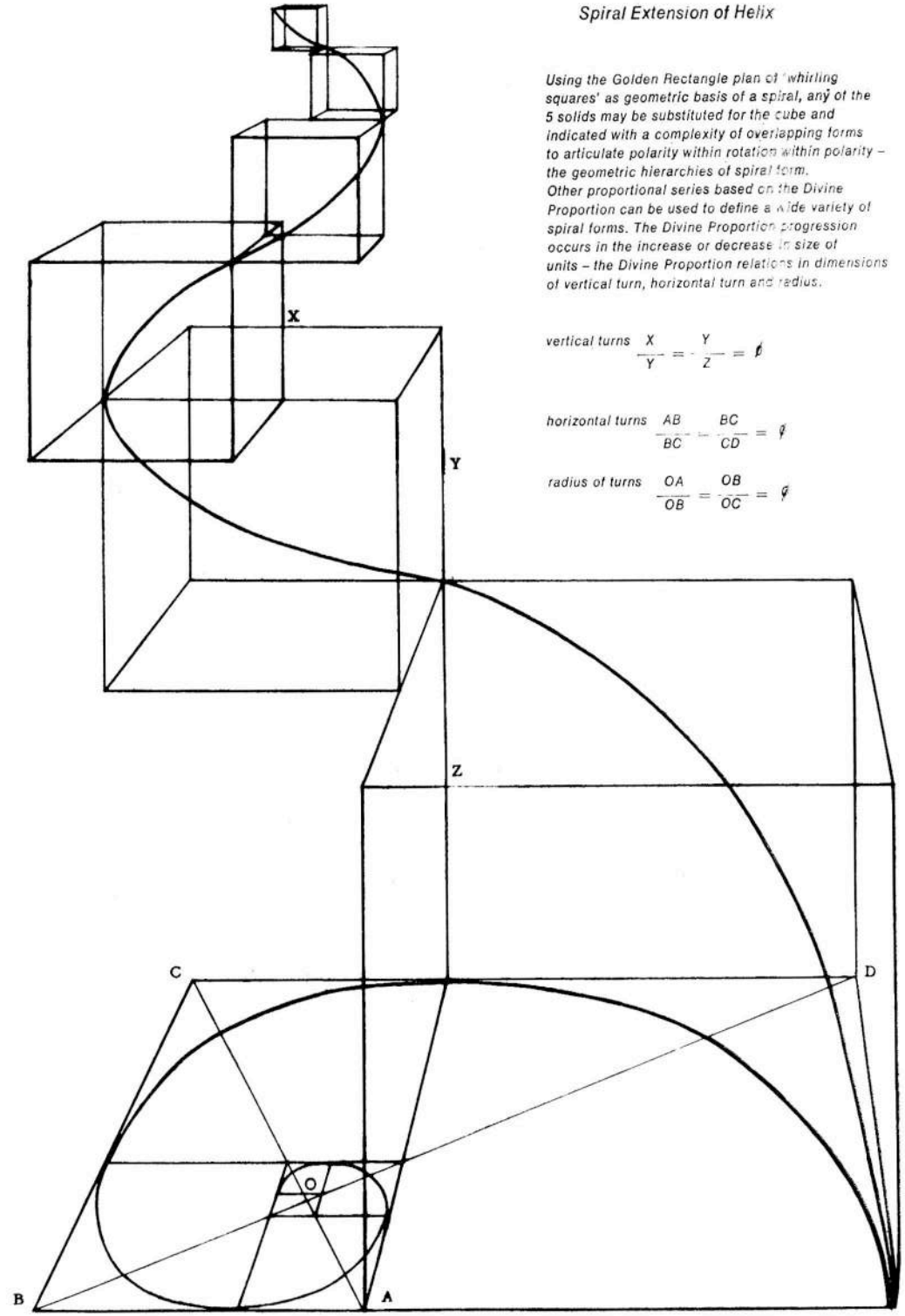
Spiral Extension of Helix

Using the Golden Rectangle plan of 'whirling squares' as geometric basis of a spiral, any of the 5 solids may be substituted for the cube and indicated with a complexity of overlapping forms to articulate polarity within rotation within polarity – the geometric hierarchies of spiral form.
Other proportional series based on the Divine Proportion can be used to define a wide variety of spiral forms. The Divine Proportion progression occurs in the increase or decrease in size of units – the Divine Proportion relations in dimensions of vertical turn, horizontal turn and radius.

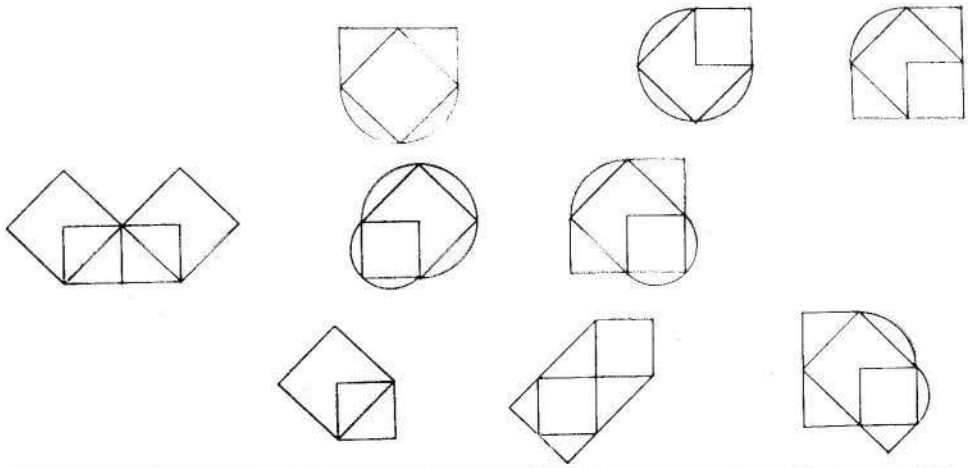
vertical turns $\frac{X}{Y} = \frac{Y}{Z} = \phi$

horizontal turns $\frac{AB}{BC} = \frac{BC}{CD} = \phi$

radius of turns $\frac{OA}{OB} = \frac{OB}{OC} = \phi$



Variety Within Repetition

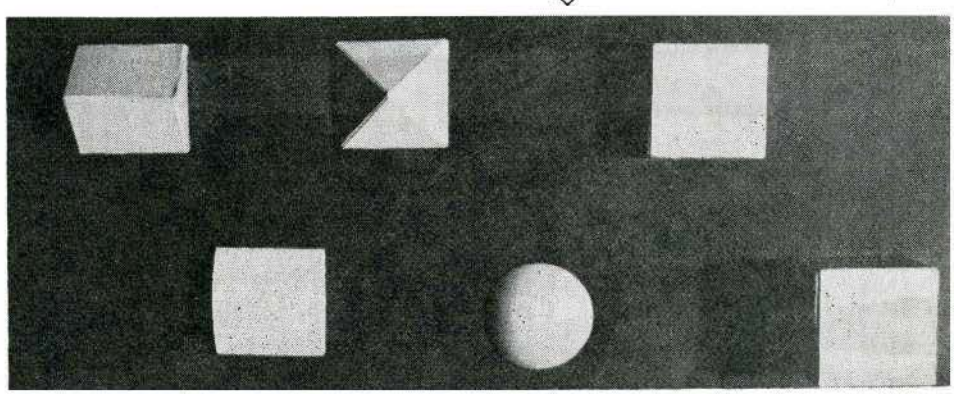


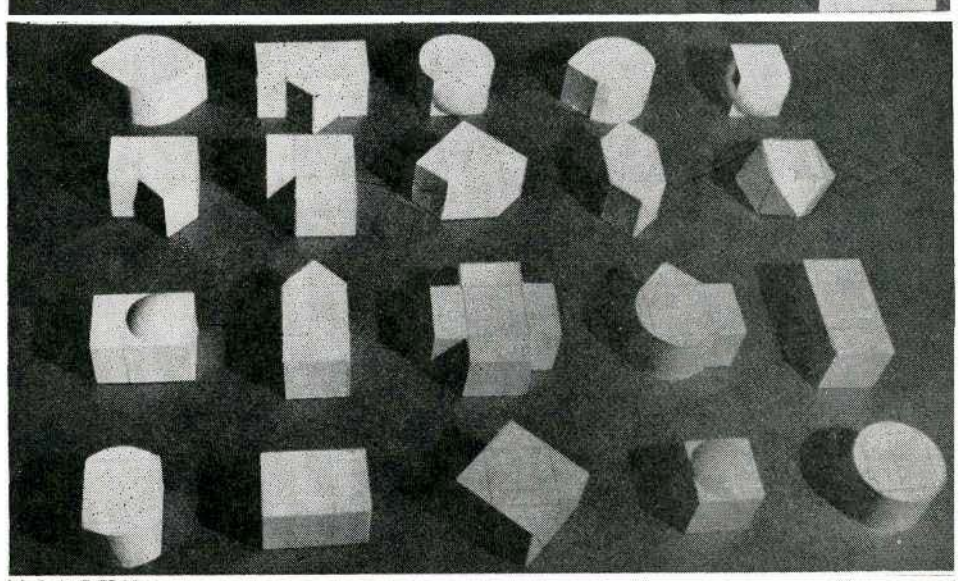
Individual Identification within Repetitive Systems

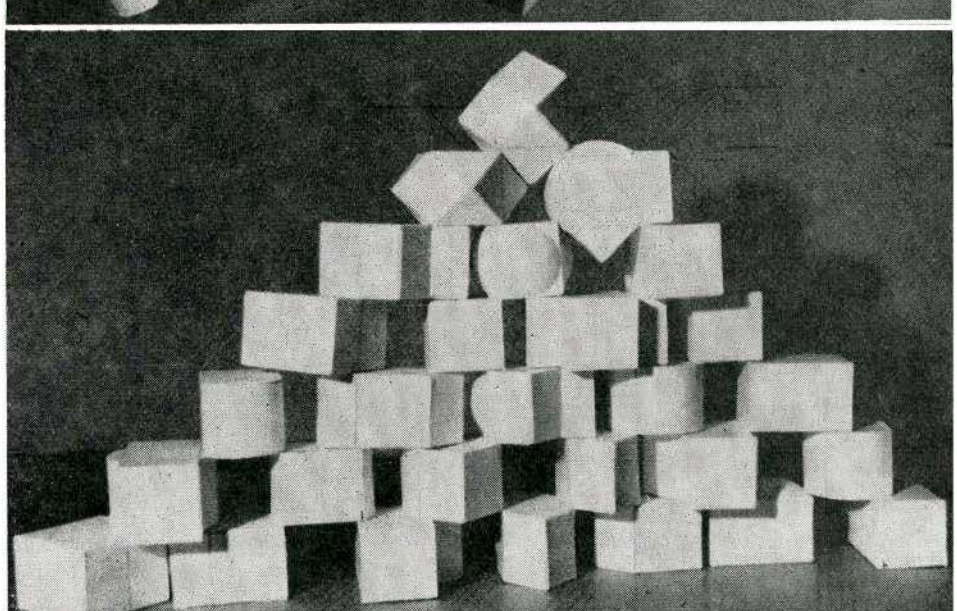
The theme of the Aspen Design Conference of 1967 was "Order and Disorder". It was suggested from a little story by Ben Shan that, for all the order in the world we must have some disorder to balance it.
The corollary would be if one had a highly ordered environment system, it would have to be balanced by a disorder of individual acts. That introduces the question of the degree of variety possible within repetitive systems.

In Habitat, I evolved a modular system which, by forming half or a third of a dwelling unilt could be combined in many permutations to produce different house plans. With all its variety, the spacial characteristics of these dwellings are similar. The geometric matrix dominates and produces a single spacial order. This illustrated that variety in itself does not mean *differentiation,* hence does not mean choice or identity to the individual.

A theoretical dwelling arranged out of a large cube divided into nine cubes in which walls and partitions, floors and ceilings could be located anywhere within the matrix and could offer thousands of permutations but no differentiation; one coul:dn't tell one from the other. Modular system (study 1967) for a cube and five auxiliary components was an attempt to show that within a limited repetitive system, permutations coul:d not only produce a variety of accommodations but totally different spacial orders – a circular space, a prismatic space, a cross-shaped plan, or a square plan – are differentiable from each other. By the choice they offer, identity would emerge.
M.S.







In two opportunities to undertake a further step in the evolution of a building system (from Habitat), two projects were developed.

In Habitat Puerto Rico, a moderate income co-operative community constructed within the existing program of the FHA, the module and its assembly were modified to permit:

a Reduced width to permit for highway shipping and hence centralized manufacturing plant.

b A split-level module to eliminate corridors and stair space, particularly with a narrow unit.

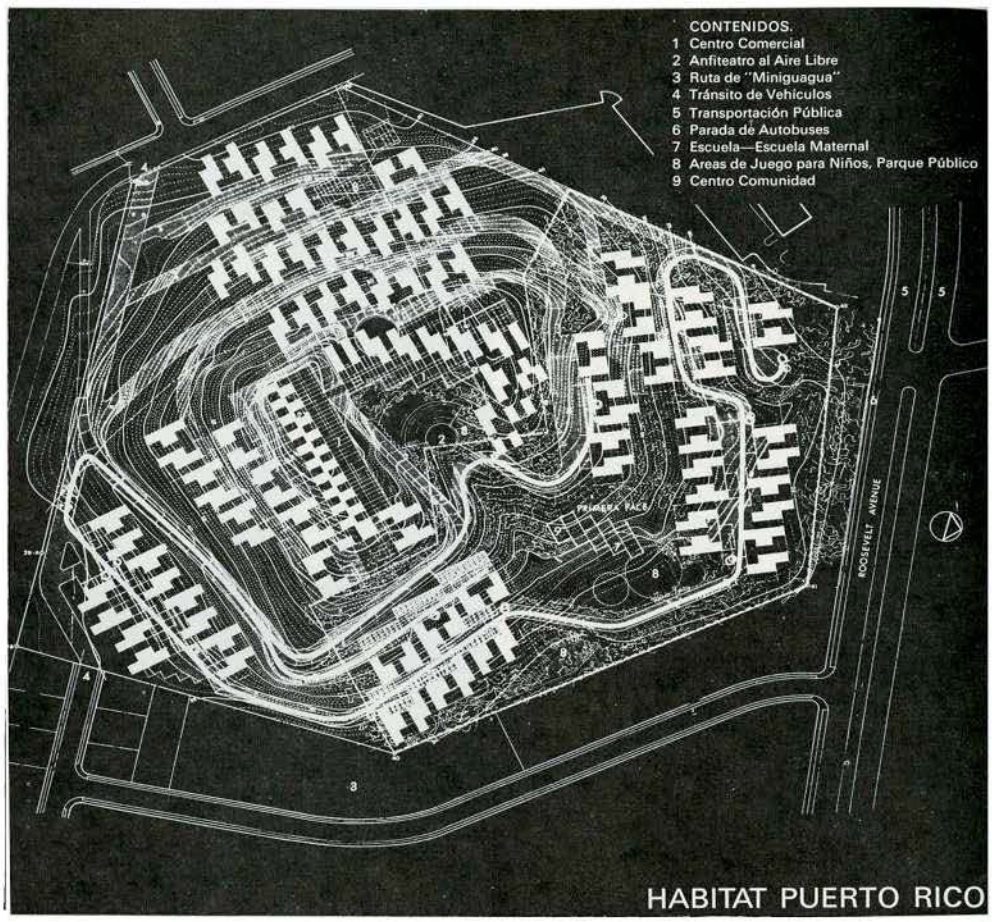
c To achieve a grouping in which the entire circulation system of public streets and access stairs is a bi-product of the module itself without additional pieces.

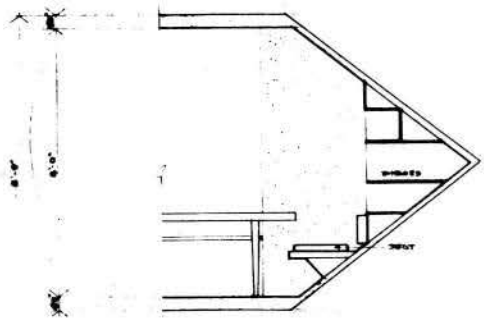
d To assemble units to achieve a simple loading pattern, thus reduce weight, thus reduce costs.

e To modify the grouping to achieve dwelling types and fenestration responsive to local climates and life styles.

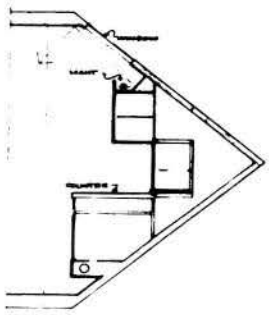
Habitat New York will accommodate 300 dwellings per acre plus extensive commercial facilities. It thus dramatizes Habitat's (Montreal) obvious shortcomings; the inability to transmit stresses efficiently to the ground. In this evolution step No. 2, modules and grouping are modified to achieve an efficient (40 stories high) three-dimensional structure in which forces flow, in which openings do not conflict with structural members, and which still permit for the factory manufacturing of large space cells.

M.S.





Seating and Shelving



Kitchen – Work – Storage

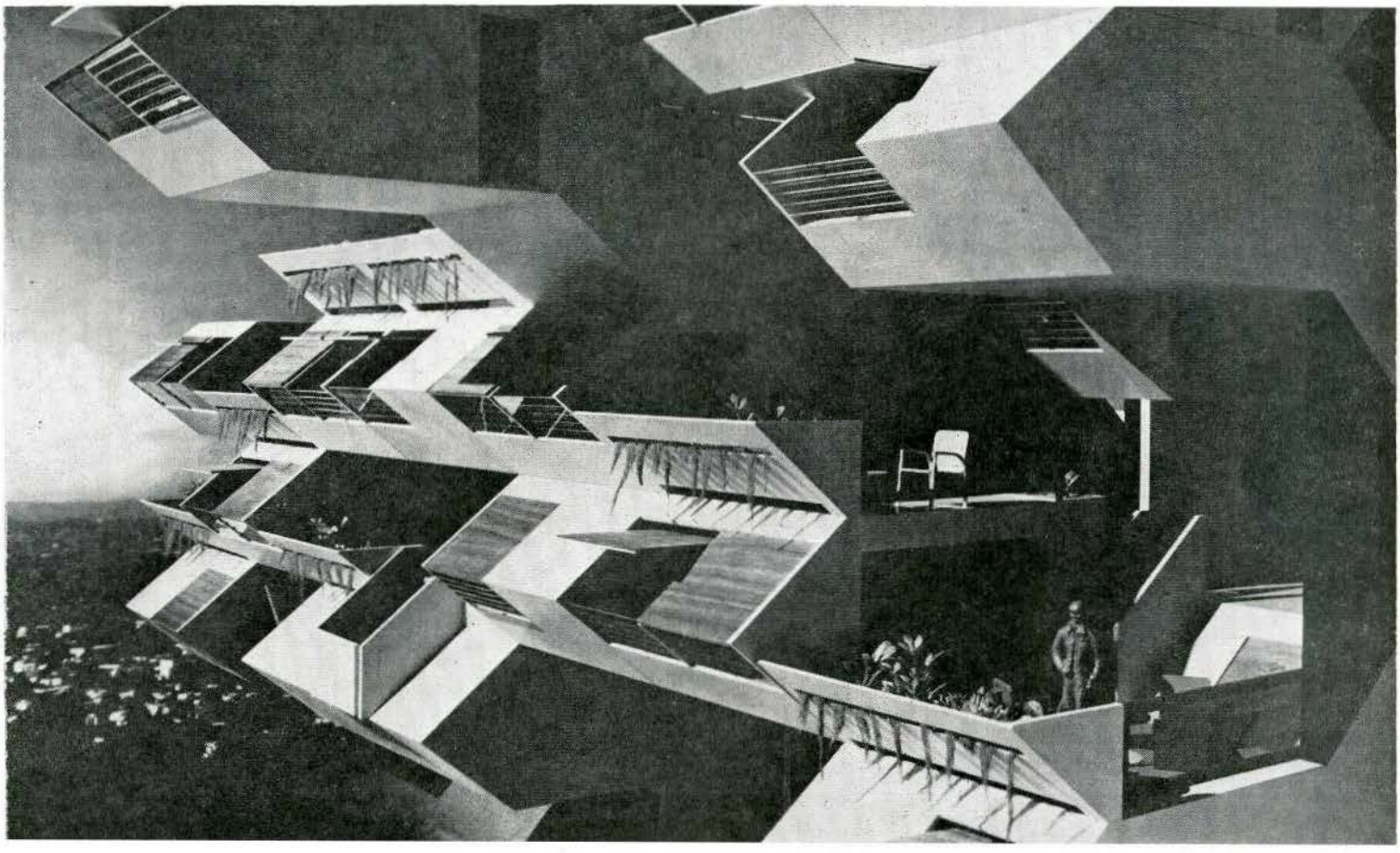
Habitat Puerto Rico

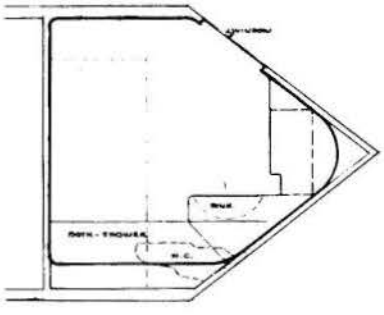
Architect: Moshe Safdie
Sponsor: Administracion de Fomento Co-operativo
Developer-Builder: Development Corporation of Puerto Rico
Consulting Engineers: Conrad Engineers

The basic program was to reproduce the living amenities of "Habitat '67" as built in Montreal in context of Puerto Rico conditions and within the unit construction costs of moderate housing programs. The principle of the housing plans is the court or patio. Each house has its own private garden court located on the roof of the house below which is surrounded by the living, dining and bedrooms. Shade is provided by the cantilever ring of house units above. Each house is conceived as a self-contained entity with complete privacy, visual and acoustic, the walls and floors of adjacent houses are duplicated to achieve sound separation. The grouping of the modules provides for cross-ventilation through each house and most rooms.

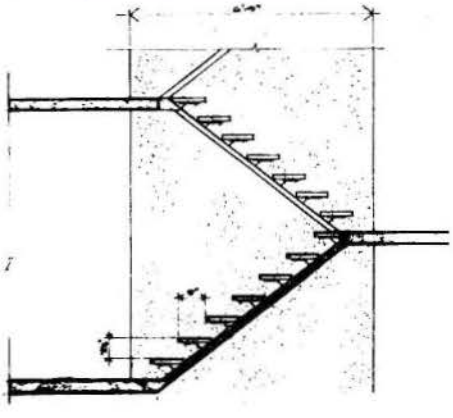
The site for "Habitat Puerto Rico" is a steep hill in the San Patricio area in San Juan. By utilizing the slope site to achieve greater density and better living amenities this project would be a prototype demonstrating the potential utilization of similar sites on the island and elsewhere.

The housing module will be 430 square feet in area, and forms part of a total housing unit, up to three modules in size. The typical module cast in concrete, would have two and three inch walls, four inch slabs and weigh approximately 22 tons. It would be 13 feet wide to permit for highway shipping.

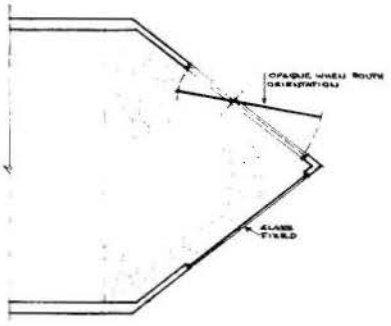




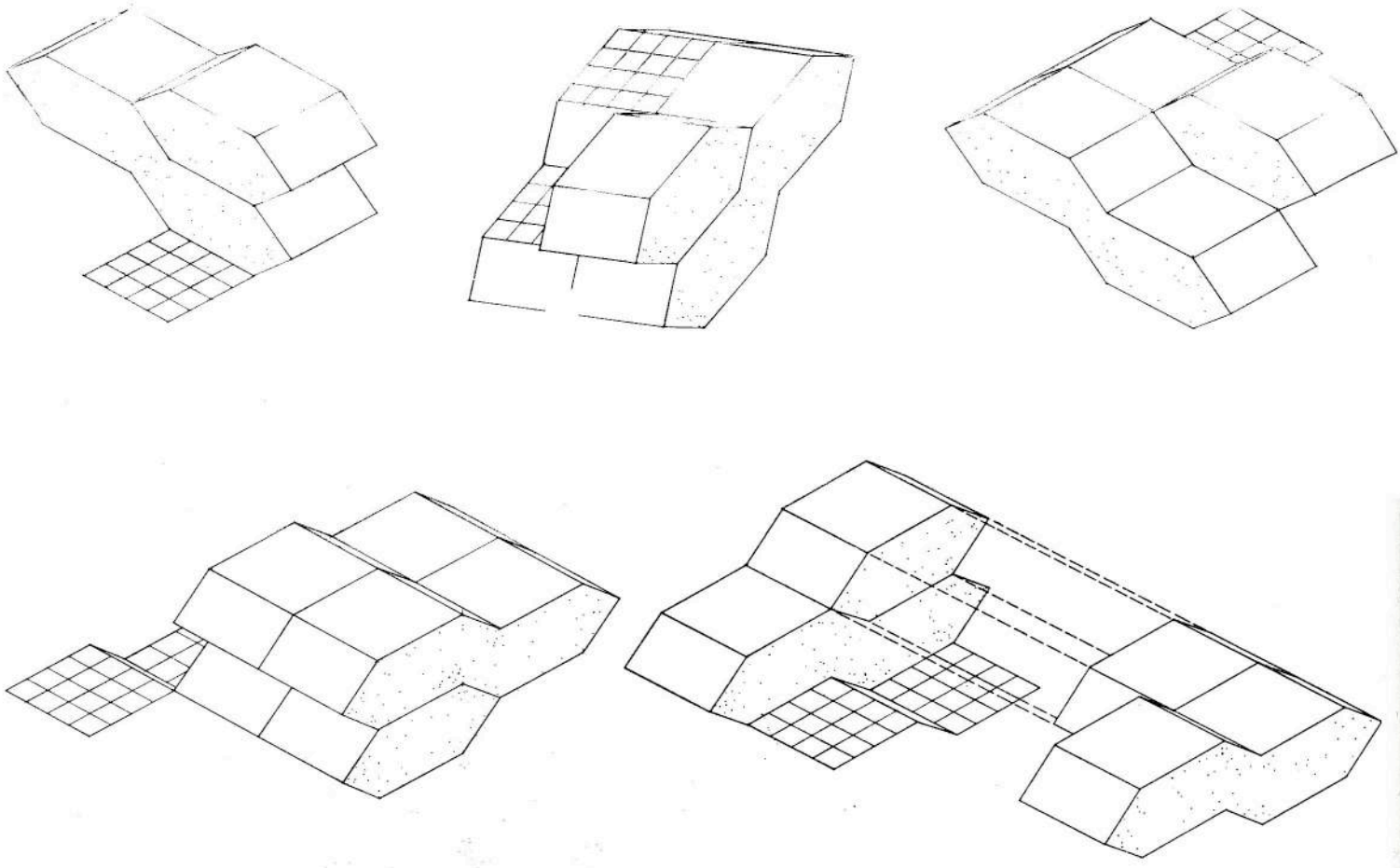
Washroom



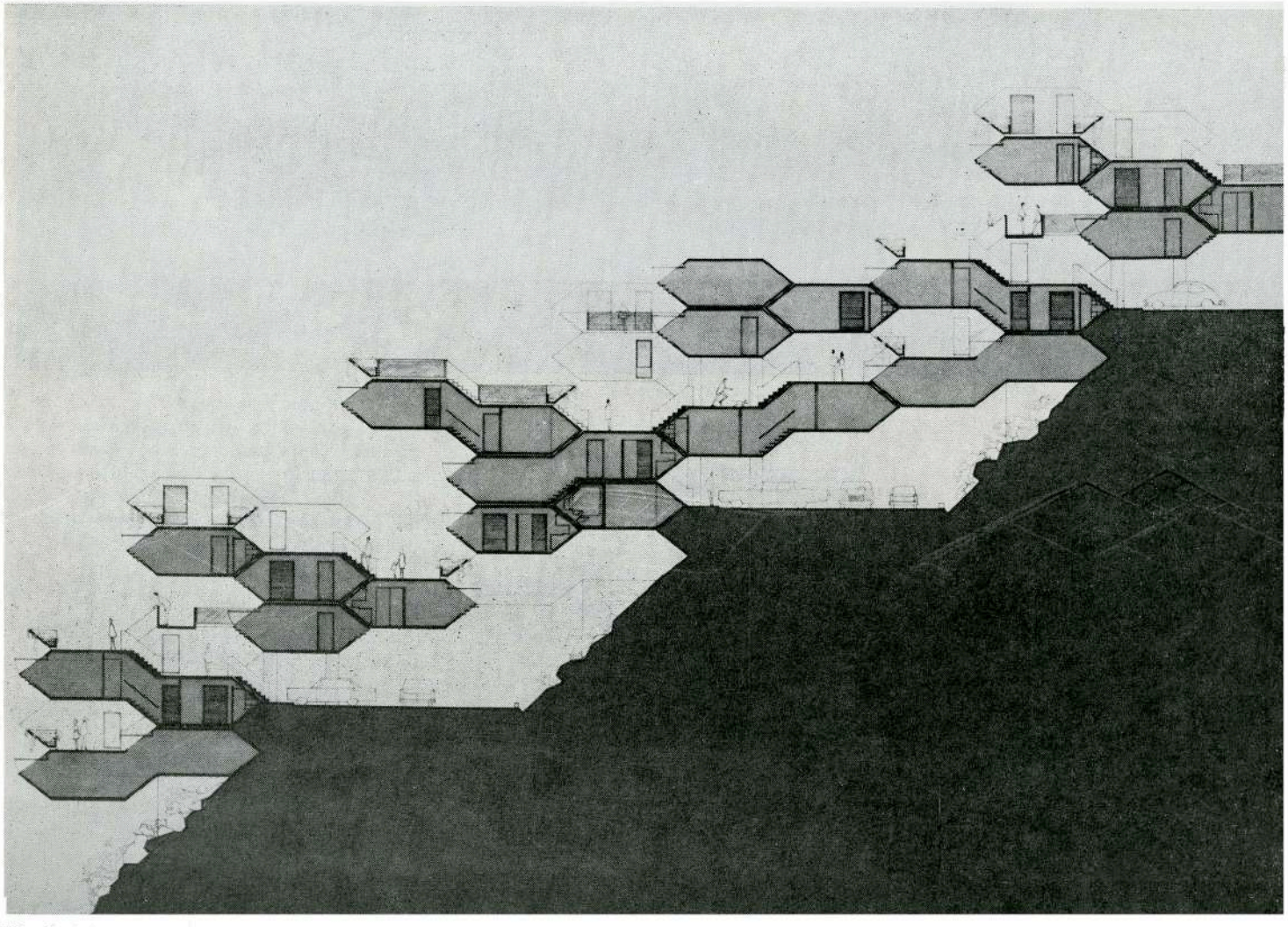
Typical Staircase



Typical Window Details



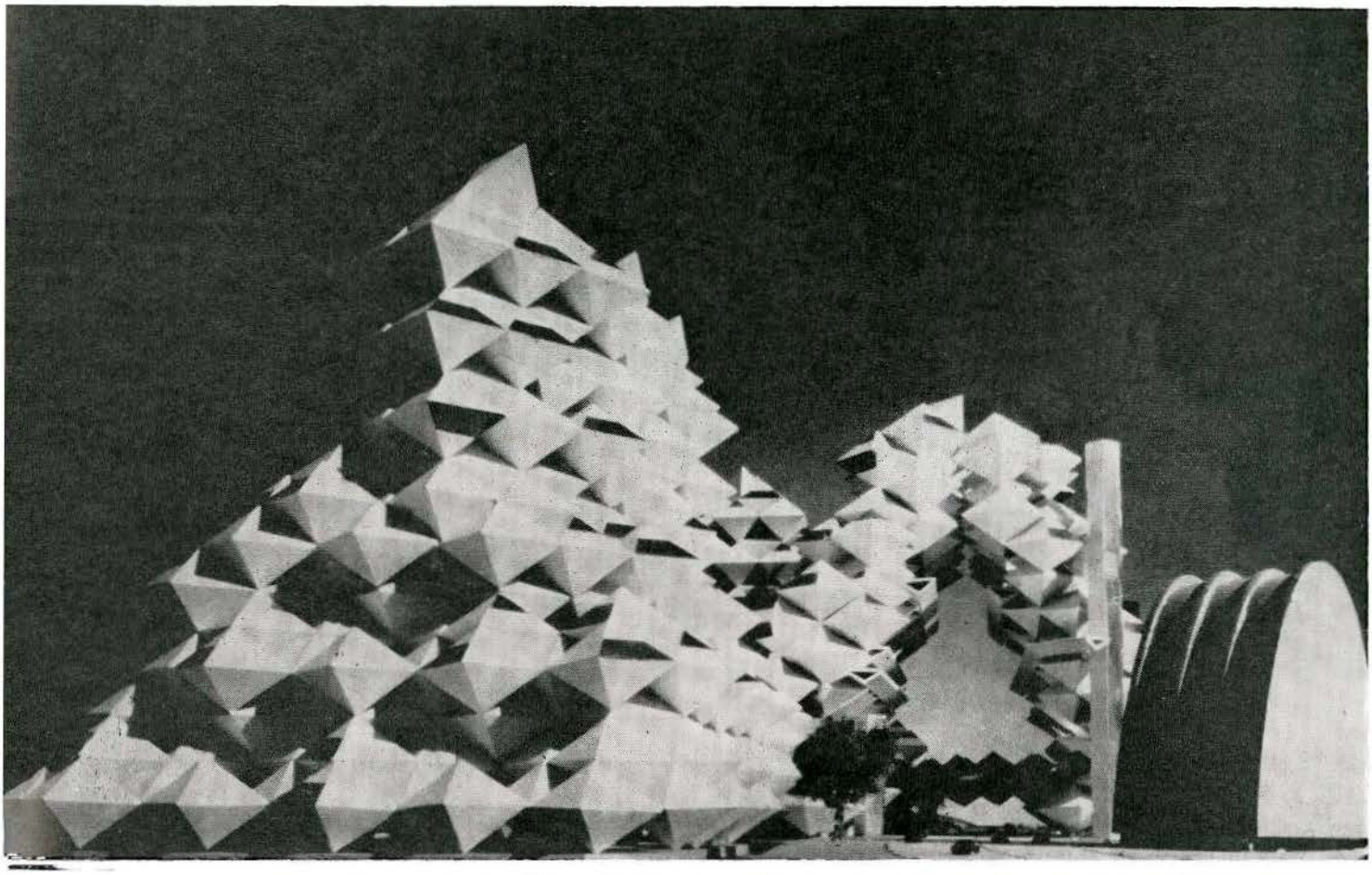
Habitat Puerto Rico

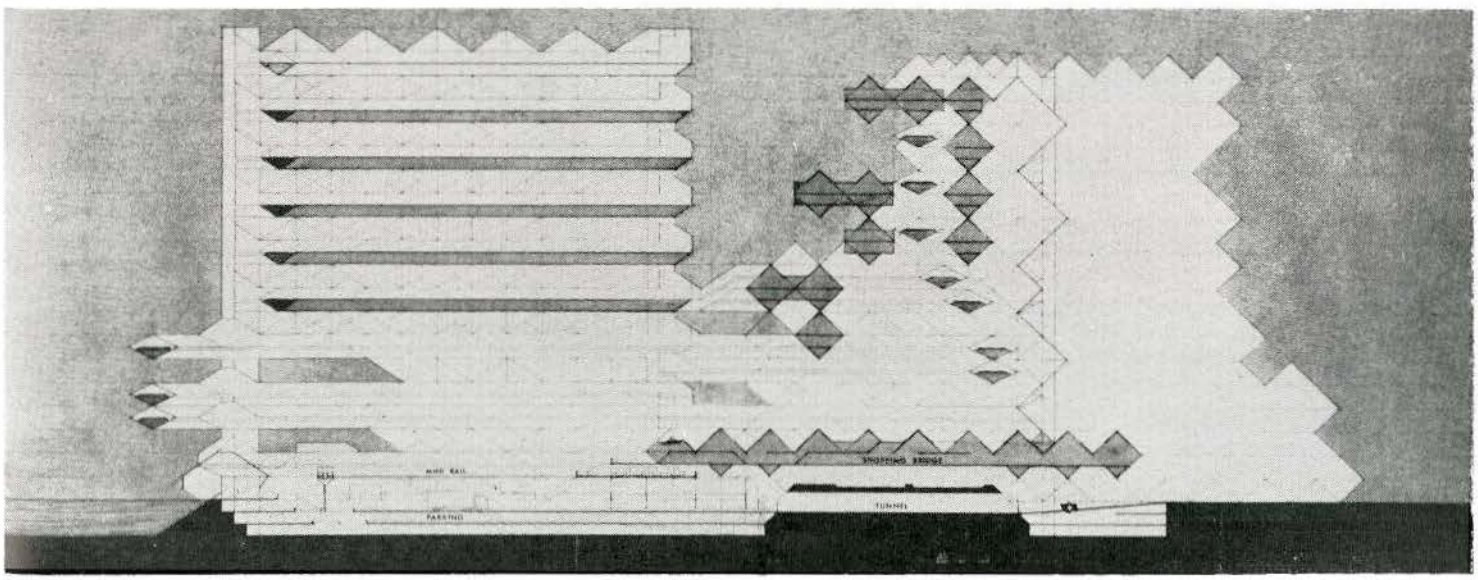


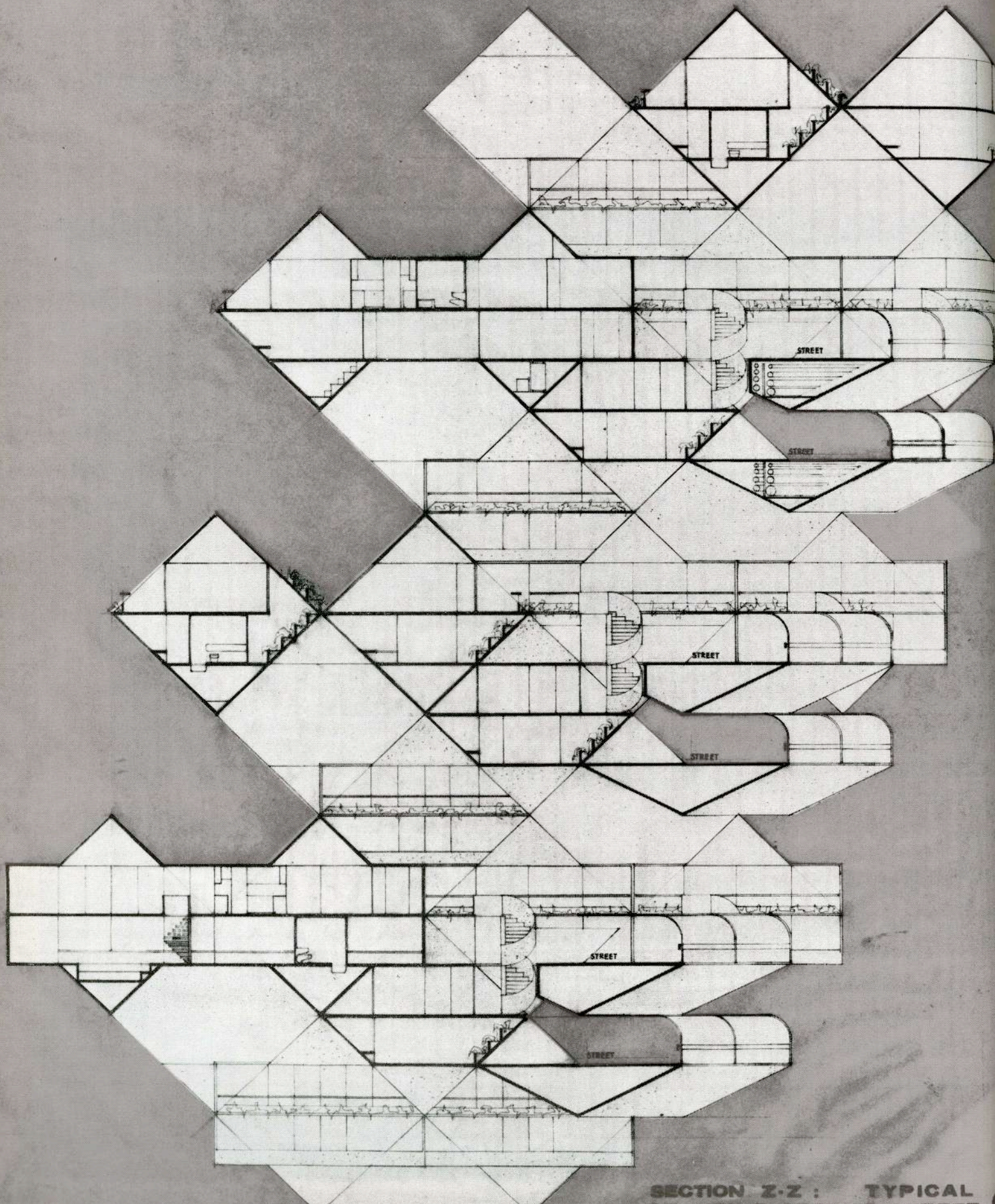
New York Habitat
Scheme I

Architect: **Moshe Safdie**
Structural Engineers: **Conrad Engineers – T. Y. Lin, New York and Los Angeles**
Consulting General Contractors: **The George A. Fuller Company**
Sponsor: **Mrs. Carol W. Haussamen, New York**

This project is in the design stages for a high density 45-storey high riverfront development in New York City, it will consist of upper middle and luxury housing and contain within it a multitude of commercial, retail, office, and institutional facilities. The basic construction system is a prefabrication of octahedron-shaped modules which would be manufactured in a plant across the East River made of thin concrete shell and steel members at the edges. The units will be shipped by barge and lifted into place within the structure. Once in place, the octahedrons combine to form a triangulated space frame with the steel members cast at the edges forming the structure. The steel members at the bottom of the building are 8" tubular section. Since the development of this design, a change in site has occurred and the project is now located as part of the Lower Manhattan Plan. A number of design developments have taken place as a result of this change which are presently in progress. *M.S.*







SECTION Z-Z : TYPICAL GROUPING AROUND STREET

MOSHE SAFDIE ARCHITECT

CANADIAN
BUILDING DIGEST

DIVISION OF BUILDING RESEARCH • NATIONAL RESEARCH COUNCIL CANADA

Stack Effect and Building Design

by A. G. Wilson and G. T. Tamura

UDC 697.952

Previous discussions (CBD 104) of the mechanism of stack action in buildings have provided a useful background for this Digest. They emphasized that the total pressure difference acting on a building as a result of stack effect depends entirely upon building height and the difference between temperatures inside and outside; and that although stack effect cannot be avoided its distribution across the building enclosure and interior separations can be modified through design.

This Digest discusses air tightness and the distribution of pressure differences resulting from stack effect in buildings as they are designed at present. It also discusses ways in which pressure differences and air flow may be modified by varying air tightness characteristics or by the operation of mechanical air supply and exhaust systems.

Current Construction

Figure 1 shows the pattern of pressures and air flow caused by stack effect for an idealized building with uniform distribution of openings in the exterior wall, through each floor, and into the shaft at each storey. CBD 104 indicated that the distribution of the total pressure difference from stack effect depends upon the air tightness of the exterior walls of the building in relation to that from floor to floor. Measurements made on several multi-storey buildings have shown that up to 80 per cent of the total pressure difference is taken across the outside walls, and that the remainder is distributed across the various interior separations. This indicates that with present construction there is a relatively low resistance to air flow from floor to floor compared with that through the exterior wall. The level of the neutral pressure plane, which depends upon vertical distribution of the openings through which air flows into, through, and out of buildings, is generally near mid-height.

For a uniform distribution of openings, as in Figure 1, pressure differences from stack effect can be estimated. For example, with 80 per cent of the total pressure difference taken across the outside walls and a neutral pressure plane at mid-height, the pressure drop at the entrance is equal to 40 per cent of the total. Similarly, the pressure difference across the walls of vertical shafts at the first floor level is equal to 10 per cent of the total.

Absolute values of these pressure differences for specific conditions can be estimated from Figure 2. For example, the total pressure difference from stack effect for a building 600 ft high at a temperature difference of 100 F deg is about 2 in. of water. With the distribution of pressures referred to above, the pressure difference across the entrance is about 0.8 in. of water and that across the vertical shaft at the ground floor level, 0.2 in. of water. When the pressure difference across a 20-sq-ft door exceeds 0.6 in. of water, the force required to open it is greater than can be applied by the average adult. In order to reduce the opening forces required and to reduce air infiltration, it is common practice to incorporate vestibule and revolving door entrances in high buildings. A vestibule divides the pressure difference across the entrance, so that each bank of doors sustains only half the total. It might be noted that exterior doors at the top of buildings leading to roof areas sustain pressure differences similar to those at building entrances, but acting in the opposite direction.

Operating difficulties with elevator or stairwell doors are not usually encountered at pressure differences of 0.2 in. of water; noise caus-

ed by air flow through cracks may, however, be perceptible with some doors at even lower pressure differences. Greater pressure differences do occur across interior doors of some buildings when they lead to a storey that has a substantial opening to outside. This effect is greatest when the storey is near the top or bottom of the building. For example, exterior walls of entrance storeys often have more leakage openings than storeys above, and thus sustain a smaller proportion of the total stack effect than is indicated in Figure 1.

An extreme case is shown in Figure 3, which illustrates pressure distribution when there is a very large opening to outside on the entrance floor; this condition would be approximated with all entrance doors held open. The pressure in the entrance floor is then the same as that outside, and this imposes a greater pressure difference across openings into the vertical shafts (on that storey), and across the floor separations above. A similar effect would occur in an upper storey with an outside wall that offered little resistance to air flow; there would be a reduced pressure difference across the exterior walls and an increased pressure drop across the floor slab and walls of vertical shafts at this level. This sometimes occurs when a mechanical equipment room is located at or near the top of a building. Where the tightness of the exterior enclosure of some storeys cannot be assured, it may be necessary to incorporate vestibule entrances around elevators and stairwells to cope with the increased pressure differences across the interior separations.

Increasing Building Tightness

Many of the problems caused by stack effect in buildings could be alleviated by increasing the air tightness of the building enclosure and interior separations. Although the tightness of the exterior of present constructions is greater than that of interior separations, recent measurements of over-all air leakage rates indicate that wall leakage values are considerably higher than would be assumed from laboratory measurements on components. There appear, therefore, to be opportunities for increasing the air tightness of the building enclosure. Because most of the total pressure difference is already taken across the enclosure, a further increase in air tightness would not cause a major shift in the distribution of pressure differences; but it would result in a decrease in the rate of air infiltration, exfiltration, and upward flow within the building.

A reduction of air leakage from stack effect could also be achieved by increasing the resistance to flow through interior separations, without any change in the tightness of the exterior. It would alter the distribution of the pressure difference illustrated in Figure 1, shifting the pressure inside the building closer to that outside, with a consequent increase in the shaft wall pressure difference and a decrease in the outside wall pressure difference. With the tightness of interior separations substantially greater than that of the exterior, most of the stack effect would be taken across the interior elements (see CBD 104, Figure 1c); and large pressure differences would then be imposed across the walls of shafts passing through several storeys. Pressure differences across the exterior walls would be minimized. Altering the tightness of buildings in this way presents some difficult problems in design and construction, both in achieving the increased tightness and in coping with the resulting increase in pressure differences between storeys and across walls of vertical shafts.

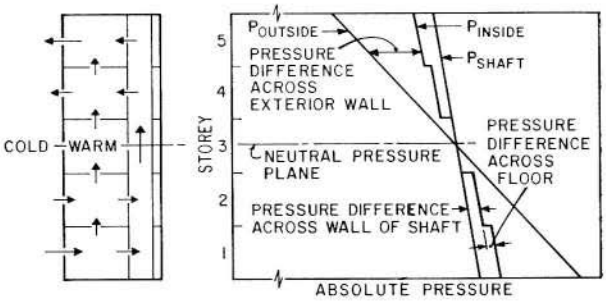


Figure 1. Stack effect for idealized building.

Special consideration of air tightness requirements for interior separations may be needed in relation to the control of smoke movement in the event of fire, when the air tightness of the exterior may not be assured; for example, entrances and stairwell doors may be open, and windows broken. The problem of designing for smoke control is a complex one involving a number of factors which go beyond the scope of this Digest.

Effect of Ventilation System

Pressures inside buildings and air leakage patterns are affected by any imbalance of the air supplied and exhausted by air handling systems. These systems are sometimes designed and operated to provide an excess of supply air and thus to pressurize the building and reduce infiltration, particularly that resulting from stack effect at lower levels of multi-storey buildings during cold weather. The pressurization that results from a given excess of supply air will depend upon the tightness of the building enclosure.

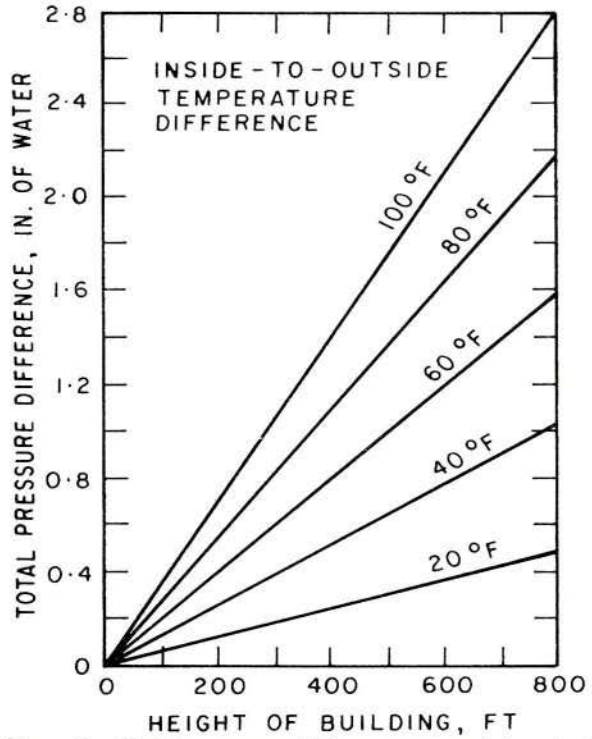


Figure 2. Total pressure difference caused by stack effect.

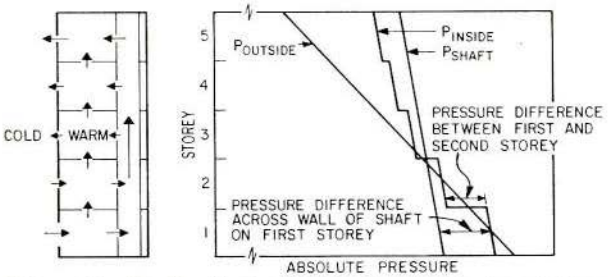


Figure 3. Stack effect with large outside opening on entrance floor.

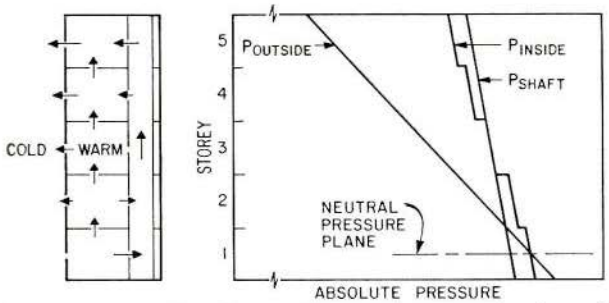


Figure 4. Stack effect with equal pressurization of each floor.

If the excess air supply is introduced uniformly at all levels, the pressure difference across exterior walls at lower levels (causing infiltration) will decrease; that at upper levels (causing exfiltration) will increase by a similar amount. This is shown in Figure 4, which indicates the effect of uniform pressurization of the idealized building of Figure 1 to the point where inside and outside pressures are equal at the first floor level.

It will be seen that pressurization does not eliminate stack effect, but that it alters the distribution of pressure differences across the exterior walls. The lines representing the pressure distribution inside the building and vertical shaft are displaced to the right; pressure differences between storeys and across walls of vertical shafts, and the resulting upward flow of air within the building, are essentially the same as with no pressurization (Figure 1). Although infiltration through exterior walls is minimized, exfiltration is greatly increased; and there is a penalty in higher heating costs because it is necessary to heat the additional outdoor air that must be brought in to provide the pressurization. In the example, the total required outside air supply is equivalent to about three times the air infiltration when there is no pressurization. The advantage of tight exterior walls is therefore apparent, particularly when pressurization is required.

Large pressure differences across shafts and floor separations may sometimes result when there are differences between floors in the imbalance of supply and exhaust air; these may be either intentional or accidental. For example, the pressure pattern shown in Figure 3 is the same as that which would result if only the ground floor were pressurized sufficiently to overcome the normal pressure difference across the entrance because of stack effect. Under this condition there would be no leakage through the entrance, but the total excess supply air required on the entrance floor would be about equal to the total air infiltration without pressurization (Figure 1); infiltration on other floors would be about one third of the original total, so that the penalty in higher heating costs would be considerably less than with uniform pressurization.

Again, stack effect is not eliminated; but the distribution of pressure differences across both exterior and interior separations is altered. The normal upward flow of air in the building is augmented by that supplied to the first floor. Pressure differences across exterior walls at upper levels are increased only slightly, but the pressure differences across the lower floor separations and across stairwell and elevator

doors at the ground floor level are substantially increased. In high buildings, these pressure differences would be excessive unless additional separations, such as vestibule entrances, were incorporated around the shafts.

In theory, a mechanical ventilation system could be designed to minimize pressure difference across the exterior wall of each storey by providing an excess of air supply to lower floors and an excess of exhaust from upper ones (see CBD 104, Figure 1c). Under this condition, all of the pressure difference from stack effect would be taken across the floor separations and the walls of any intervening vertical shafts, and upward air flow through the building would be very large unless the air tightness from floor to floor were greatly increased. Such a system would not, therefore, be practicable without major changes in building design.

An excess of supply or exhaust air is sometimes used to maintain a space at a pressure either above or below surrounding areas in order to control the movement of contaminants to or from the space. This technique may have some application in the control of smoke movement in buildings, either to maintain some spaces smoke free, or to minimize smoke transfer from a fire zone to other occupied parts of the building. The design of such a system would require careful consideration of the air tightness characteristics of the spaces under fire conditions, and integration with the overall fire safety plan for the building.

Summary

Stack effect in buildings cannot be avoided, but it can be modified by design if its nature is recognized. In current buildings a large part of the pressure difference caused by stack effect is taken across the exterior walls at upper and lower levels; the wall and its components and entrances must therefore be designed to accommodate it if serious problems are to be avoided. The pressure differences across interior separations are generally smaller, but they can be excessive across entrances to vertical shafts under certain conditions. Many current buildings present a relatively low resistance to the air flow induced by stack effect, and many of the associated problems could be alleviated by increasing the air tightness of exterior enclosures and interior separations.

There are possibilities for modifying the distribution of pressures and air flow patterns resulting from stack effect through changes in building design and construction. Distribution can also be modified through the operation of mechanical air handling systems to provide an imbalance of supply or exhaust. This technique is best considered at an early stage in planning so that its effects on pressures and air leakage can be considered in the design of the structure.

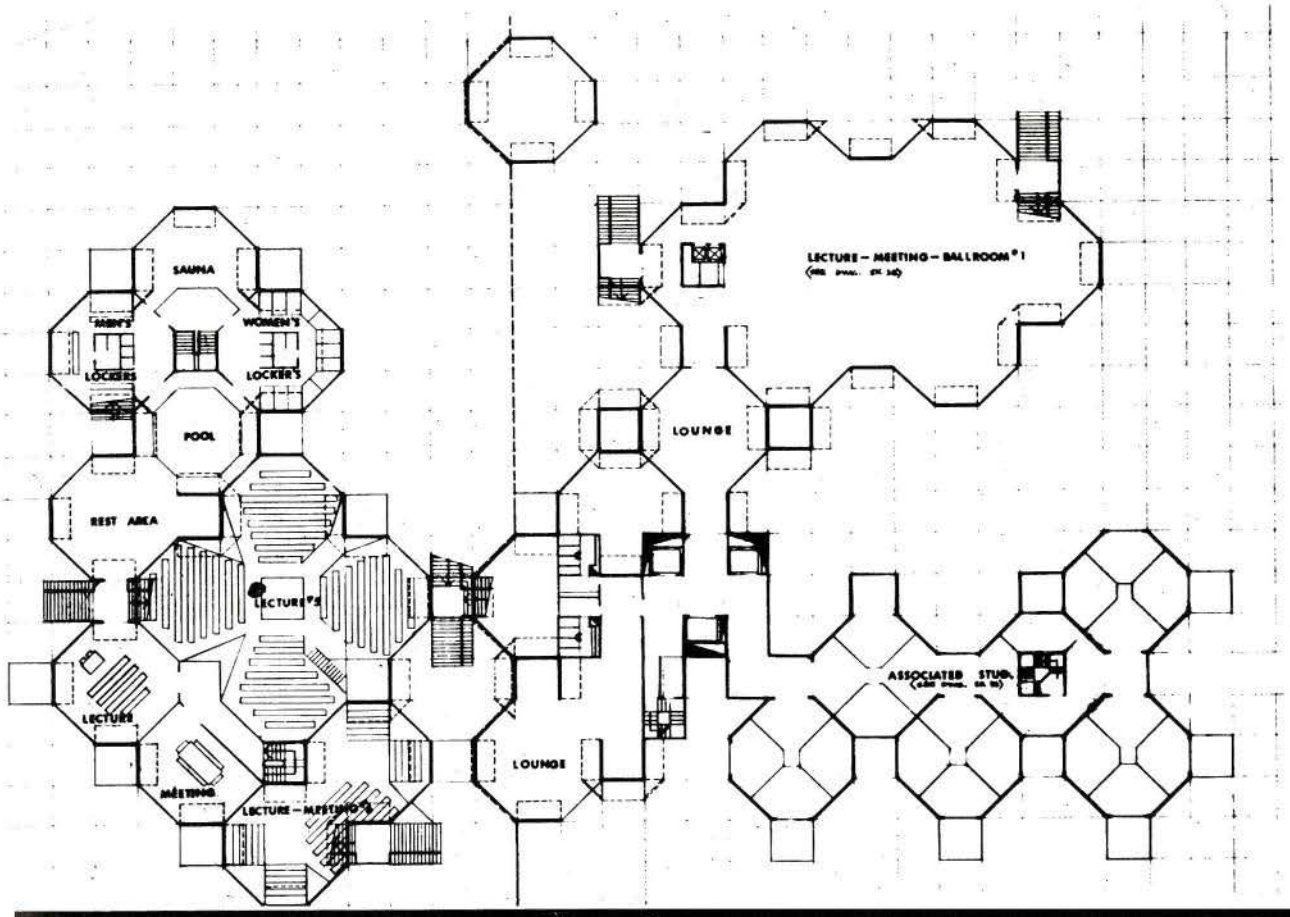
Finding a Genetic Code

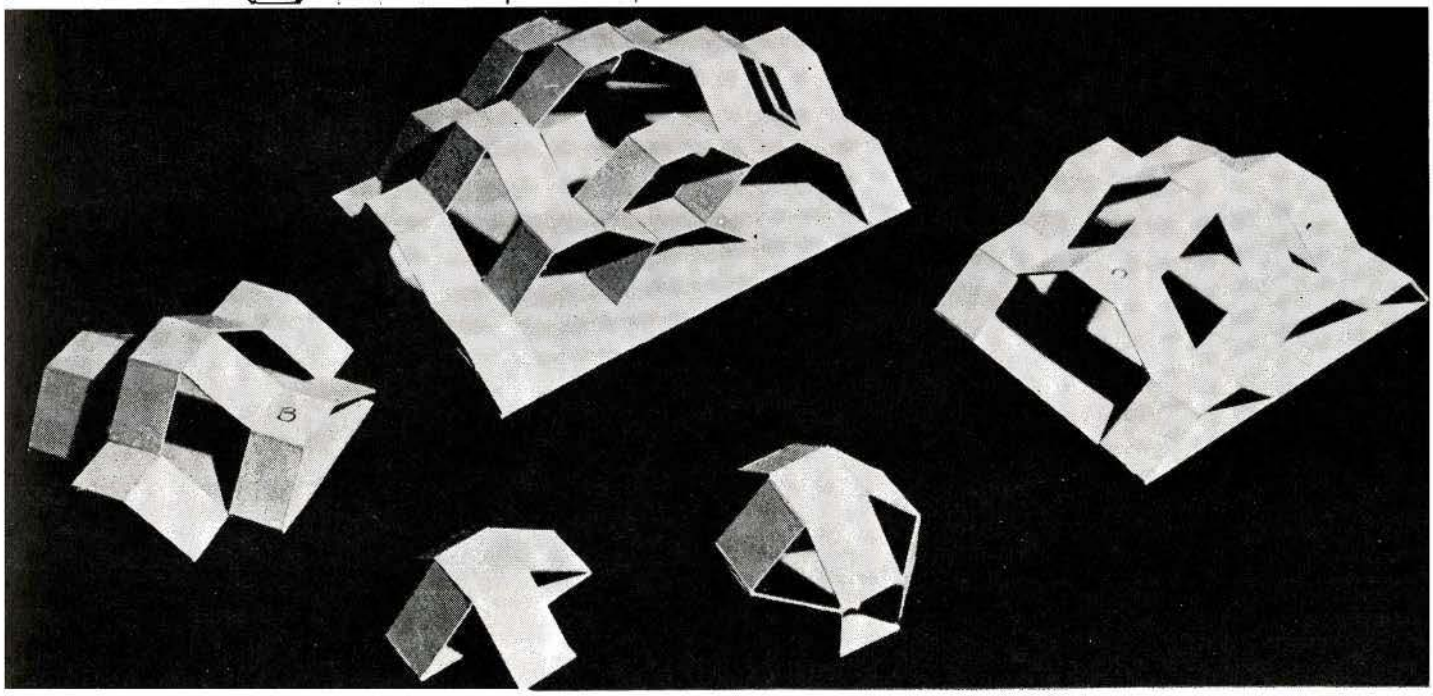
College Union San Francisco

Architect Moshe Safdie

The College Union in San Francisco is not an assembly of repetitive components as are schools, hospitals, or groups of houses. It is the complex assembly of spaces of varying sizes – offices, dining-rooms, assembly rooms, stores, theatres, and the like. A single component combines to form the smallest and the largest rooms. The biproduct of the geometry of the grouping creates circulation patterns within and upon the building.

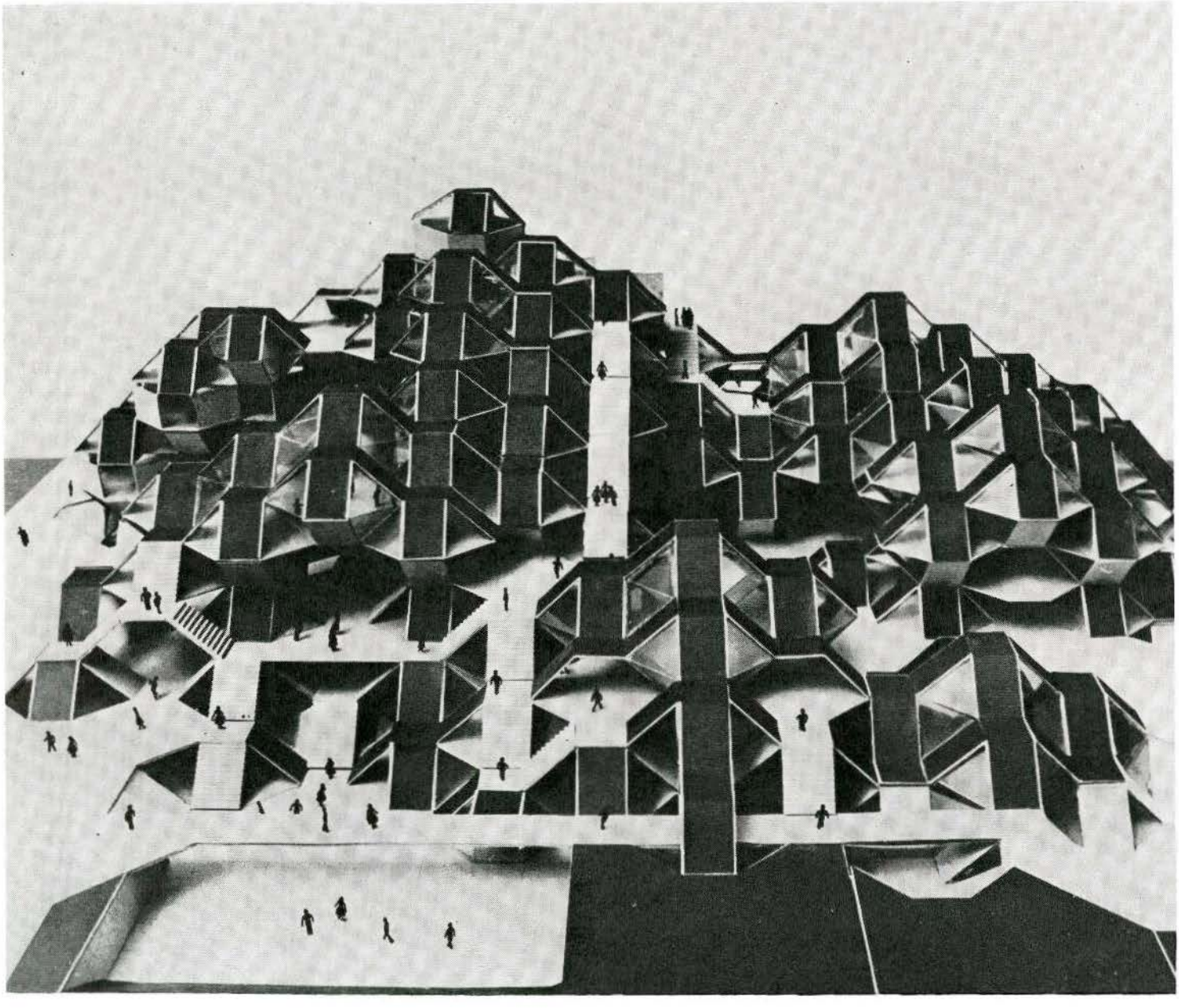
The wish to achieve a modular system in this building cannot be rationalized on technical/economical grounds alone. It is not a factory produced space cell,

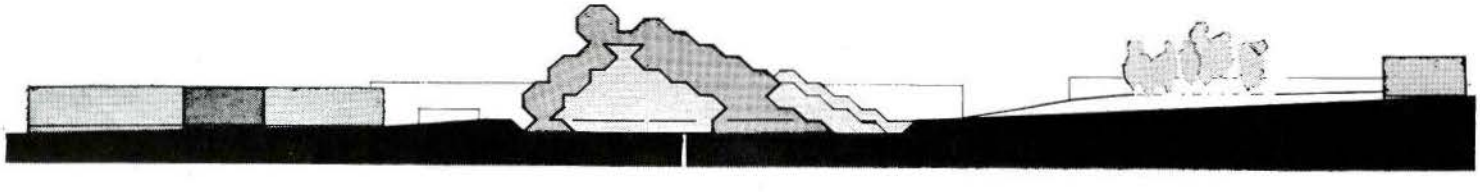


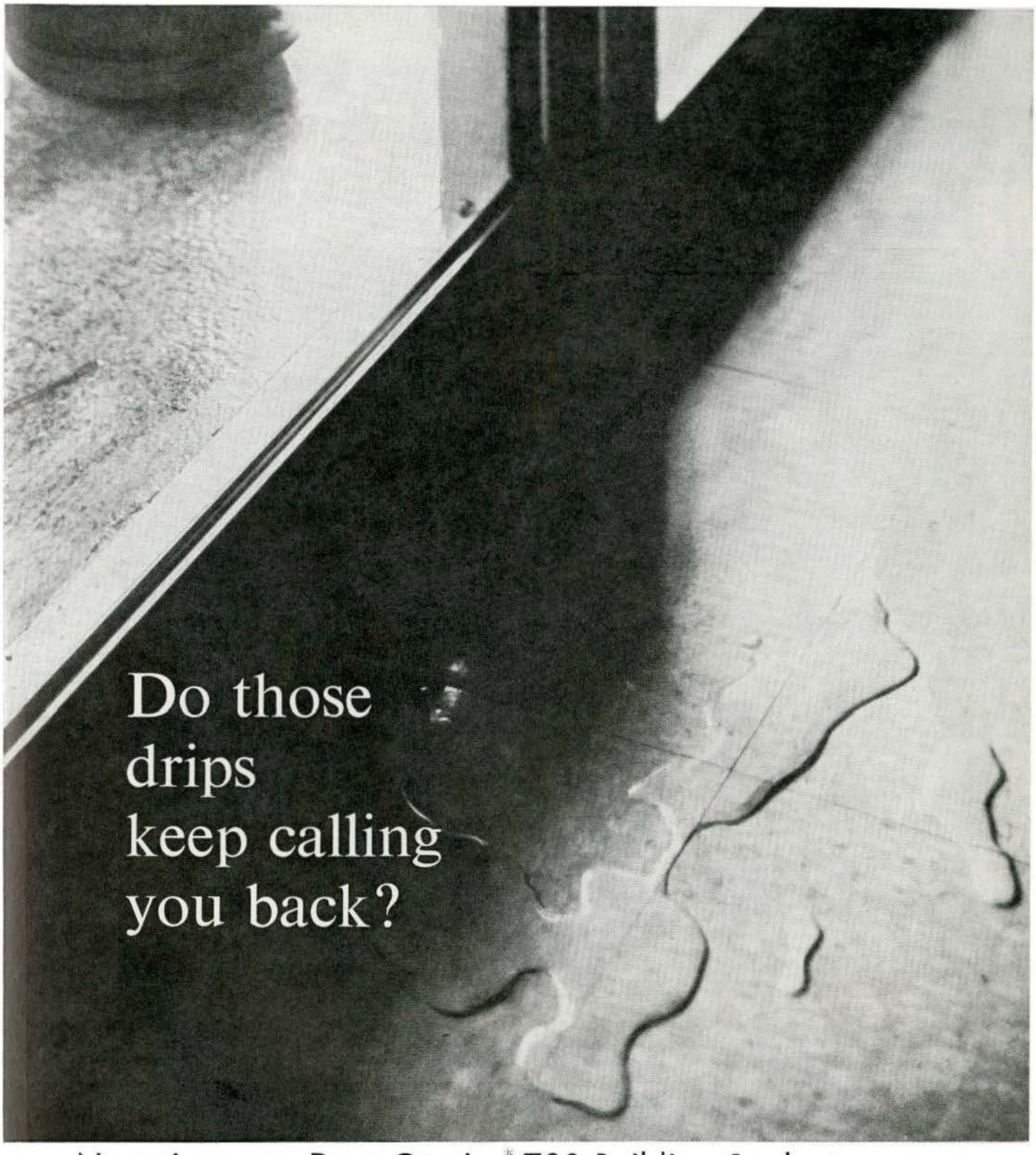


although it could be if one was building at a larger scale, say a whole college. What is significant is that, having established the basic system itself, and the rooms or patterns by which it can be manipulated to form major and minor spaces, I would have been quite content to leave the application of this system in the specific buildings to the students (who are the clients) themselves.

This is an attempt at a contemporary vernacular, *like the cubes, domes, arches, and courts of an Arab village. This building is not finite – it is not a composition – it could be added to, expanded and changed without detraction of its environment. Variations in the program would have produced different applications of basically the same life. It is an attempt to find the genetic code of an environmental type. As with the DNA molecule, each life is a specific adaptation of the unalterable generic qualities of the species. Thus, a building system is not only a method of manufacturing; it is not only an environmental system of organized space, it is a process of design, of translating the multitude of "structures" or "programmatic requirements", and distilling them into a vernacular.* M.S.







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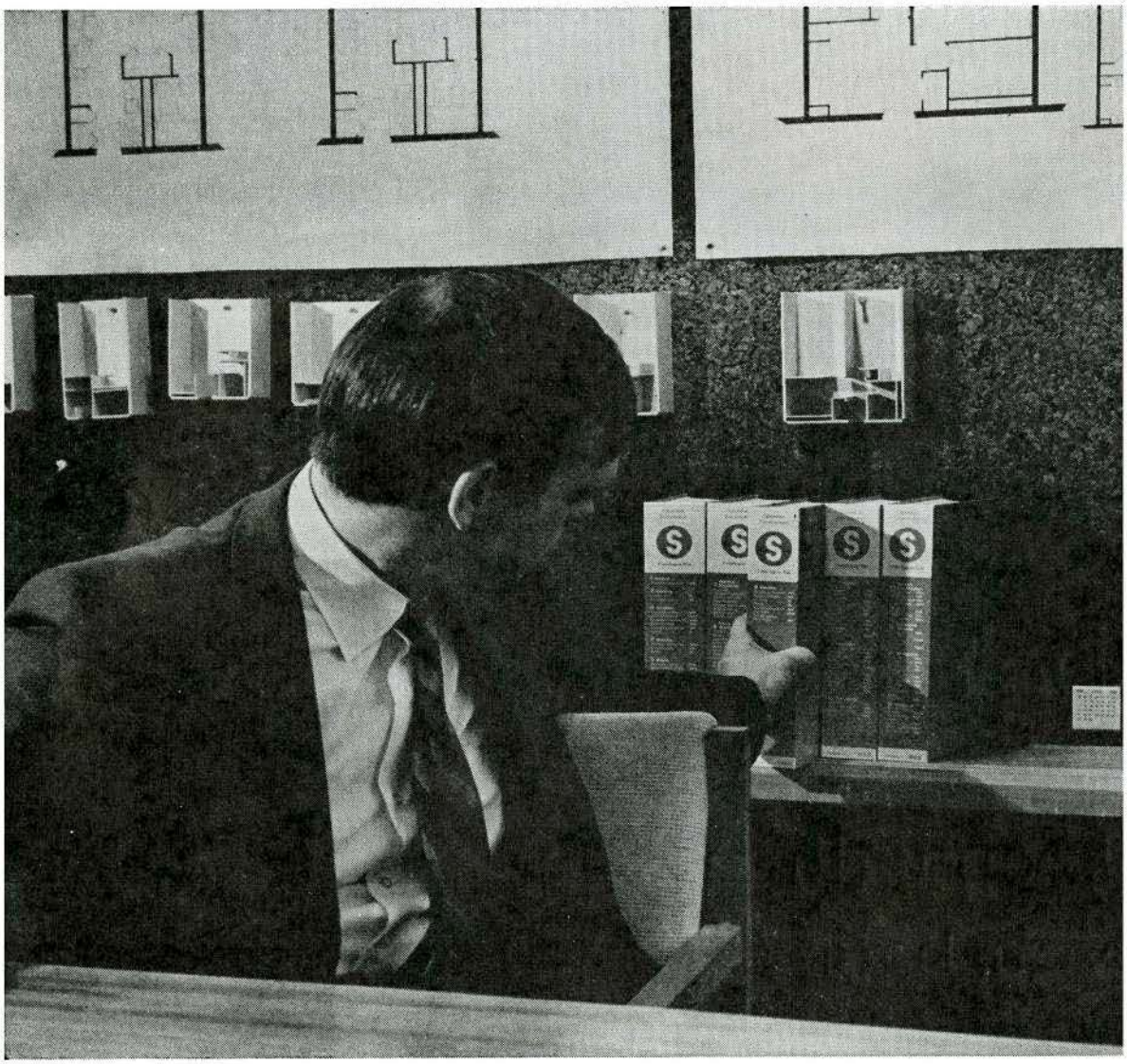

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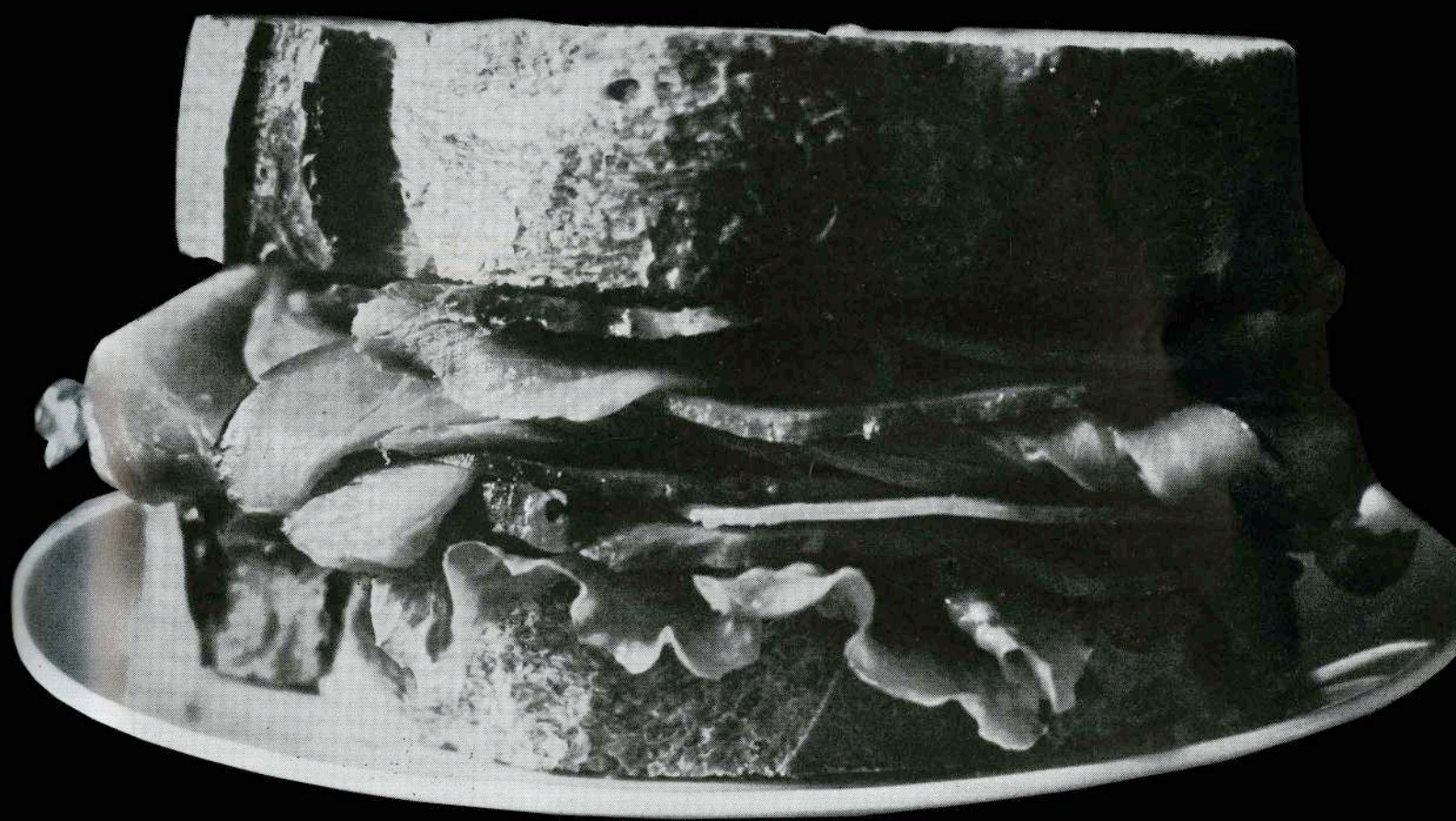

If you take oven-fresh crusty bread. And use the crispest, juciest lettuce. You can still get a mediocre sandwich if the meat isn't first class.

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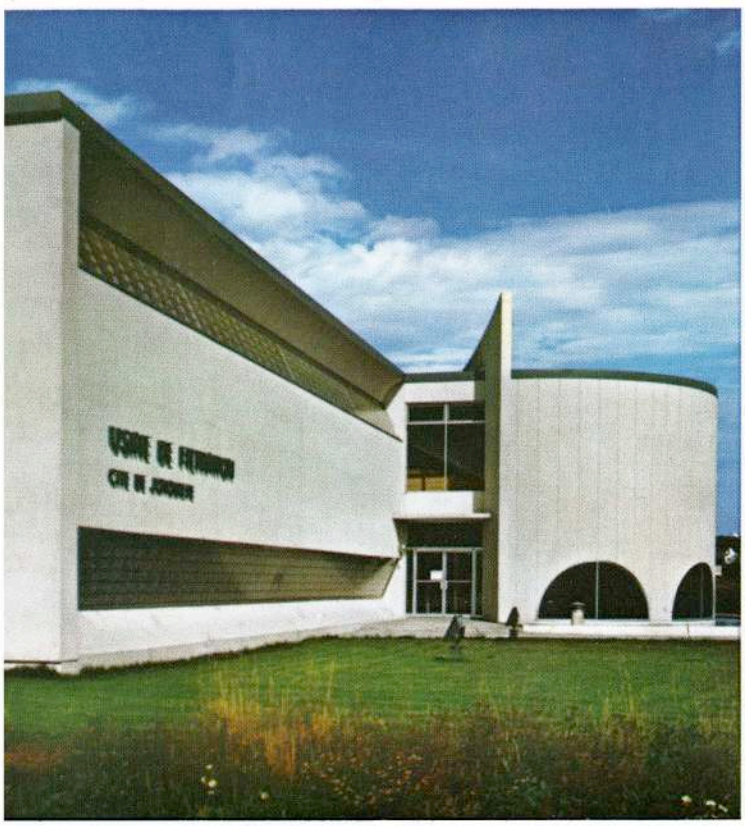
1. The Terminal Towers, Hamilton, Ont., features precast concrete panels.

2. A variety of concrete masonry units for the Riviera Motor Hotel, Edmonton, Alta.



Cast-in-place concrete molded the shape of this Filtration Plant at Jonquière, Que.

6. The Rodighiero Building near Montreal, a modern all-precast concrete building

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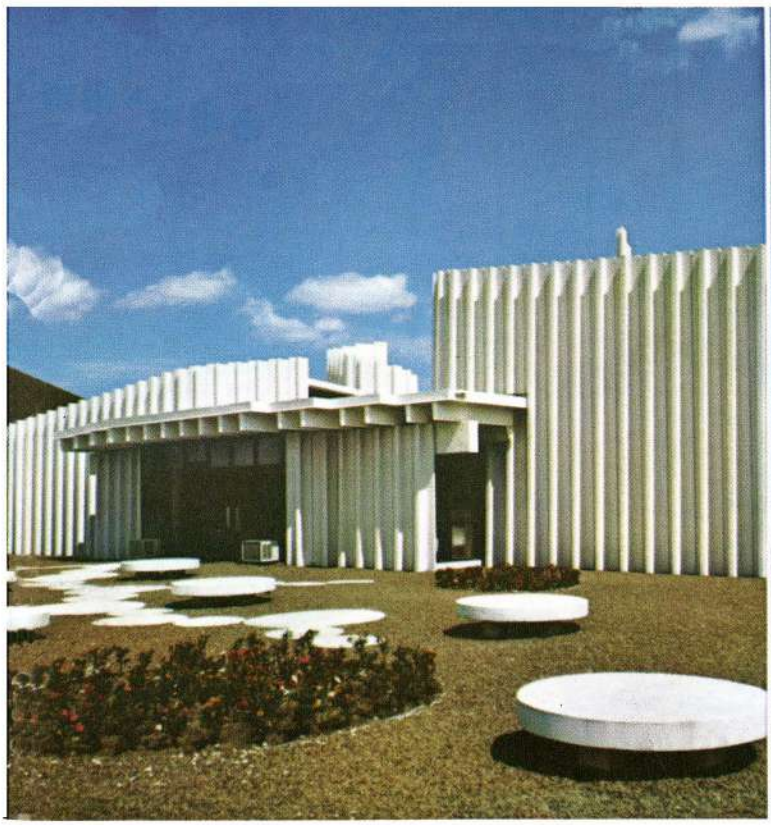
3. The Oldfield, Kirby & Gardner Building, Winnipeg, Man., an all-concrete structure.

4. Exposed concrete walls for the Health & Welfare Building, Charlottetown, P.E.I.



7. The all-precast concrete Man and Music Pavilion at Expo 67 can be dismantled.

8. The precast concrete Bishop Grandin Academic & Vocational High School, Calgary, Alta.

ENDURING STRUCTURES IN CONCRETE

1. Architects: Crang & Boake
Cons. Struc. Engrs.: Bradstock, Reicher & Partners Ltd.
General Contractor: Taylor Woodrow of Canada Ltd.
Precast concrete members: Artex Precast Limited
Ready-mixed concrete: Red-D-Mix Concrete Ltd.

2. Architects & Consulting Structural Engineers: Maxwell & Campbell Consulting Engineers Ltd.
General Contractor: Alta-West Construction Ltd.
Ready-mixed concrete: Rex Underwood Concrete & Aggregates Ltd.

3. Architects: Moody, Moore & Partners
General Contractor: Malcom Construction Co. Ltd.
Precast concrete members: Supercrete Ltd.

4. Architects: Affleck, Desbarats, Dimakopoulos, Lebensold, Sise
Cons. Struc. Engrs.: Adjeleian & Associates Ltd.
Gen. Contractor: Thomas Fuller Construction Co. (1958) Ltd.
Ready-mixed concrete: M. F. Schurman Co. Ltd.

5. Architect: Bertrand Dallaire
Cons. Struc. Engrs.: Morin & Doucet
General Contractor: Bouchard & Gravel Inc.
Ready-mixed concrete: Arvida Mix & Supply Co. Ltd.

6. Architect: F. A. Dawson
General Contractor: Rodighiero Construction Co. Ltd.
Precast and prestressed concrete members: Francon (1966) Ltd.

7. Architect: Paul-Marie Côté of Desgagné & Côté
Consulting Structural Engineer: Ernest Dauphinais and Surveyer, Nenniger & Chenevert,
Gen. Contr. and supplier of precast and prestressed concrete members: Francon (1966) Ltd.

8. Architects & Consulting Structural Engineers: Cohos Delesalle and Evamy
Gen. Contr.: Oland Construction Co. Ltd.
Precast members: Con-Force Products Ltd.
Ready-mixed concrete: Gallelli Construction Materials Ltd.

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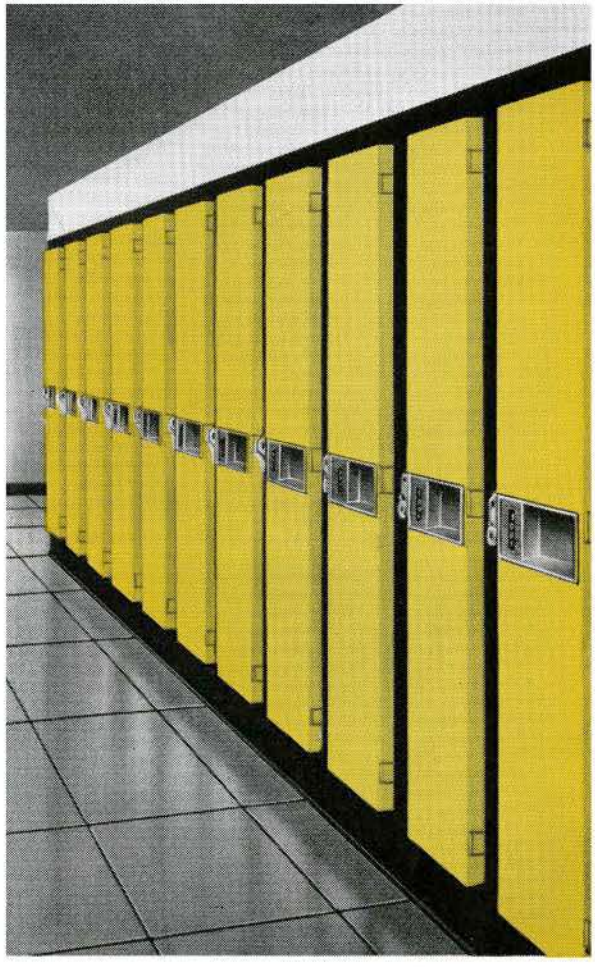

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Specifications

Technical Technique 6

A. W. Cluff

Specification is defined as "Definite or determinate, distinctly or plainly set forth, to state in full and explicit terms, a definite and complete statement as to contract."

Relationship of Specifications to Drawings and Contract Documents

One of the most difficult problems which arises in contract administration is the conflict between drawings and specifications. The Canadian Standard Form of Construction Contract, Document No. 12, Article 2, is quite explicit and states that – "should the specifications conflict with the drawings, the specifications shall govern". Despite the clarity of this article, many architects rely heavily upon the drawings. With most projects, the time spent in drafting is many months, yet the specification preparation time can be measured in weeks.

Both drawings and specifications have been found necessary as a practical means of conveying instructions for the construction of buildings. They are used jointly to inform the bidders, contractors, inspectors, subcontractors, suppliers and manufacturers of the full requirements of the contract. Drawings contain information which is best shown graphically, *eg* dimensions, locations and relationships of the various parts. Specifications contain information which is descriptive in nature containing the physical property of materials and workmanship required to fabricate, erect and install, samples, shop drawings and other requirements. The drawings, specifications and the form of agreement in which the drawings and specification are identified together make up the complete contract documents.

Conflicts between Drawings and Specifications

Members of the building industry should be vitally concerned that the drawings and specifications are complementary and do not conflict. Some feel however, that the specifications are principally used in bidding, the drawings are used by the on site superintendent and the specification is seldom read at all. This may indeed be true and is perhaps the cause of many of the on-site disputes which arise during construction. The architect often takes refuge in Article 2 of the Construction Contract which states that the contract documents are complementary and what is called for in any one (document) shall be binding as if called for by all. The result is disagreement on cost and general dissatisfaction with contract administration.

Items Specified but not on Drawings

Where items are specified but not shown on drawings the contractor is unsure where they are to be installed. This may be the result of using old specifications not written for the job and suggests carelessness on the part of the architect. This casts doubt on the remainder of his work.

Described in Detail on Drawings and also in Specifications

This is a duplication and there is usually discrepancy in the detailed description. For efficiency this can be avoided by a clear understanding of the items which should appear in the specification and those in the drawings.

Duplication in More than One Part of the Specification

This creates confusion and may result in two sub-contractors including the work in their prices, giving a higher than necessary job cost. With the emphasis given to specifications in the construction contract there is a need to improve the present standards and the importance given to specification writing by architects.

Types of Specifications

Descriptive Specifications

These are the common form of specifications in current use and describe in detail the materials to be used and the workmanship required and were evolved from the older crafts of concrete, masonry, carpentry, plastering, etc. By describing the method in which the contractor performs his work we attempt to control the end result. The BCI[1] describes the basic araringement of specifications and provides a table of contents for construction specifications summarized as follows: –

The specification is divided into 16 major groups for convenience of location and indexing. These groups or divisions remain constant and are sub-divided into sections. The sections are not fixed by title or number, however, these are always to be found in the same division of the specification. The major divisions are as follows:–

Division 1 – General Requirements
Division 2 – Site Work
Division 3 – Concrete
Division 4 – Masonry
Division 5 – Metals (Architectural & Structural)
Division 6 – Woodwork
Division 7 – Moisture Protection
Division 8 – Doors, Glass & Windows
Division 9 – Finishes
Division 10 – Specialties
Division 11 – Equipment
Division 12 – Furnishings
Division 13 – Special Construction
Division 14 – Conveying Systems
Division 15 – Mechanical
Division 16 – Electrical

The question of which information belongs on the drawings and which in the specification is under consideration by some offices as new reproduction techniques enable specification requirements to be printed on the sheets of drawings. This has the advantage of placing both the graphic and the written requirements, side by side. It would appear that additional specification clauses will still be required and the use of a standard format is essential for easy reference by all parties concerned in the contract.

Performance Specifications

A performance specification is one which specifies the end result by formulating the criteria for its accomplishments. It describes

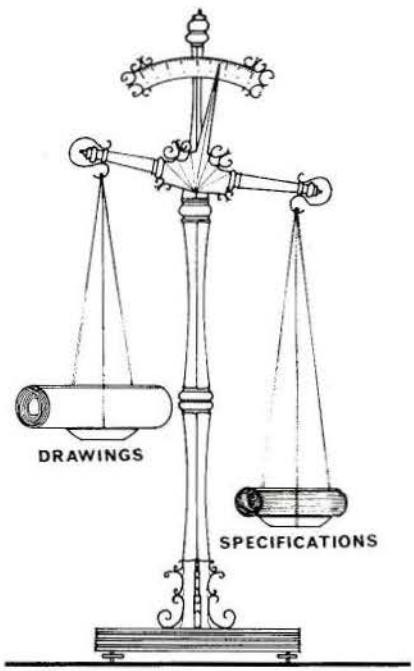
the result to be achieved and the methods to be used. When a situation occurs where existing materials and methods will not achieve the required result, a specification for the performance required can be written stating what the product must do.

It has been suggested that the manufacturer with his detailed knowledge of materials and funds available for research and development, may be in the best position to carry out the required research in order to provide a suitable material. The burden of achieving this result however together with any necessary testing and other procedures, rests with the manufacturer and not with the specifying authority. This approach in the use of performance specifications is being used in connection with the "systems" approach to building.

The Metropolitan Toronto School Board Study of Education Facilities (SEF2) has divided the total building process into a number of sub-systems. Detailed user requirements[3] have been developed and from these performance specifications for each sub-system were produced.

The performance specification and sub-system does not correspond with the traditional building trade divisions and requires the sub-system bidder to accept complete responsibility for all trades included in the tendered sub-system. In the SEF program the following divisions or sub-systems have been used.

Sub-system #1 – Structure . . . floor and roof deck, spanning members, columns, etc.
Sub-system #2 – Atmosphere . . . heating, cooling, ventilating, etc.
Sub-system # 3 – Lighting . . . Ceiling: Lighting fixtures, fireproofing, acoustic insulation, etc.
Sub-system #4 – Interior Space Divisions . . . Doors, panels, partitions, etc.
Sub-system #5 – Vertical Skin . . . Walls, insulation, windows, doors, etc.
Sub-system #6 – Plumbing . . . Fixtures, drainage, hose cabinets, washroom accessories, etc.
Sub-system #7 – Electric-Electronic . . . Distribution, lighting panels, sockets, fire alarm, public address, telephone, television, etc.
Sub-system #8 – Casework . . . Cupboards, counters, benches, shelving, etc.
Sub-system #9 – Roofing . . . Roof covering, vapor barrier, insulation, flashings, etc.
Sub-system #10 – Interior Finishing . . . Floor finishes, special coatings, paintings, etc.



The above sub-systems, together with site work and other items stipulated as "non system", together make up the total building process. The development of performance specifications requires extreme care and success depends upon a receptive attitude towards change. It is hoped that performance specifications may provide the required link to improve the co-ordination of the various members of the building industry.

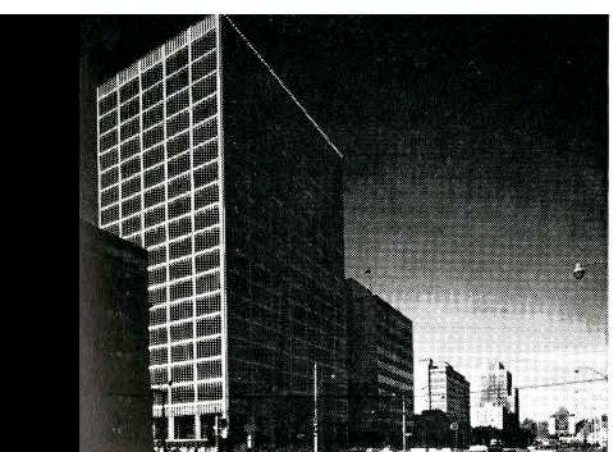
Automated Specifications

By the use of a master specification which is reproduced on a magnetic tape and edited as required by the specification writer, it has been suggested that the production of specifications can be greatly simplified. The major advantages are the reduction in typing errors and the elimination of proof reading. The most advanced equipment uses a computer which is capable of doing almost anything; however, the key to its use lies in the preparation of suitable master specifications and these must be geared to the practice of each individual office. It is suggested that there is no master specification which will suit all offices; they must be custom designed for the particular needs of each office and the type of work undertaken. In some sections of the specification the use of manufacturer's catalogue numbers is desirable and these can only be included in the master specification with difficulty. It is my opinion that we are only on the threshold of mating the specification to the computer and more significant changes may take place in the building industry, making this eventual combination outdated.

Conclusion

The vital need for improved communication in construction has become essential. Architects with pride and confidence in the abilities of their profession must take the lead in improving communication by providing clear, concise, positive drawings and specifications. Other methods of communication should be used as these become available but there is little excuse for the present inconsistencies which exist within the documents which together make up the construction contract.

[1] *Building Construction Index,* Specification Writers Association of Canada, 57 Bloor Street West, Toronto. $2.00
[2] *Educational Specifications & User Requirements for Elementary Schools,* Ryerson Press, 299 Queen Street West, Toronto, 2B.
[3] *Metropolitan Toronto School Board, Study of Educational Facilities, Documents T1 & T2,* SEF, 49 Jackes Avenue, Toronto 7.



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Il s'agit de construire un nombre minimum de pièces différentes qui pourront être assemblées de plusieurs façons en permettant à l'enfant d'évoquer le plus grand nombre possible d'êtres et d'objets de son environnement.

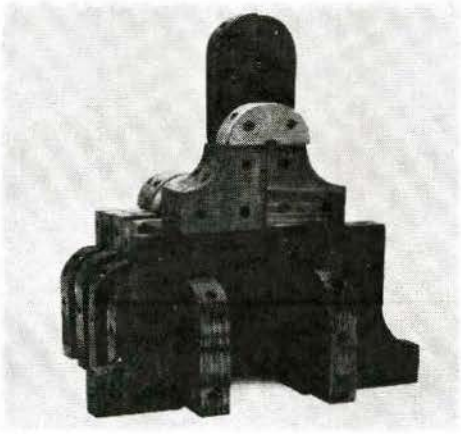
Les assemblages devront permettre cette évocation non seulement par le contour et les limites des choses, mais aussi par la représentation de certaines de leurs caractéristiques formelles ou propriétés essentielles, par exemple: la capacité de contenir d'une maison, d'un train; la capacité de se mouvoir des animaux; la structure d'une bicyclette, etc.

Les éléments composants du jouet devront de plus être choisis et élaborés de façon à offrir une possibilité d'emballage dense et une manipulation naturelle par l'enfant, dont l'âge n'est pas déterminé. *P. Morisset, B. Bernier, P. Girardin, P. Larochelle.*

A Toy to Assemble

One of the problems given to first year students at the School of Architecture Laval University, was to design a toy to assemble. It was to consist of a number of different forms which could be combined in many ways so that a child could make objects from his environment. It should be possible for the child not only to interpret the external form of a thing but some of its formal or essential qualities as well, for example: the capacity of a house or a train to contain, the ability of an animal to move, the structure of a bicycle, etc. The elements of the toy were to be selected and developed so that they could be close-packed and manipulated in a natural way by a child of unspecified age.

Seven of the solutions were sent to us by Prof. Luc Durand, joint director of the Laval School of Architecture. They are shown on this and the following page.



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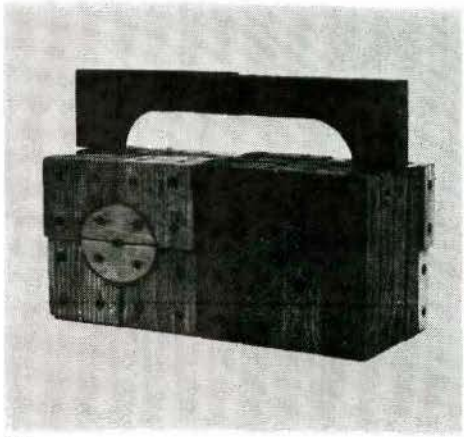

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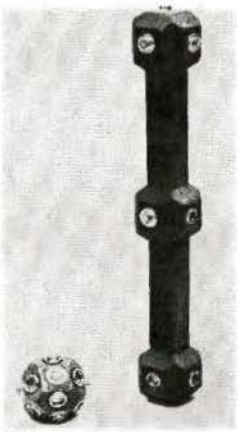

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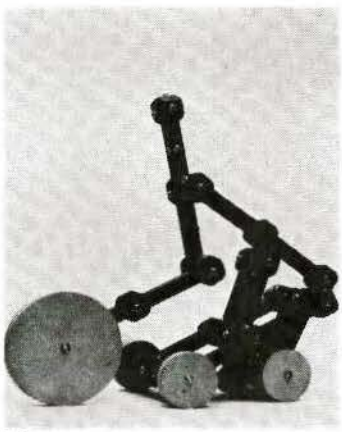

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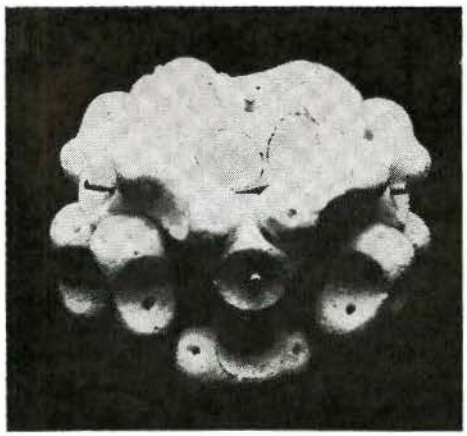

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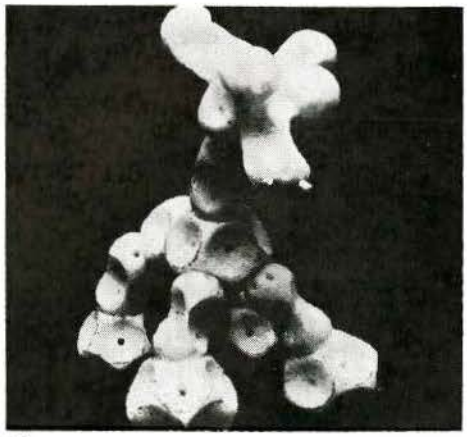

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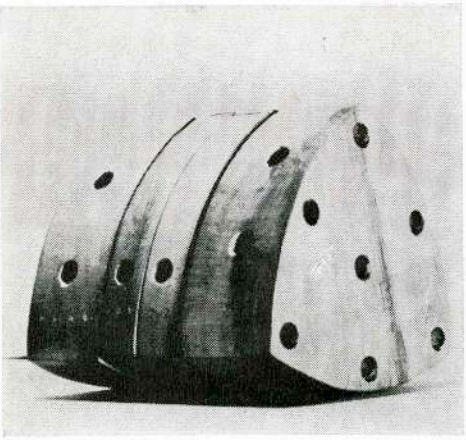

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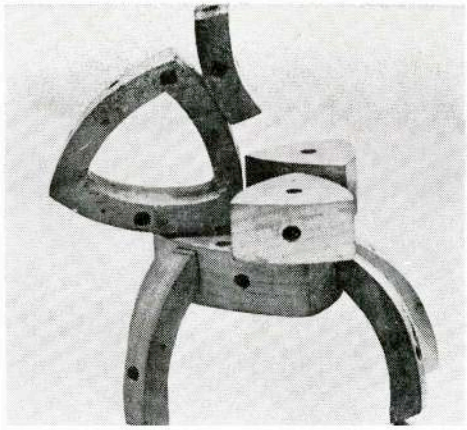

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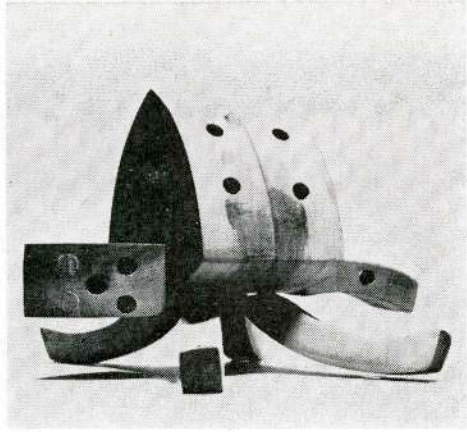

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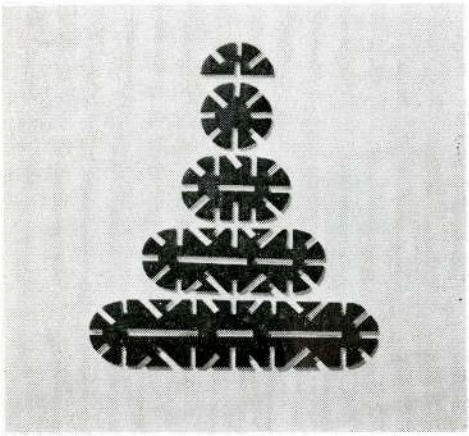

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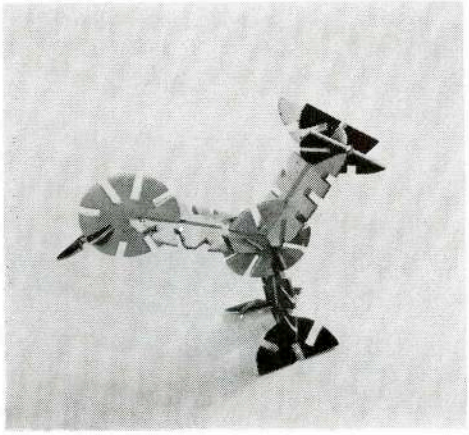

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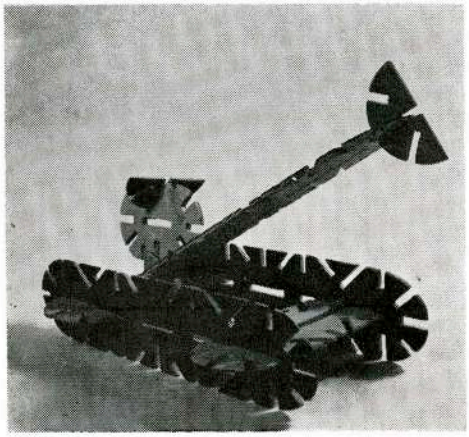

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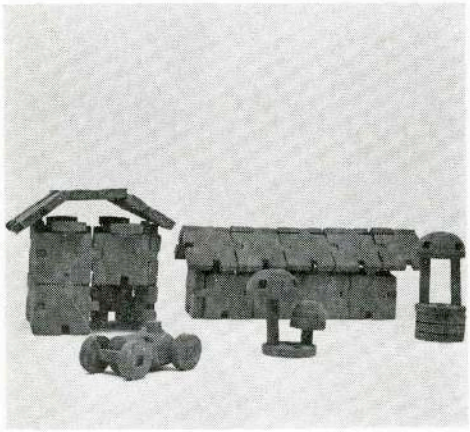

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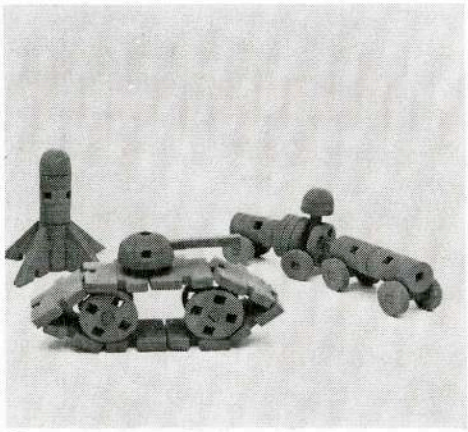

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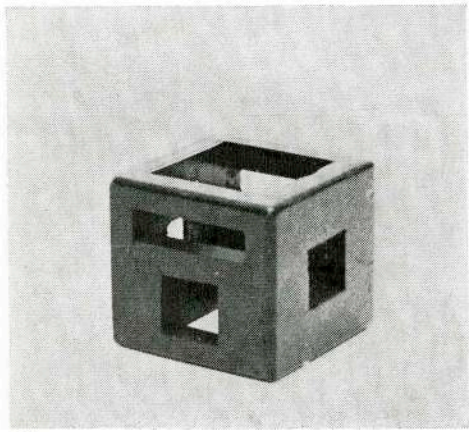

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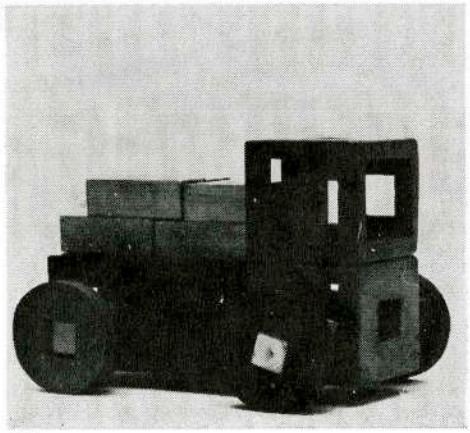

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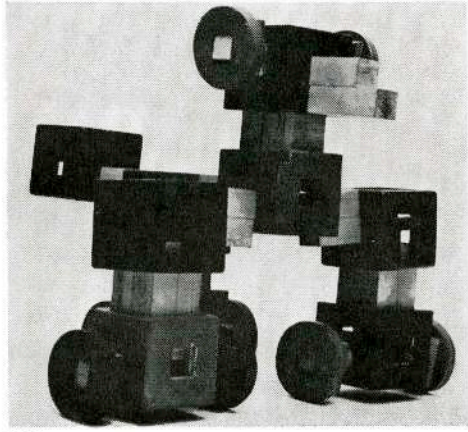

g3

Letters
Lettres

8

Husky Tower

The Editors:

In your section "Number 4, Review" in the September issue, mention is made of Husky Tower, Calgary, which most unfortunately is completely inaccurate.

We are the architects for the Tower, which was finished and in operation since the end of June, 1968.

May we suggest that your "A.J.D." and "B.M." check with the architects on buildings to be mentioned, thus avoiding this type of "happening" which to a sensitive client can be most disturbing. We have photographs and plans of the finished Tower and enclose a small brochure of the "event". Perhaps you might wish to feature an article and thus assist the tourist traffic to sunny Calgary. Some of them might even carry on to our colder sister city to the north and advise A.J.D. of this current attraction.

A. Dale, MRAIC, Calgary

Editors' Note:

We apologize for any inaccuracy. This material was published from an undated press release.

AJD and BM

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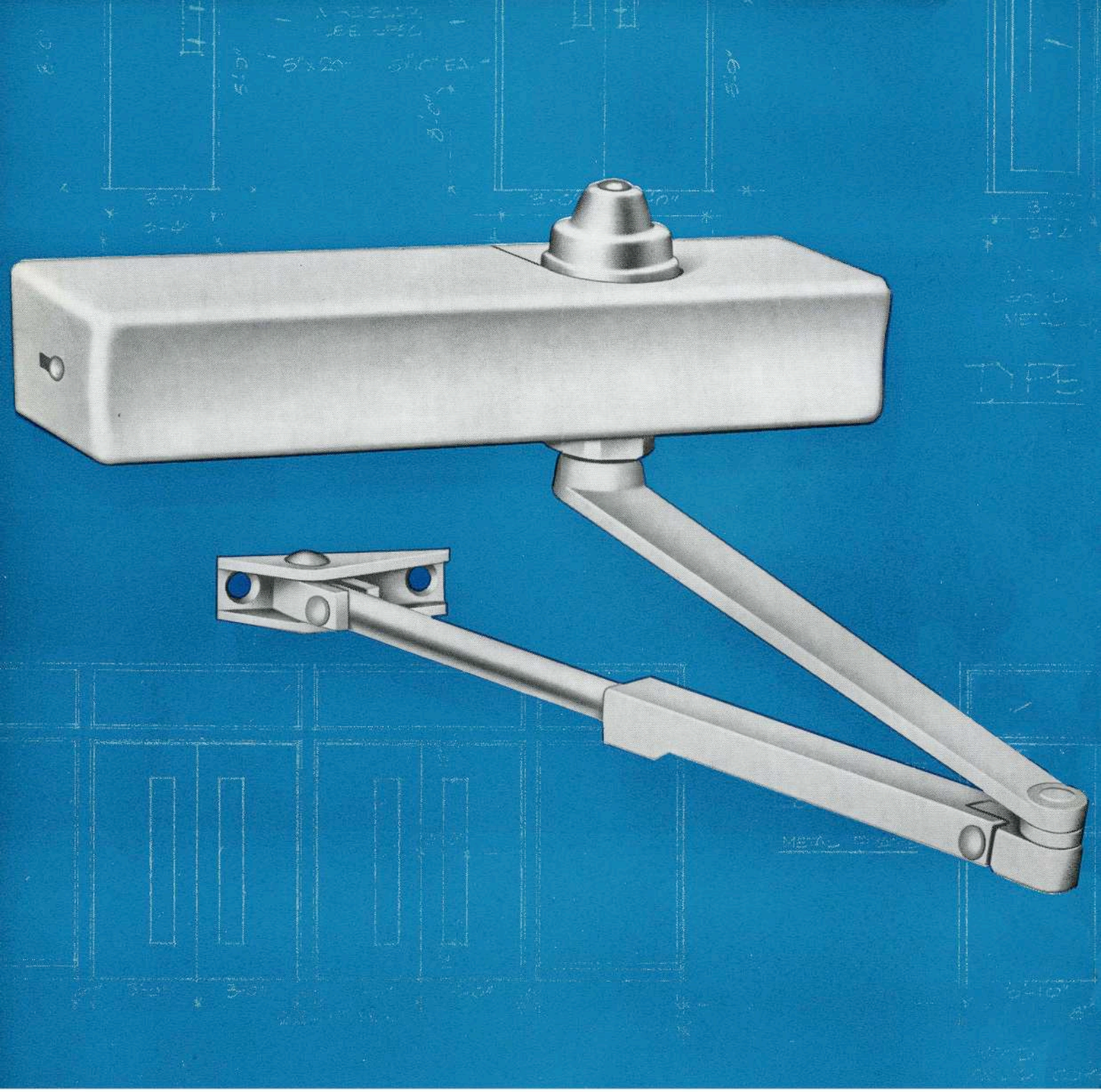

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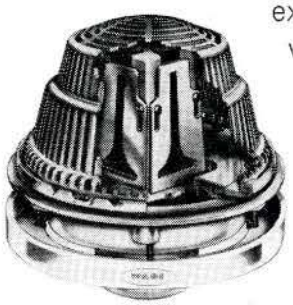
This remarkable little 4"x6" piece of cast aluminum can save you up to $24,000 (sometimes more) on construction costs.

It's the parabolic weir that's standard on the new Wade Meter-Flo roof drains. With it you can control with mathematical precision exactly how fast you want water to drain off a roof.



The roof itself becomes part of your drainage system. Excess rainwater is temporarily stored for drain down at whatever rate you select for your drainage system.

That way you don't have to waste unnecessary extra dollars on piping with a big enough diameter to drain off the worst storm that will occur in the next fifty years.

That could save you up to $24,000 (possibly more) on your next flat or sloped roof building.

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Wade

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The Sealair Window is available in projected, casement, top-hinged open-in or out, double hung, double-double hung, bottom hinged, vertically pivoted, and seamless mullion types. The illustration shows how Sealair Windows can be custom designed to blend unobtrusively with contemporary fascia treatment. Credits—North American Tower, Olympia Square, Toronto. Architects: Bregman and Hamann, Toronto, Ontario.

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Classified
Annonces
Classées

9

Advertisements for positions wanted or vacant, appointments, changes of address, registration notices, notices of practices including establishment or changes in partnership, etc., are published as notices free to the membership.

Positions Wanted

Fillipino Architect, 24, B.S. Architecture, University of Santo Tomas, National University, 4 years office experience seeks position in Canada. Planning, designing, drafting, specification writing. Write Manuel D. Villamater, 307 M. F. Jhocson, Sampaloc, Manila, Philippines

British Architect, Town Planner seeks position in Toronto, graduate of the Universities of Edinburgh and London, knowledge of French. Write A. M. Hunter, ARIBA, 6 rue Camou, Paris 7e, France

Graduate architect from University of Belgrade, Yugoslavia, postgraduate study in Urban Planning, University of Belgrade, five years experience in city planning, seeks position as junior planner.
Contact: Aleksandar Milenov, 6 Regal Road, Toronto 4, Ontario. Telephone Number 532-1569

Architect/Planner B. Arch; Diploma T.P. (London); AMTPI, Age 30 with six years experience in both architecture and planning seeks interesting and challenging job in Canada. Replies to B. Chadha, 87 Perryfield Way, Ham, Richmond, Surrey-England

Swiss townplanner, 28, leaving Switzerland spring 1969 wishes to contact townplanning offices specialized in industrial development, four years office experience. Write to H. R. Schwarzenbach, 8833 Samstagern, Zh, Switzerland

Associate of Indian Institute, 36, seven years experience with American and Swiss Architects-Engineers seeks position as senior assistant. Write Peter S. Rodrigues c/o James Munce Partnership, 19 Chichester Street, Belfast, Northern Ireland, U.K.

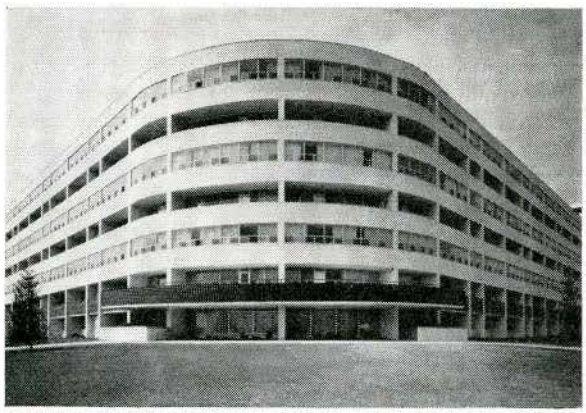
British architectural model maker, 28, 11 years experience in all fields of model making, seeks position in Canada.
C. J. Olney, 40 Alracks, Basildon, Essex, England.

High Park Gardens, Toronto, Ont. *Owners & Builders:* Oak Pacific Holdings Ltd. *Architects & Consulting Structural Engineers:* Grozbord, King & Assocs. Ltd. *Masonry Contractor:* O. M. Construction Co. *Concrete Masonry Units:* Richvale Block Supply Co. Ltd. *Ready-Mixed Concrete:* Richvale Ready Mix Ltd.

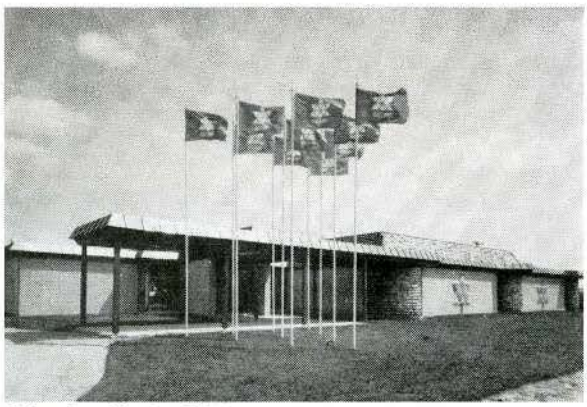
Gramercy House, Toronto, Ont. *Owners & Builders:* Greenwin Construction Company Ltd. *Architects:* Harry B. Kohl. *Consulting Structural Engineers:* Kazmar Consultants Ltd. *Masonry Contractor:* New Hillmount Construction Company. *Concrete Masonry Units:* Richvale Block Supply Co. Ltd. *Ready-Mixed Concrete:* Richvale Ready Mix Ltd.

Apartment Complex at 100 Maitland Street, Toronto, Ont. *Owners, Architects & Builders:* Grozbord, King & Associates Ltd. *Consulting Structural Engineers:* Kazmar Consultants Ltd. *Masonry Contractor:* J. Russo Masonry Contractors. *Concrete Masonry Units & Ready-Mixed:* Richvale Ready Mix Ltd.

The Attache, on Shaughnessy Blvd., Toronto, Ont. *Owners & Builders:* North Valley Const. Ltd. *Architects:* E. I. Richmond. *Consulting Structural Engineers:* Alex Tobias & Associates Ltd. *Masonry Contractor:* Omar Masonry Contractors Ltd. *Ready-Mixed Concrete:* Mel-Mix Concrete & Asphalt.



Markham-Eglinton Square, Toronto, Ont. *Architects:* Martin L. Mendelow. *Consulting Structural Engineers:* Farkas, Barron, Jablonsky. *General Contractor:* F.T. Developments Ltd. *Masonry Contractor:* M. Rodaro Co. Ltd. *Concrete Masonry Units:* Meteor Building Supplies Ltd. *Ready-Mixed Concrete:* Mel-Mix Concrete & Asphalt.

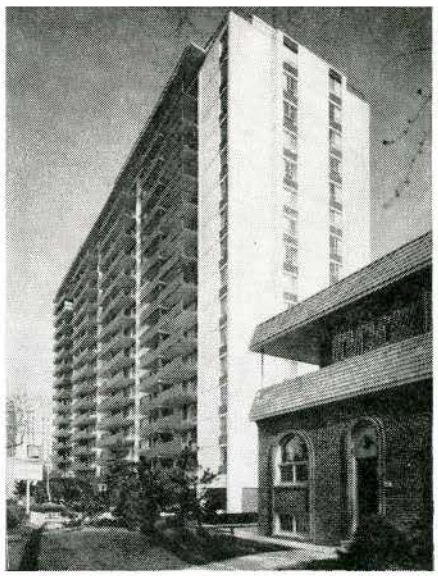


Columbus Centre, Kitchener, Ont. *Owners:* Corporation of the Knights of Columbus. *Architects:* Horton & Ball. *Consulting Structural Engineers:* McCargar & Hachborn Ltd. *General Contractor:* Brandon General Contractors Ltd. *Masonry Contractor:* Seibel Masonry Ltd. *Concrete Masonry Units:* Forwell Ltd. *Ready-Mixed Concrete:* Albert Raith Cement Contractor Ltd.

Prague Towers, 737 Birchmount Road, Toronto, Ont. *Architects:* Keywan & Kassian. *Consulting Structural Engineers:* Farkas, Barron, Jablonsky. *General Contractor:* Prague Towers Investment Ltd. (*Owner & Builder*). *Masonry Contractor:* Gottardo Contracting Co. Ltd. *Concrete Masonry Units:* Richvale Block Supply Co. Ltd. *Ready-Mixed Concrete:* Richvale Ready Mix Ltd.

The Forest Hill Apartments, Montreal *Owners & Builders:* Raoul Blouin Ltée. *Architects:* Charles Grenier. *Consulting Structural Engineers:* G. Horvath & Associates. *Masonry Contractor:* U. Tomassini & Frères Ltée. *Ready-Mixed Concrete:* Francon Limited.

"Top of the Valley" Apartment Complex, Toronto, Ont. *Owners:* The Rubin Corporation & Mr. Jos. Godfrey. *Architects:* Henry Fliess. *Consulting Structural Engineers:* Reicher Bradstock & Associates Ltd. *General Contractor:* The Top of the Valley Limited. *Masonry Contractor:* Zachary De Vuono. *Concrete Masonry Blocks:* Richvale Block Supply Co. Ltd. *Ready-Mixed Concrete:* S. McCord & Co. Ltd.



Greenwin Place (East) Toronto, Ont. *Owners:* New Age Development Company. *Architects:* Harry B. Kohl. *Consulting Structural Engineers:* Kazmar Consultants Ltd. *General Contractor:* Greenwin Construction Company Ltd. *Masonry Contractor:* Village Contractors. *Concrete Masonry Units:* Richvale Block Supply Co. Ltd. *Ready-Mixed Concrete:* Richvale Ready Mix Ltd.

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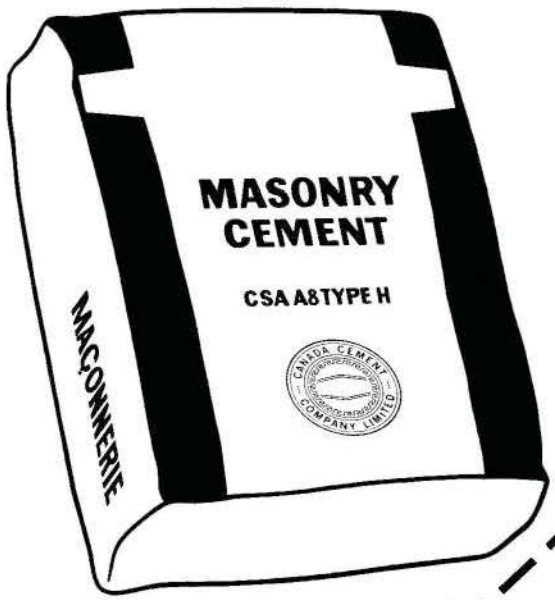

Open one bag. Mix with sand and water. With this simple formula, you can turn out masonry mortar with virtually no mixing errors because all the ingredients of "Canada" Masonry Cement are interground during manufacture. These include an air-entraining agent that combats freeze and thaw and provides plasticity and durability. Masons know that "Canada" Masonry Cement assures mortar uniformity — in workability, colour, strength, and yield, batch after batch. It exceeds rigid ASTM and CSA specifications.

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Index to Advertisers

How do you keep concrete in place on a 32° slope?

Design the mix with POZZOLITH.

The soaring, cone-shaped roof of Vancouver's spectacular H. R. MacMillan Planetarium and Centennial Museum complex is further evidence of POZZOLITH's ability to improve the workability and cohesiveness of concrete.

Shotcreting was originally recommended for construction of the roof which spans 130′ in diameter and measures 72′ to the peak. However, the general contractor elected to place the concrete and—in spite of the 32° slope—the cohesive POZZOLITH concrete stayed in place. And it finished nicely.

POZZOLITH also helped to exceed the specified strength of 5,000 psi by 2,000 to 2,500 psi.

700 precast POZZOLITH concrete sections also went into this project, including panels up to 30′ in length.

You'll find POZZOLITH used wherever predictable concrete performance is needed—on routine as well as complex pours such as this. Like to know more about POZZOLITH and how you can benefit from using it? One of our field men will be happy to talk it over with you. General office and factory—Toronto 15, Ontario. Branch offices: Vancouver, Calgary, Edmonton, Saskatoon, Winnipeg, London, Ottawa, Montreal, Moncton.

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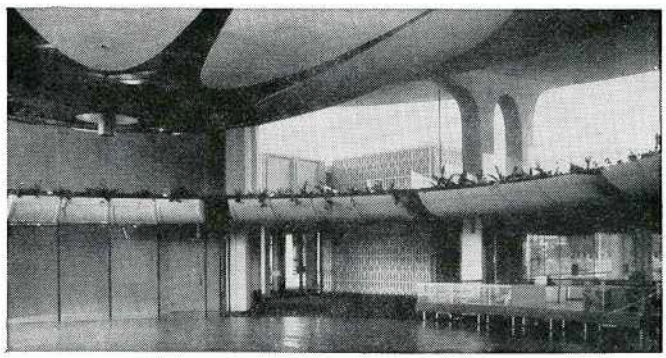

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Take a look at the Tempo and Manoir panels. Both designs are embossed, tone on tone. Another industry first for Domtar.

So find out for yourself what's so hot about our new fire-rated ceiling systems. Call Domtar Construction Materials Ltd. for samples and technical literature.

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