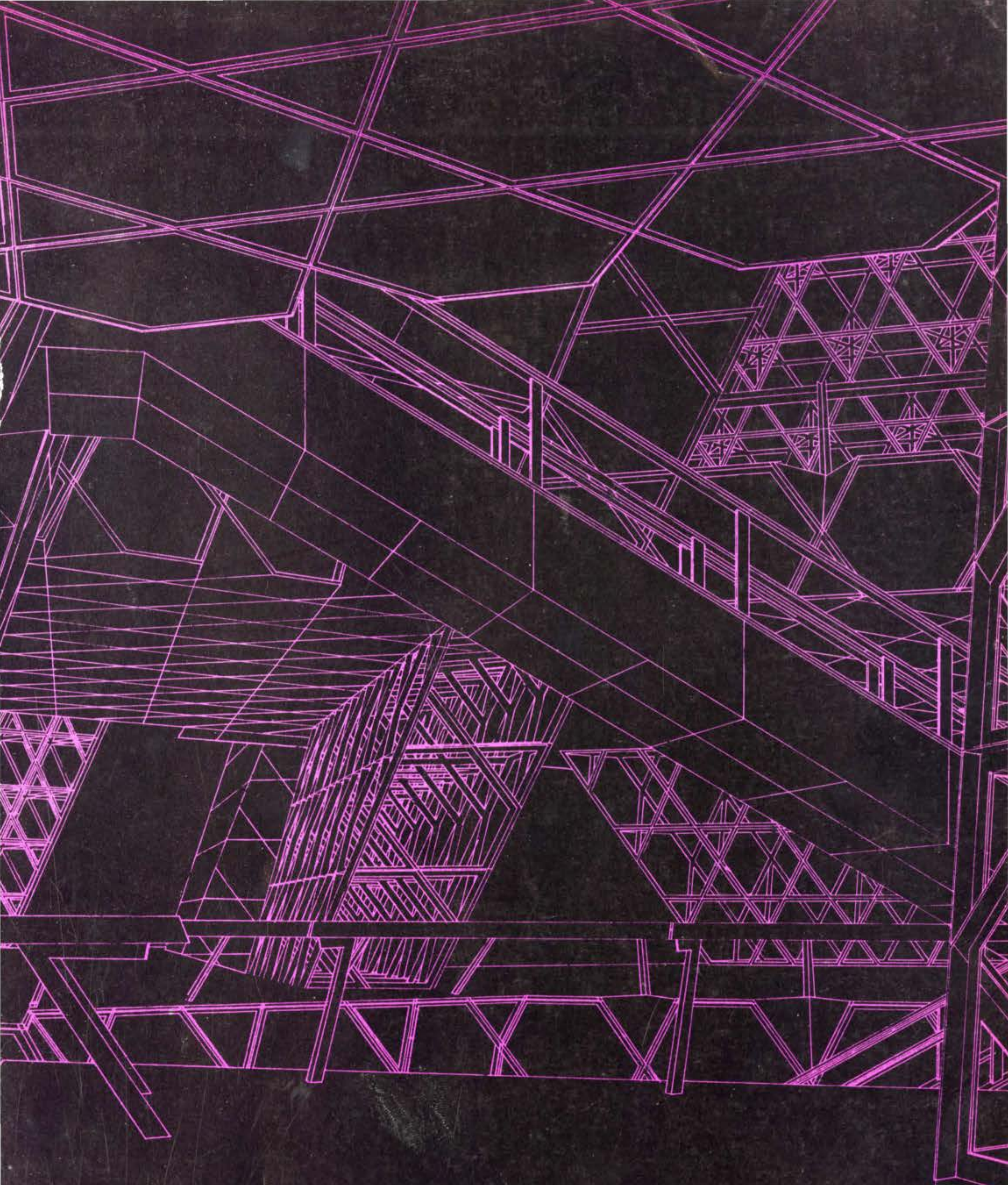

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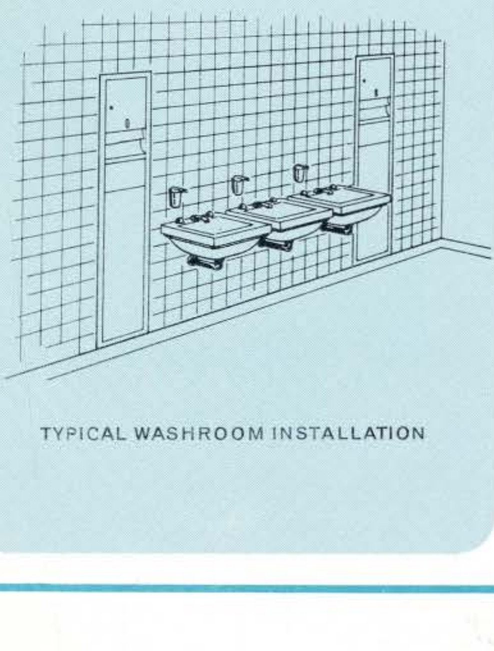

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JOURNAL
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October 1964 Octobre 469 Vol 41 No 10

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L'Institut Royal d'Architecture du Canada

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HEADQUARTERS/SIÈGE

88 Metcalfe Street, Ottawa 4, Ontario

EXECUTIVE DIRECTOR/DIRECTEUR GÉNÉRAL
Fred W. Price

EXECUTIVE SECRETARY/SECRÉTAIRE ADMINISTRATIF
Maurice G. Holdham, MBE

Institute News

EXECUTIVE COMMITTEE

The RAIC Executive Committee met in Winnipeg September 18-19. Appointments to standing and special committees were confirmed; reports of committees, including one on progress of the Committee on the Profession were presented; dates and locations for future assemblies up to 1970 were proposed, and congratulations were extended to the Journal on the productions of the first issue of the Architectural Directory Annual. Members of the Executive Committee of the Manitoba Association of Architects, led by their president, J. E. Whenham, were invited to attend part of the first afternoon's session to discuss MAA resolutions concerning CMHC and NHA housing, and the effect of sales tax on architects fees.

Those present were President F. Bruce Brown (F), Toronto; Vice-President Gérard Venne (A), Québec; Honorary Secretary C. A. E. Fowler (F), Halifax; Immediate Past-President John L. Davies (F), Vancouver; and Councillors Gordon Arnott, Regina; P. T. M. Barott (F), Montreal; W. B. Guihan, St. John's, Nfld; William G. Leithead (F), Vancouver; Gilles Marchand (A), Montréal; Norman H. McMurrich (F), and Earle C. Morgan (F), Toronto; John R. Myles, Saint John; James Searle, Winnipeg, Hugh W. Seton, Calgary; Fred W. Price, Executive Director and Maurice G. Holdham, Executive Secretary, Ottawa.

SALARIED ARCHITECTS COMMITTEE

The meeting agreed with a recommendation of the committee that steps should be taken in collaboration with engineer organizations to seek the requirement for registration of architects in government employ. While the Institute could deal only with the Federal Government on a national basis, any progress would greatly assist the provincial associations in making similar representations to their own governments. If the approaches were successful, some adjustments might have to be considered to give representation to this group in RAIC affairs.

NEW ADDRESS

Effective December 1964

RAIC Headquarters is in

Suite 1101, 75 Albert, Ottawa

NOUVELLE ADRESSE

de l'IRAC depuis décembre 1964

INTERNATIONAL RELATIONS COMMITTEE

Now that the RAIC has joined the International Union of Architects, it was decided that this committee would be replaced by the official representatives to the various international bodies with whom the Institute has contact. Joseph Pettick, Regina, chairman of the former committee, will act as RAIC representative to the IUA. The VIII International Congress of the IUA is to be held in Paris in 1965, and the four man RAIC delegation will include the President, Past President John L. Davies, Mr Pettick, and a delegate from the PQAA. Heads of schools are being urged to attend the Congress, and it is hoped for a good respresentation of members at large, so that a group transportation fare rate may be obtained. Members will be encouraged to take out subscriptions to the IUA Review ($5.00 per year for six issues), and to acquaint members with the Review, 200 copies will be purchased for free distribution at the next Assembly.

RAIC SPORTS FACILITIES EXHIBIT, TOKYO

The Executive Director reported that the display panels of the five entries for the Tokyo Exhibition from RAIC members had been arranged by Mr Derek Buck, chairman of the Editorial Board. The Journal had looked after their organization, design and dispatch.

(Continued on page 14)

Front row: Members of the Manitoba Association Council (left to right), B. F. Schaeffer, I. Coop (*F*), J. E. Whenham (President MAA), D. H. Carter (*F*), J. P. Lewis, A. H. Waisman, V. Sobkowich; second row: RAIC Executive Committee P. T. M. Barott (*F*), Montreal; E. C. Morgan (*F*), Toronto; W. B. Guihan, St John's; G. Marchand (*A*), Montreal; H. W. Seton, Calgary; N. H. McMurrich (*F*), Toronto; J. R. Myles, Saint John; G. R. Arnott, Regina; top row: M. G. Holdham, Executive Secretary; F. W. Price, Executive Director; C. A. E. Fowler (*F*), Halifax, Honorary Secretary; Gérard Venne (*A*), Québec, Vice-President; Dr F. B. Brown (*F*), Toronto, President; J. L. Davies (*F*), Vancouver, Past President; J. E. Searle, Winnipeg; and W. G. Leithead (*F*), Vancouver. (Photo by Campbell & Chipman)


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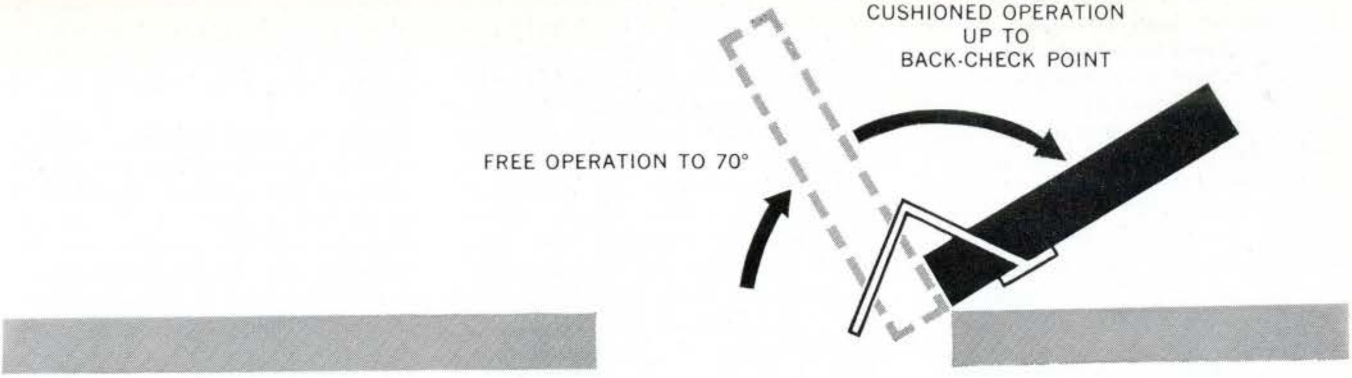

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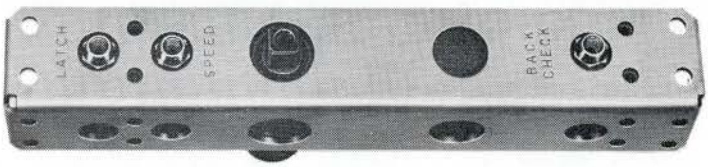

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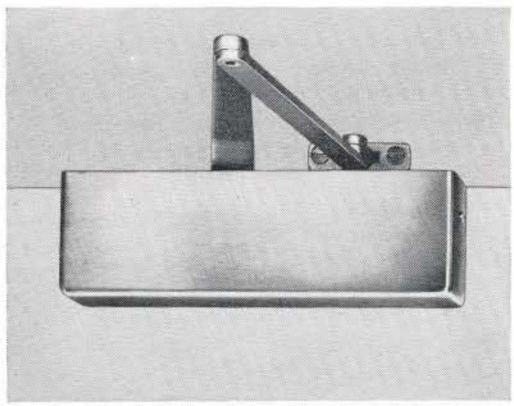

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COMMITTEE ON FUTURE ASSEMBLIES

Locations for future assemblies and the recommendation for enlargement of committee functions were highlights of the assembly committee's report.

Future assembly locations were proposed as follows: 1968, Regina; 1969, Province of Quebec (either Quebec City or Murray Bay); 1970, Winnipeg; 1971, Toronto (or area); and 1972, British Columbia (possibly Victoria). Dates and locations up to 1967 are already confirmed as 1965, Montreal; 1966, Jasper; and 1967, Ottawa.

The functions of the committee on future assemblies will be enlarged to put forward recommendations as to the organization, logistics and planning detail of assemblies; to review programs to avoid repetitious material and to assist in establishing stimulating programs. It was emphasized that they would be a sounding board for the local committees rather than direct or authorize Assembly arrangements.

1965 ASSEMBLY, MONTREAL

The 1965 Assembly will be held from June 9 - 12th at the Queen Elizabeth Hotel. This assembly will have no set theme. P.T.M. Barott, *(F)*, Chairman of the Host Committee, also reported that to date, 30 booths had been sold for the manufacturers' exhibition to be held with the assembly.

APPRECIATION TO EXECUTIVE SECRETARY

The Executives' awareness and gratefulness for the excellent service being given to the Institute by Maurice Holdham, MBE in the course of his work as executive secretary was placed on the record.

GROUP INSURANCE FOR RAIC MEMBERS?

Letters to determine interest in the possibility of group life and disability insurance for RAIC members are being sent to the secretaries of Provincial Associations.

RAIC COMMITTEES AND MEMBERS

Members of standing and special committees were named as follows:

Architectural education: John L. Davies *(F)* chairman (members to be named by chairman); *Scholarships and Awards:* A. T. Galt Durnford *(F)*, Montreal, chairman; H. Gordon Hughes *(F)*, Ottawa; Henri Mercier *(A)*, Montréal; Earle C. Morgan *(F)*, Toronto; F. J. Nobbs *(F)*, Montreal; Peter M. Thornton *(F)*, Vancouver; Gérard Venne *(A)*, Québec; *Competitions:* Edouard Tremblay, chairman, André Blouin, G. Marchand *(A)*, F. J. Nobbs *(F)*, Guy St. Aubin Mongenais, all of Montreal; G. D. Gibson *(F)*, Toronto; and A.W. Davison, Ottawa; *Public Information:* P. T. M. Barott *(F)*, chairman, and H. P. Labelle, Montreal; A. Avramovitch, Halifax; C. J. Congdon, St. John's, Nfld; Alfred Chatwin, Saint John; E. C. S. Cox *(F)*, Toronto; K. L. MacMillan, Regina; Mrs Freda O'Connor, Edmonton; P. M. Scott, Saskatoon; *Legal Documents:* Robert S. Briggs, chairman, and C. S. Jarrett, Toronto; Isadore Coop *(F)*, Winnipeg; *Massey Medals:* Dean John A. Russell *(F)*, chairman, Winnipeg; Prof. John Bland *(F)*, Dean Guy Desbarats *(A)*, Montreal; Prof. Henry Elder, Vancouver; Dr Thomas Howarth *(F)*, Toronto; H. Gordon Hughes *(F)*, Ottawa; *Duty on Plans:* L. E. Shore (F), chairman, Toronto; Richard E. Bolton *(F)*, Montreal; Howard L. Bouey *(F)*, Edmonton; Allan F. Duffus, Halifax; H. A. Larson, Saint John; Stewart E. Lindgren, Winnipeg; George Y. Masson *(F)*, Windsor; John R. Myles, Saint John; Frank Noseworthy, St John's; John H. Wade *(F)*, Victoria. *Committee on the Profession:* H. H. G. Moody *(F)*, chairman, Winnipeg; Peter Dobush *(F)*, Montreal; P. M. Keenleyside, Toronto; Henri Mercier *(A)*, Montreal; W. G. Raymore *(F)*, Toronto; Peter M. Thornton *(F)*, Vancouver; *Housing* (RAIC - CMHC): James A. Murray *(F)*, chairman, Toronto; James W. Strutt *(F)*, Humphrey Carver, A. J. Hazeland, Ian Maclennan *(F)* all of Ottawa; John Bland *(F)*, Montreal; *Architect-Engineer Joint Committee:* C. A. E. Fowler *(F)*, chairman, Halifax; John Dayton, Vancouver; Francis J. Nobbs *(F)*, Montreal; Fred W. Price, Ottawa; James E. Searle, Winnipeg; *Canadian Architecture Abroad (Dept. of External Affairs):* F. Bruce Brown *(F)*, chairman, Toronto; H. Gordon Hughes *(F)*, Ottawa; Henri S. Labelle, *(A)*, Montreal; *Canadian Joint Committee on Construction Materials:* Robert E. Briggs, Vice-Chairman, Toronto; Gordon Arnott, Regina; Peter T. M. Barott *(F)*, Montreal; Ernest Smith *(F)*, Winnipeg; André Tessier, Québec; *Journal:* Loren A. Oxley *(F)*, chairman, Toronto; André Blouin, Montreal; F. Bruce Brown *(F)*, Toronto; Derek Buck, Toronto; Ronald Dick, Toronto; Earle C. Morgan *(F)*, Toronto; James W. Strutt *(F)*, Ottawa; *Editorial Board:* Derek Buck, chairman, Toronto; (see Journal, page 5 for members); *Wintertime Construction (Joint Committee with Dept. of Labour,* CCPE, NRC*):* Sidney Lithwick, chairman, Ottawa; M. Kohler and Fred W. Price, Ottawa.

CANADIAN DESIGN AWARDS

The first Canadian Design Awards competition for outstanding achievement in the creative use of structural steel in the design of Canadian buildings has been announced by the National Design Council in association with the Department of Industry. The awards are to encourage and honor noteworthy accomplishments in this field by registered architects and engineers practicing in Canada. The aims and terms of the awards have been endorsed by the RAIC.

Awards of design excellence are to be made by a jury of well-known Canadian architects and engineers. The chairman of the jury is James A. Murray (F), Toronto; and the members are Guy Desbarats (A), Dean, l'Ecole d'Architecture, Université de Montréal; D'Arcy Helmer, President, Ontario Association of Architects; Ignace Brouillet, P.Eng., President, Corporation de l'Ecole Polytechnique de Montréal; Robert F. Shaw, P.Eng., Deputy Commissioner General, Canadian Corporation for the 1967 World Exhibition.

Awards may be made in each of four classifications: buildings costing $2,000,000 or over; buildings costing less than $2,000,000; bridges costing $500,000 or over; and bridges costing less than $500,000. To qualify, buildings and bridges must be located in Canada and have been completed during the three years prior to September 1, 1964.

Candidates are asked to submit a "Notice of Intention" to the National Design Council in Ottawa by December 1, and their preliminary submissions by December 15, 1964. Preliminary judging will take place in January, 1965 and final adjudication in February, 1965.

In addition to certificates of design excellence, a suitably inscribed plaque will be prepared for attachment to the award-winning buildings and bridges. As a memento, winning designers also will receive a replica of their work executed by a leading Canadian sculptor. Award winning submissions subsequently will be exhibited at the Design Centre in Toronto and in centres across the country.

Details of the competition may be obtained from The National Design Council, c/o Department of Industry, Ottawa, Ontario.

(Institute News continued on page 85)

Letters

Editor, RAIC Journal

I think the "resume" of the Bellmere Public School featured in your July edition is an insult to the intelligence of your architect readers. The first few paragraphs stress the residential character of the school and are its main raison d'etre while the following paragraphs explains that the usual window walls are omitted so that the children cannot be distracted by events outside. Apparently the "homey" atmosphere is not meant for the classroom where the children spend most of their school hours.

N. L. Irwin, Toronto.

Book Reviews

THE COURT-GARDEN HOUSE, by Norbert Schoenauer and Stanley Seeman, McGill University Press, 1962, 204 pages, $6.00.

BY RONALD WHITELEY

This book is perhaps the first one to study seriously the Court Yard House. There have been many works on the subject of a specific type of house, such as the Roman House or the Spanish Court Garden House, but in this book we have a rather comprehensive examination of the type, its roots in prehistory, its development through the ages, its contemporary flowering, and how it may be adapted to Canadian conditions. Indeed it was pointed out to me that this type of dwelling is ideal in a situation such as is usually found in Saskatchewan; where the wind is strong and constant, with a wide variation in temperature, and a flat, continuous, and visually uninspiring landscape.

The book is divided into four main sections, each dealing with some aspect of the Court Garden House; a history of the type (or as the authors put it "the genesis of the vernacular"); some contemporary examples; a fairly detailed analysis of the concept and, last but by no means least, a discussion of its adaptability to the Canadian scene. Each section is dealt with in the same manner, using the same format. The method employed is to present on the left hand page, which is tinted grey, a pen and ink sketch of plans or houses, and to discuss the sketches in a well written and lucid text on the right hand page. In most cases this works very well and makes for clarity and easy reading. Occasionally the sketches and text don't quite match up, but this was probably unavoidable.

The idea of using the same layout for the four sections — while giving the book a strong unity and continuity — is, perhaps, a little monotonous and dull.

The section on the adaptability of the Court-Garden House to Canadian conditions is an outstanding part of the book. This is especially true of the discussions of the Court House and the Canadian climate, which is a very thorough exploration of this important subject.

The book is quite easy to read, not perhaps as engrossing as the accounts of the exploits of James Bond, but interesting in its own way. The square shape of the book and its cloth binding make it attractive, and it would be a worthwhile addition to anyone's library.

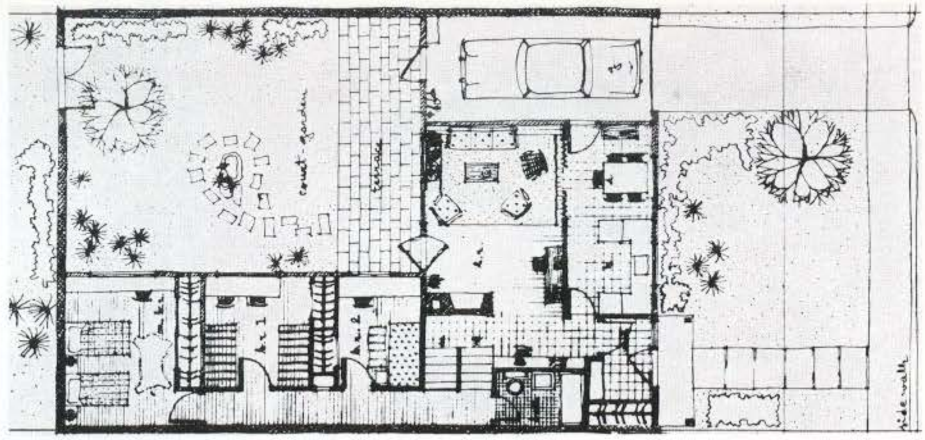


Illustration from the *Court Garden House*

RECENT BOOKS RECEIVED

PLANNING FOR MAN AND MOTOR, by Paul Ritter, Pergammon Press, Collier-Macmillan Canada Ltd., New York, 1964, 384 pages, $16.50.

ARCHITECTS' WORKING DETAILS REVISITED, by Michael Devereau, The Architectural Press, London, 1964, 198 pages, illustrated, 36s.

BEER PRECAST CONCRETE INVADES APARTMENT FIELD

Apartment Tower—The Lonsdale, 619 Avenue Rd., Toronto

In what is reported to be the first major invasion of precast concrete into the luxury apartment field — the exclusive Lonsdale Apartment now under construction at 619 Avenue Rd., Toronto, offers an impressive new look for apartment buildings.

Designed by Hancock, Little, Calvert Associates and M. S. Yolles Associates Ltd. the 17 storey tower has four large apartments per floor and features insulated precast concrete wall panels by Beer Precast Concrete Ltd.

Although the original plan for the concrete building called for the use of conventional brick and block back-up construction in external walls — the architect's desire to express the harmony and serenity of the main structural concept led to the consideration of using concrete externally. It was realized that it would be necessary to insulate the outside face of the external wall-columns to overcome the serious problems of partition cracking in the upper floors caused by internal and external temperature differential of 100 degrees. Designing partitions to withstand these stresses or to be flexibly jointed to avoid them was too expensive. The problem then became one of a suitable facing as protection to the insulation.

Before reaching a definite conclusion, alternate materials such as textured aluminum and stucco were considered, only to be discarded for reasons of initial cost, expensive or difficult maintenance. Brick proved to have complications in that shelf angles and ties would have to span across the 1″ insulation from their fixing in the poured concrete column — and brick too would obscure the nature of the building's structure.

Serious investigation of precast concrete indicated that if certain conditions were met, it was both economical and practical, i.e. —

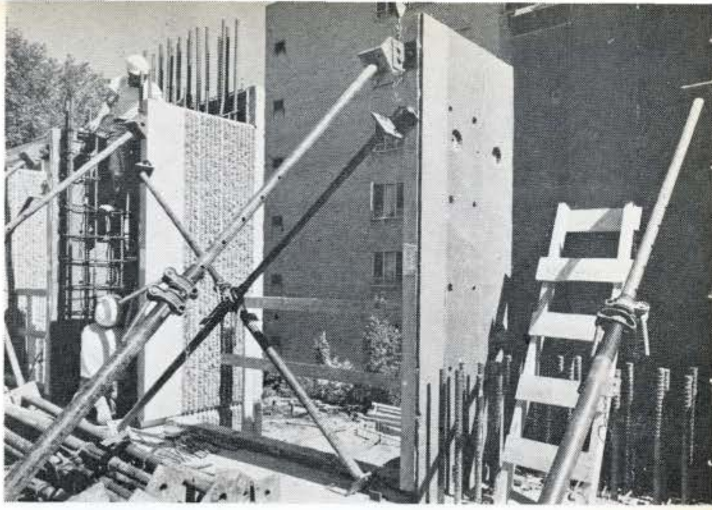
(a) Panels to be of plain concrete without special aggregate facing, and with insulation behind.

(b) Panels to be a full-storey in height and the full width of wall column utilising tower crane on job for setting.

(c) That they be used as part of the formwork to the wall-column and supported separately with insulation between to allow for movement with thermal changes.

Having met these conditions it was found that not only did the precast panels reflect the structure of the building, but economically they competed favourably with highly fired or glazed brick veneer and City authorities showed preference for their methods of support over insulation.

Working with project architect Alan Graham, Beer Precast Concrete Ltd. made full size two-bay prototypes to perfect finish and colour under all conditions of sun and rain. Full height ribs projecting 2″ were broken off and the resulting fracture of the aggregate produced a facing of unusually rich textures and warm grey-brown colour. Precision dowels were fabricated into panels for alignment and fast setting and removable wooden shims used to achieve expansion joints at every floor.

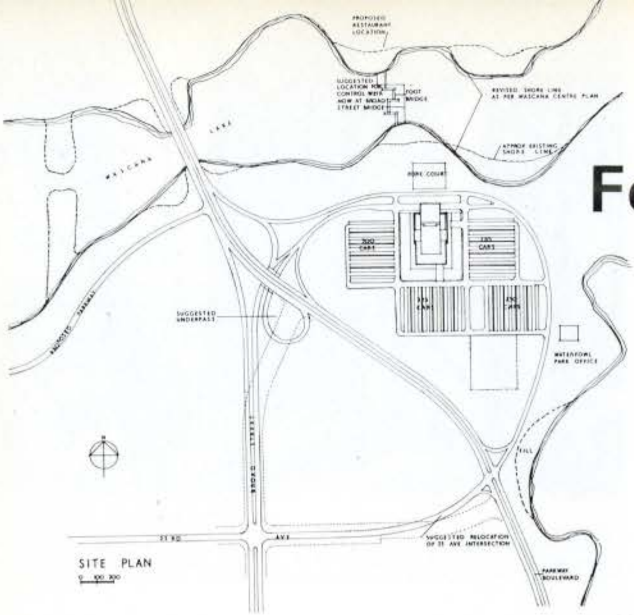


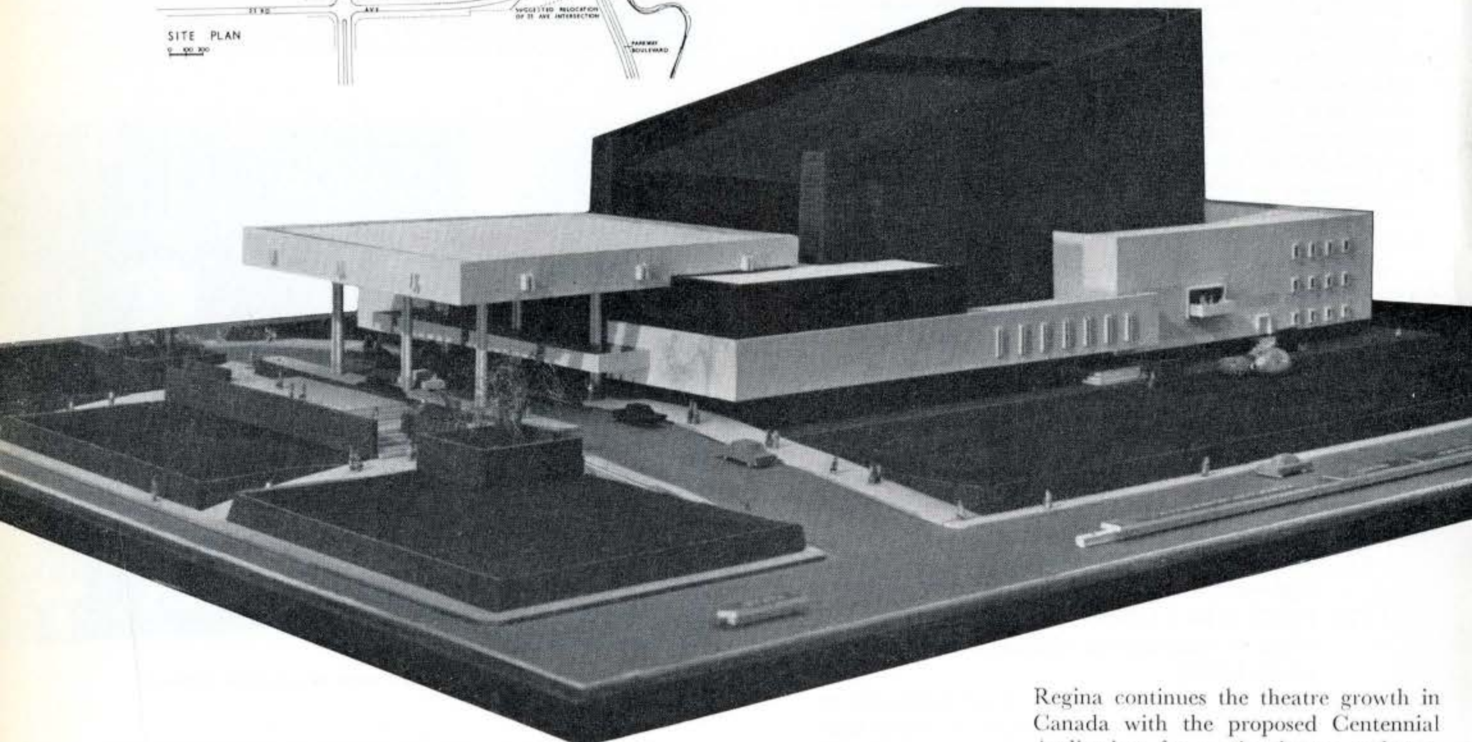
Adjustable Acrow shore braces the panel to floor of building. Insulation placed on back of panel which is used as outside formwork. Larger cutouts are for support bolts which attach panel to structure. Smaller holes are for inner formwork ties. Dowels from reinforced concrete floor below overlap reinforcing cage for floor being poured.

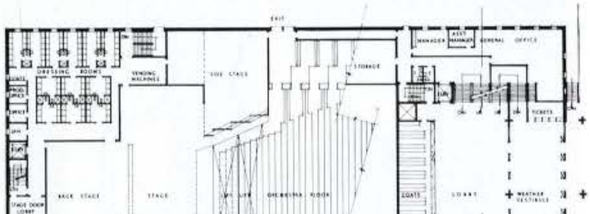
Main steel reinforcing and formwork ties in place ready for inner formwork.

Panel is set on removable wooden shims, utilizing precision dowels for alignment and fast setting of panel above. After column is poured—shims are removed and open joint becomes expansion joint at every floor. No scaffolding required—building is finished on outside face after initial pour, eliminating need for formwork.

Features







MAIN LEVEL

Regina continues the theatre growth in Canada with the proposed Centennial Auditorium for music, theatre and convention purposes. It has been placed, by Yamaski's master plan, within Wascana Centre, where the Saskatchewan Legislative Buildings, Regina College and other planned facilities for community use are judiciously located in this oasis of the prairies. Architects are Izumi, Arnott and Sugiyama. The stage and house have been designed for flexibility. The two side stages and back stage can give a scale of performance from grand opera to intimate drama. The two orchestra lifts when raised, bring the production line to within 68 feet of the rear of the house, reducing the number of seats for greater intimacy. The maximum seating capacity is 2050. As there is no prosenium structure, flexibility in stage lighting allows overhead lightup for thrust stage productions besides the normal prosenium lighting. The lower level convention area has banquet hall, meeting rooms and serving facilities. The auditorium is to be ready by that ominous year 1967. Y.H.

Management Practices

Staff Development

by James W. Vair

(No. 6 in a series of bi-monthly articles)
Mr Vair is a vice-president with The Thorne Group Ltd., Management Consultants.

Only by building up and keeping competent people can you ensure the continuation and long-term prosperity of the firm. The development of an effective response to this challenge requires a careful consideration of the goals of the firm, the process by which staff development comes about, and the factors contributing to professional job satisfaction.

I. THE PROBLEM FROM THE STANDPOINT OF THE FIRM

What is staff development and what does a firm hope to accomplish by pursuing an organized program of this nature? Happily, it does not require the conversion of the firm from a business into an educational institution, as some senior partners fear when they are presented with an inadequate description of the process. The fact is, staff development cannot take place apart from the day-to-day activities of the firm, and classroom instruction if it is part of the program, must be correlated to a large extent with on-the-job experience. This should be apparent when we consider that the aim of staff development from the standpoint of the firm is simply to create the ability to get work done, not to develop a given set of personality traits. In fact, most psychologists and professional business educators will agree that there is no ideal set of personality traits for a job. A person develops when he makes his own decisions and when he can work in his own way. Not everyone in an organization is capable of making many decisions. However, the more the associates and employees of a firm are allowed to make their own decisions, the more these individuals will develop.

This principle was hinted at in the discussion of the position of Project Manager (see ORGANIZATION in the September, 1964 issue), wherein it was stated that "it is desirable to encourage and test the senior employees, for it is from them that the future members of the firm will emerge."

The best approach, then, and one with which I believe most experts would agree, is to assign substantial, definitive amounts of responsibility as early in a man's career as possible. That is, the cornerstone of a staff development program should be the assignment of a specific project, no matter how small, where performance can be measured and where the individual can recognize his own achievement; where, upon the completion of the project, he can say without reservations, "I did this." At the outset, a considerable amount of faith and forbearance may be required from a partner to restrain himself from checking back twice a day to see if the work is being done the way he (the partner) would do it, and the end result is shaping up in accordance with his own personal concept.

This brings up another important element in the process: the principle of "identification," a psychological term to describe what happens when a younger person identifies himself with an admired superior and strives to acquire his characteristics, to absorb his attitudes, and to imitate his behaviour. While identification with a worthy model is not all that is required to become a good architect — obviously, other skills and a fair amount of native talent are also needed — identification is the base upon which all else rests. Conversely, of course, identification with an improper model can be disastrous for a young man. Thus, the responsibility of the principals in a firm to set proper examples for their subordinates is enormous.

Finally, we cannot ignore the importance played in the process by the tangible rewards factor or monetary compensation. This is considered further below in the discussion of what the professional employee wants in his job, but in summing up the firm's responsibility, the following proposition may be stated: "the firm should commit itself to a policy that gives no raises to mediocre performers, that drops poor performers, and that gives outstanding recognition to outstanding performers."[1]

II. FACTORS CONTRIBUTING TO PROFESSIONAL JOB SATISFACTION

At this point, it is useful to examine the attitudes of professional and technical employees towards their jobs, for such attitudes obviously determine their susceptibility to development and their response to any organized program that the firm may undertake. Some of the more important of these are contained in the following factors — points which professional workers themselves have stated to be of major importance in contributing to job satisfaction.

1. Interest potential of work

This need suggests that the partners should constantly strive to assign work that will provide a challenge to the professional employee's technical interests and abilities, and to use effectively his knowledge and skills. In short, do not include in his functions duties which should be properly delegated to a draftsman, a technical assistant, or even a qualified clerk. Re-alignment of responsibilities in accordance with the talents of the architect or engineer may even reveal that a supposed shortage of these specialists can be eliminated, or at least minimized.

2. Integrity of Management

The principals should demonstrate that they also have a code of ethics in directing the internal operations of the firm. The professional needs to know the facts of firm performance, to know the firm's aims and objectives and what is being done about them. By reason of his specialized education, the professional deserves a clear explanation of the firm's

[1]*"The Developed Executive" by Gerald G. Fisch, Management Review, June, 1964.*

ideology and methods in order that his identification with the organization can be based upon respect.

3. Calibre of supervision

This is an area in which the professional is particularly sensitive. In fact, it is no exaggeration to state that the development of a staff member depends to a large extent on the interest shown in his advanced training by the partners of a firm. As was stated in an article which appeared some years ago with reference to a public accounting firm, and which seems to the writer to be equally relevant to a firm of architects, — "by displaying a sincere interest in the development of the younger men, and by ensuring that there is a policy of adequate personal supervision at all levels, the partners can create an environment in which both the desire to teach and the desire to learn can flourish."[2] At the same time, care must be taken to avoid unnecessary multiple supervision, a concept against which the professional rebels. Also, if it is unavoidable to have a supervisor who is not himself a professional exercise jurisdiction over those who are, extra care must be taken to define a practical working relationship where each recognizes the contribution the other can make towards an effective and productive unit.

4. Opportunity to do and discover creative work

Professionals tend to be more career-oriented than firm-oriented. They often find it hard to work on projects not of their own choosing. Naturally, the immediate business interest of the firm determines the nature and timing of his work, and this the professional must accept. However, this does not preclude the firm from ensuring that all opportunities for research and development are first assigned internally to the creative talent of its specialists, whenever possible.

5. Pay

Dissatisfaction with pay does not set the technical and professional employee apart from any other type of employee. The demand for qualified staff among architectural firms in recent years has been sufficiently fluid that, whenever a firm's pay scale has not been competitive, the professionally qualified employee feels compelled to seek another position where his worth will be immediately recognized. Perhaps, it is in the firm's interest that he does so, if his performance is mediocre or just average. It is also interesting to note that a study made to evaluate the causes of professional attitudes on the subject of compensation came to this conclusion: "If you can't motivate with devices other than pay, you can't motivate with pay!"

The above list of points is, of course, by no means all-inclusive. It is sufficient to demonstrate, however, that to the professional, his work is more than just a paid job — and it is probably safe to add that no professional firm would wish for any other attitude.

[2] *"Responsibilities in Staff Training" by Donald C. Scott, The Canadian Chartered Accountant, December, 1961.*

NEXT MONTH: NO. 7, FRINGE BENEFITS

The impact of fringe benefits on employment decisions and business operating costs.

Fringe benefits have become an important segment of an employee's total compensation in almost every business. As a result, it is important for employees to recognize that fringe benefits are a significant part of the cost of being in business.

Steel Structure

This issue contains the results of the Journal's research into current examples of the imaginative use of steel in design, and into significant developments in steel technology. We appreciate the co-operation of Mr Edouard Fiset FRAIC, chief architect, and his colleagues in the Canadian Corporation for the 1967 World Exhibition, and of the consulting architects concerned, in making available preliminary design studies for several Expo '67 buildings (Mr Fiset's comments upon them follow). The Canadian Institute of Steel Construction has been most helpful with information of interest to the construction industry.

Will Expo 67 influence architecture? Has any previous world exhibition or fair ever influenced architecture? An interesting subject for a thesis indeed — argumentative also!

As soon as the question is asked, the memories of the Eiffel Tower, the "Galerie des Machines", the Crystal Palace come into mind: new material used in a daring way, a new scale in construction, the flavor of new adventure in design. I will let the historians and the professors of architecture debate this and draw their own conclusions.

I would like, however, to acknowledge the fact that there is a great turmoil and excitement created around world exhibitions, shared equally by the architect, the scientist or merely the average "badaud", which stimulate a climate favorable for discussions and exchange of opinions. Any innovation, any strong statement in design consequently may become more easily and more quickly a centre of universal attention and thus spread a chain reaction which in turn leads to controversy and research. The climate so created is of no special significance, however, unless it centres around a subject of exceptional quality, which leads to another question: Is Expo architecture "per se" real architecture? Is it not only "make believe", a garment for exhibits, a stunt, a gymnastic display?

At close scrutiny it could be stated that Expo architecture, as much as any architecture, is related to the present way of life, the present conditions, the every day requirements and exigencies created by the ever accelerating growth of multiplied needs and techniques. Expo architecture, if one makes such a distinction so that it is not confused with exhibits "garments", does not seem to differ intrinsically from such architectural expressions which result from solving the design problem created by the requirements of a shopping centre, with its desire to attract and retain visitors and its constant concern to offer a new face; Expo architecture does not differ from a plant built on a modular system for rapidity of construction and ease of expansion, or a contemporary school craving for openness, smooth circulation and attractiveness of its component elements.

Recognizing the challenge and the unique opportunity, Expo 67 is, however, in a somewhat favourable position to bring into being some architectural expressions which may contribute to the evolution of the "noble art". The most important ingredient determining its success is of course, the talent of the architect.

If, at this very early stage, I were to venture to state a way in which Expo could influence architecture, I would suggest the marked tendency to use a cellular or unit system, whether it be a structural, a planning, a design or a functional unit. There are indications that many designers are oriented in that direction. This tendency will become the subject of a close study in the coming months as more and more designs emerge from the mass of production which will come into being.

A limited number of designs for Expo in their preliminary stages are presented to you in these pages. They are different in function, concept and architectural expression though they use the same basic structural approach to design, the feasibility of which is currently being investigated. Will there be a follow-up? Will it lead to a new architectural expression? Will it influence industry and building techniques? Post Expo will tell!

Edouard Fiset

Theme Buildings/Expo '67

Consulting Architects/Affleck, Desbarats, Dimakopoulos, Lebensold, Sise

Partner in Charge/Guy Desbarats (A)
Project Architect/Thomas Ewing Blood; Project Manager/R. H. P. Marshall
Consulting Engineers/Eskenazi, Baraes, deStein & Associates
with Professors Jaeger and Harris, McGill University

The Truncated Tetrahedral Space Frame

The briefing or design program as prepared by the Canadian Corporation for the 1967 World Exhibition embodied a most comprehensive and challenging program which took careful note of the complex building requirements, together with a rigid timetable necessary to ensure the completion of the buildings, services and exhibits in time for the opening of "Expo '67". The physical requirements for this program are summarized as follows:

(a) The buildings would be of a temporary nature;

(b) The structural system must accommodate spans of over 100 feet with average live loadings at 125 pounds per square foot;

(c) The structural system should be able to form large volumes for exhibits;

(d) The building system should be able to change its configuration during the latter stages of working drawing production;

(e) The structure should accommodate a flexible installation of the separate services and their integration with exhibits;

(f) If possible the buildings should be easily demountable to minimize the cost of clearing the land at the conclusion of the Fair;

(g) The character of the buildings must present an unmistakable visual link between the two buildings in their positions on two sites of widely varying characteristics;

(h) The buildings should act as orientation and focal points for the visitors to the fair grounds.

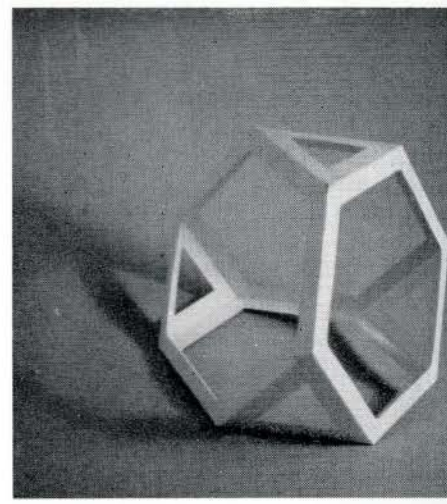
The overlapping between design development of the superstructure and the construction of the substructure created the need for a disciplined yet versatile structural unit, which also offers a variety of solutions to the many problems inherent in the program. In the early stages of design development a large number of structural systems were investigated and found lacking for various reasons. In addition to well-known systems, studies were made of the possible use of suspension structures; interlocking Vierendeel trusses in both concrete and steel; space frames with the various nodal systems presently available; and cellular or block construction.

The principle of devising a structural system based on a "universal cell" or "building brick" which might form walls, floors and roofs appeared to be a solution to the program. A structure based on such a cell would ideally be clipped together in a basic pattern that could be adjusted to meet the developing requirements of the various exhibit designers without interrupting the production of working drawings or construction. To impose a further design requirement on the idea of a cellular construction, the unit should enable the development of open spaces where required, yet withdraw into a quiet grid in those areas where the structure should become the background to individual exhibits.

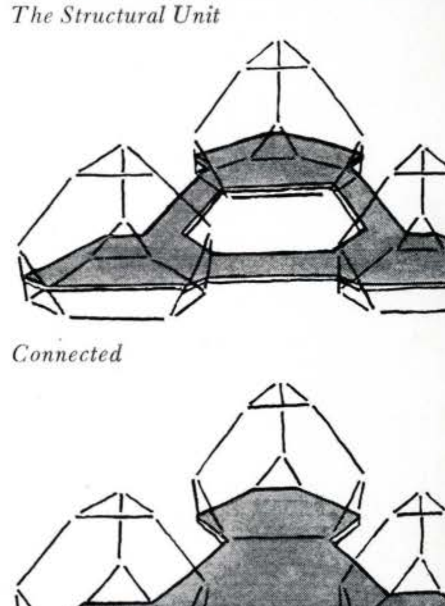
It was quickly found that there was but a limited variety of geometric forms which "nested" or "filled space" in such a manner as to disclose two parallel planes. One of the least complex of these forms which also suggests a structural system is the truncated tetrahedron.

The surfaces formed by this geometric unit contain a pattern of regular hexagons and triangles; the edge configuration consists of regular hexagons separated by pairs of triangles. After a review of the structural system suggested by the development of a geometry based on the truncated tetrahedron, it became apparent that the assembly offered intriguing solutions to the exhibit, architectural, structural, and mechanical distribution design criteria. As the structural engineering consulting team studied the problem of analyzing a structural system based on this geometry, the architects launched a program of defining the "vocabulary" of intersections.

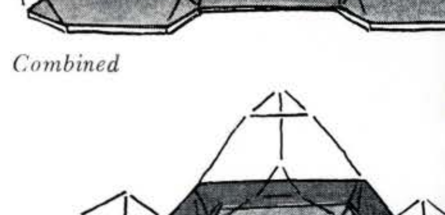
A structure based on the principle of building large assemblies from small members places very heavy emphasis on the study and successful resolution of a



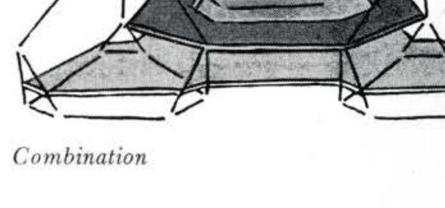
The Structural Unit



Connected

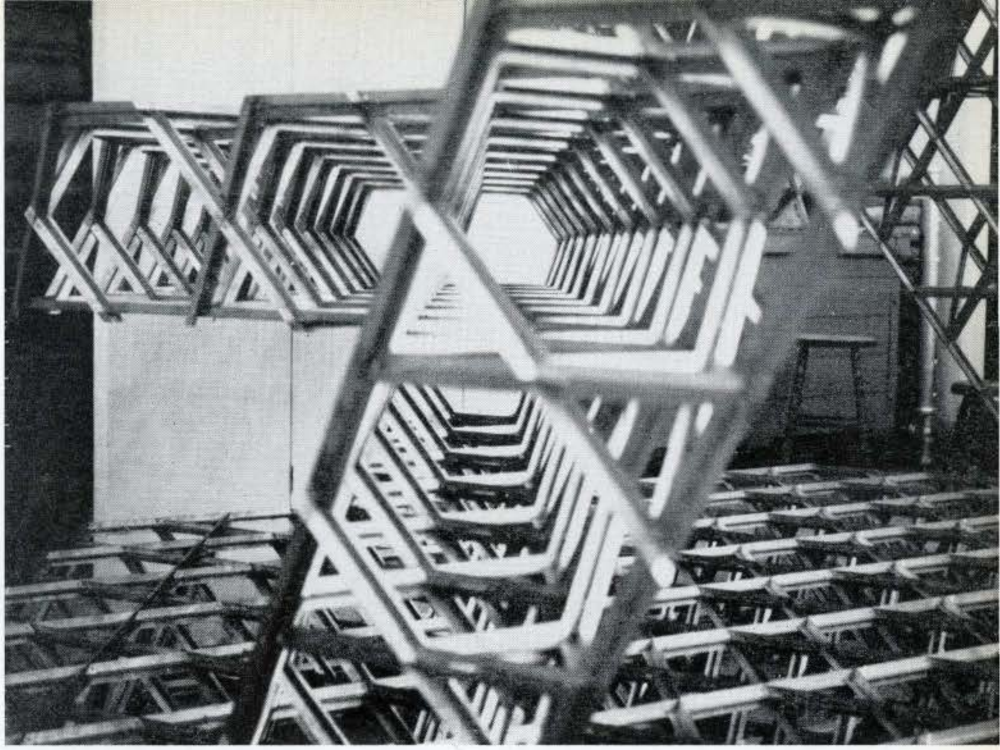


Combined



Combination

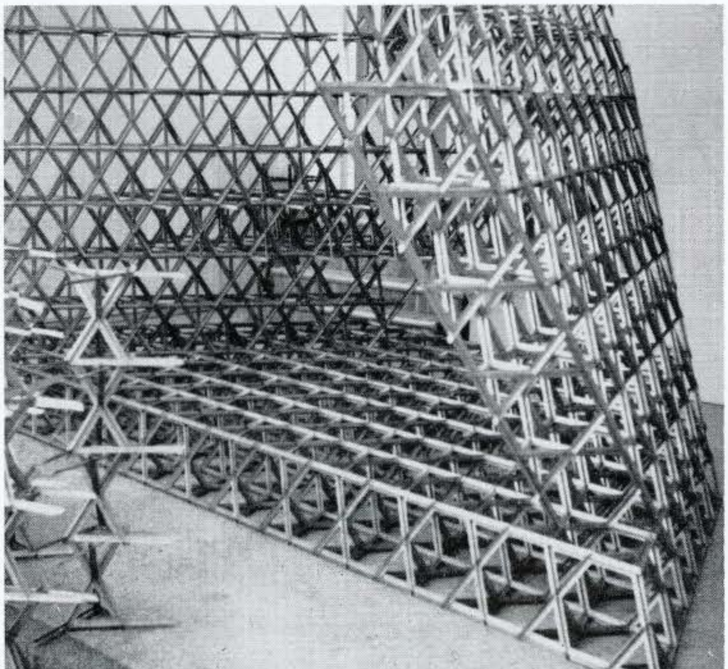
fabrication and jointing system. Several systems are now under study, each showing particular promise in solving a portion of the problem. It should be noted that the spans and loads to be carried by this space frame are quite large. The stresses anticipated at the critical nodal points exceed values that can be accommodated by most, if not all, nodal systems presently commercially available. It is anticipated that a combination of the various systems under study will yield a straight-forward, comprehensive solution to the assembly of the structure.

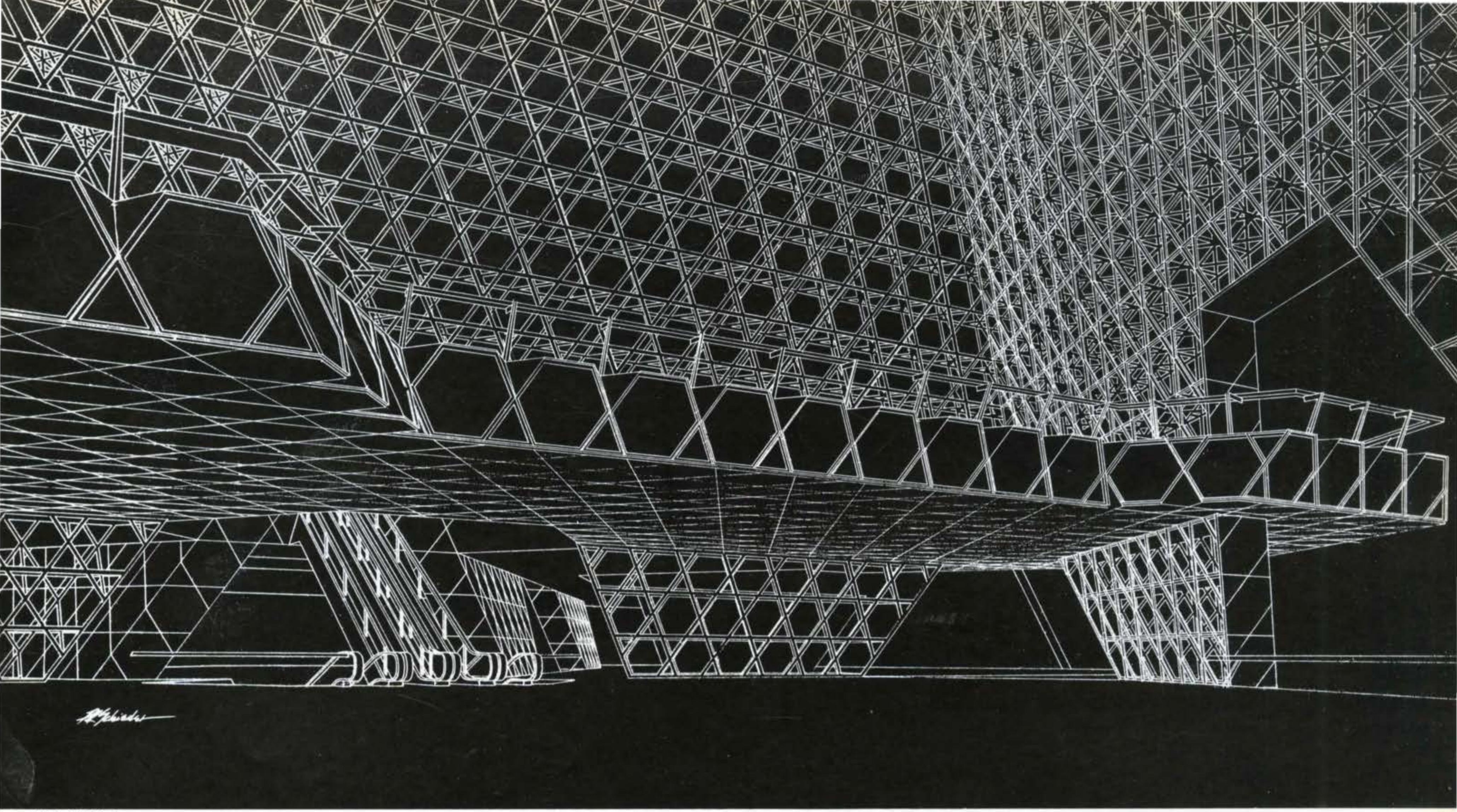


One of the techniques being studied has been erected, in model form, at one-sixth full size and is a potential solution to the design of the nodes.

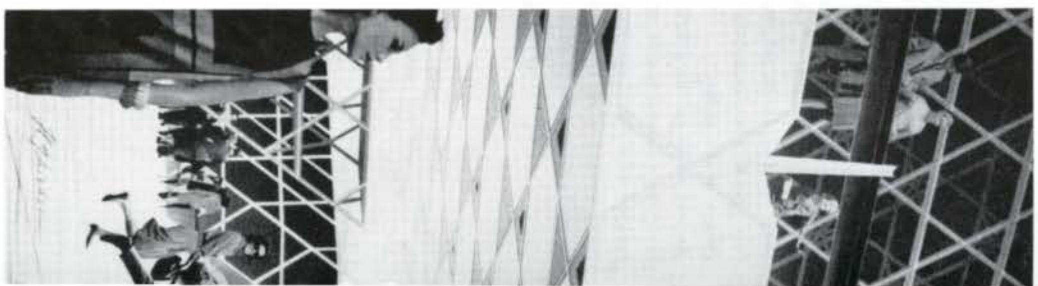
Recent study of the fabrication and erection procedures for this space frame have yielded additional economies in the structural system with the promise of further simplification still possible.

Thomas Ewing Blood



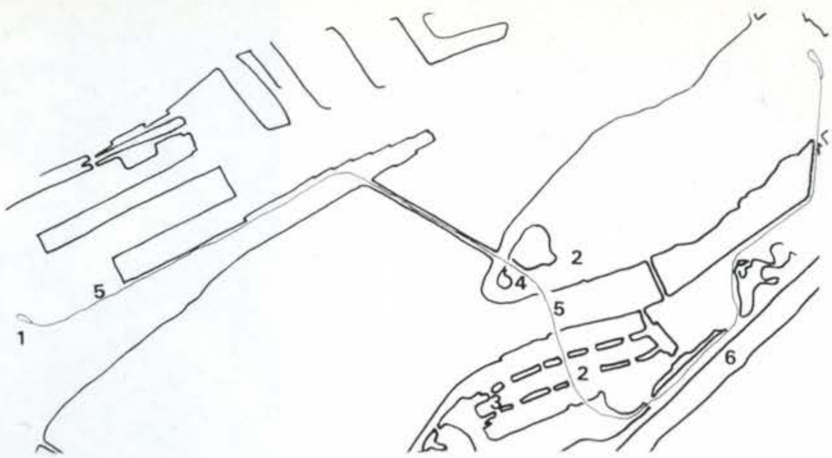


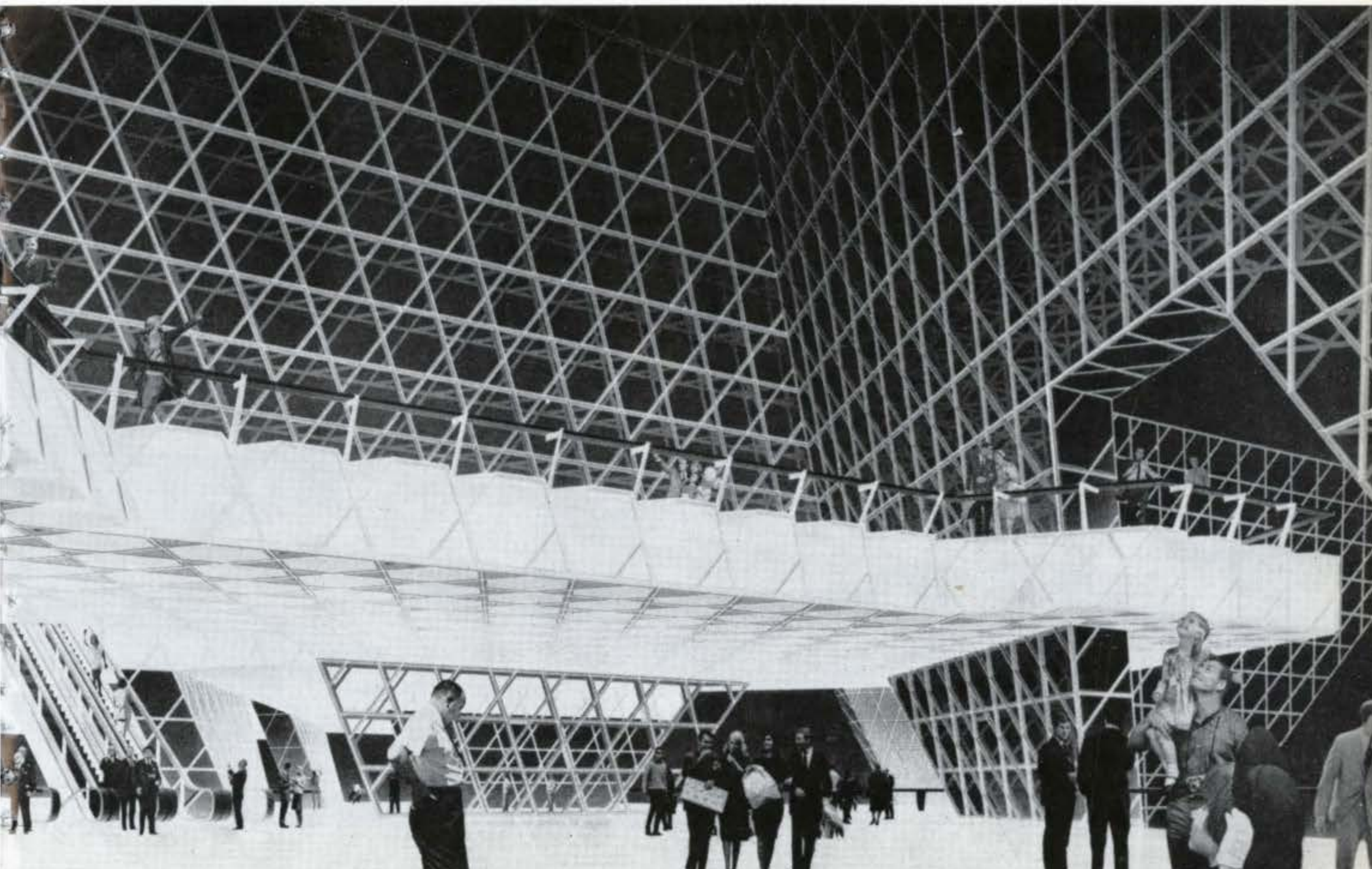
F. R. Schieder



LEGEND

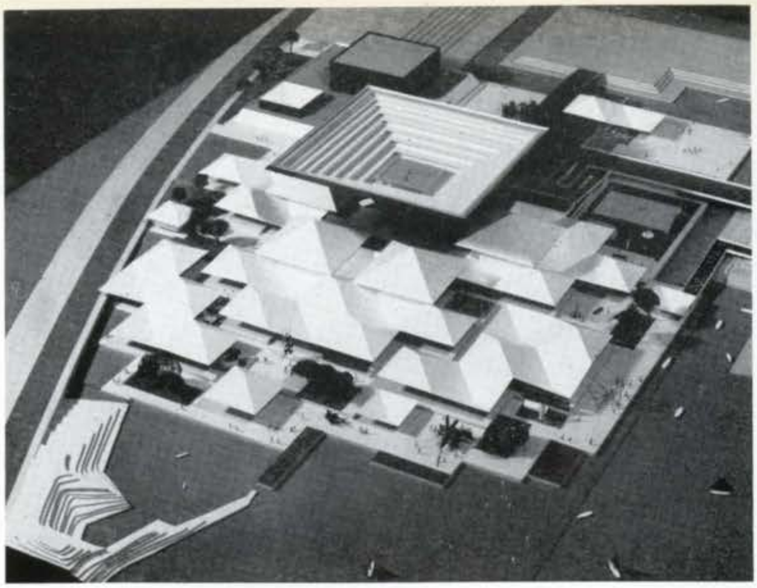
1 PLACE D'ACCUEIL
2 THEME BUILDINGS
3 CANADIAN PAVILION
4 PLACE DES PEUPLES
5 TRANSPORTATION
6 ST LAWRENCE CANAL

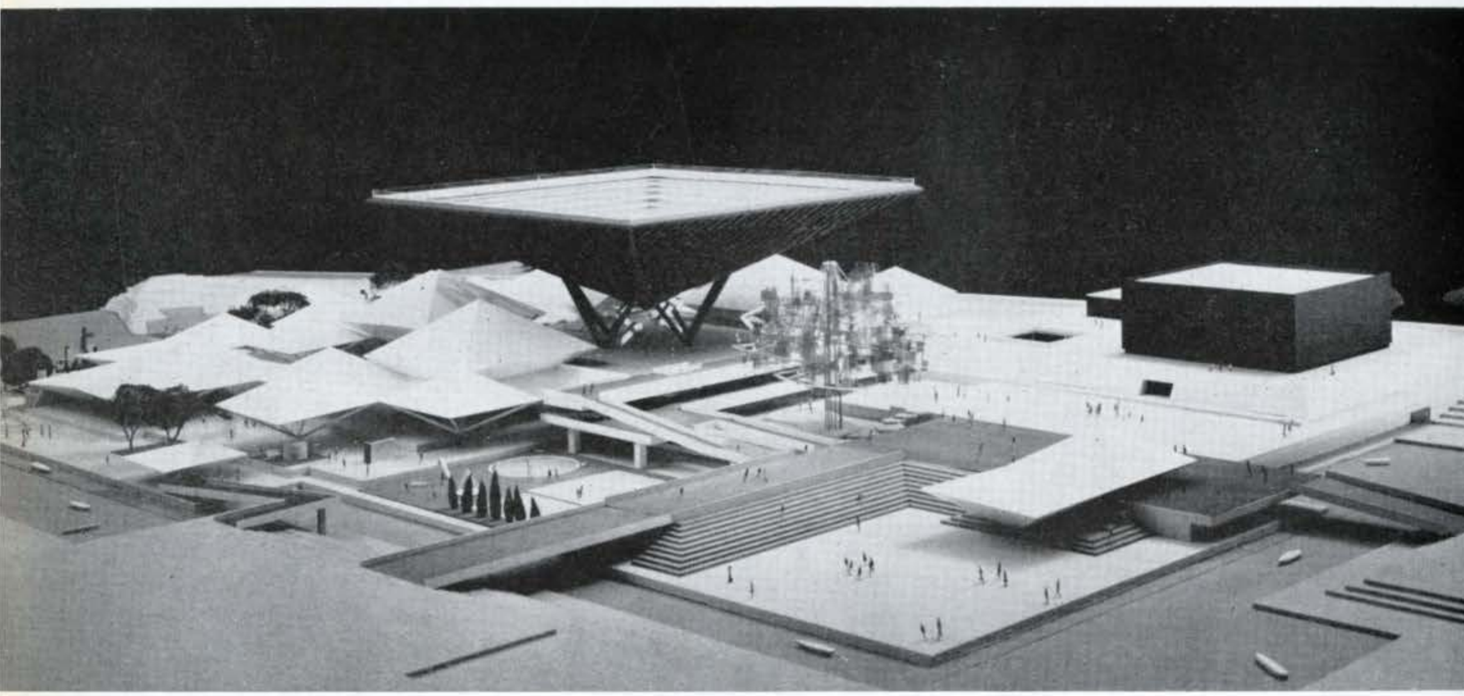




F. R. Schieder

Theme Building





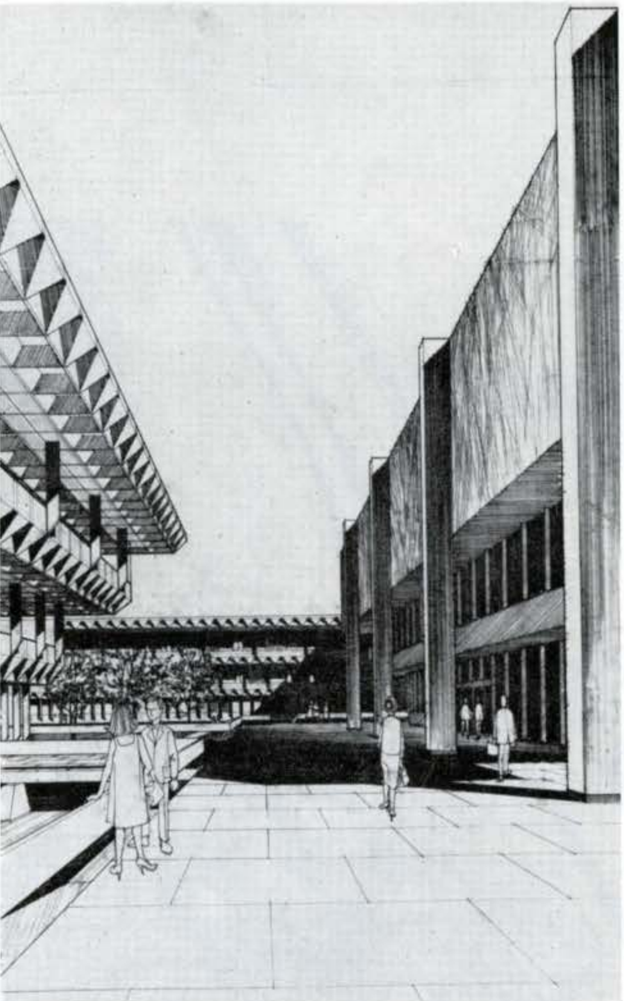
Canadian Pavilion/Expo '67

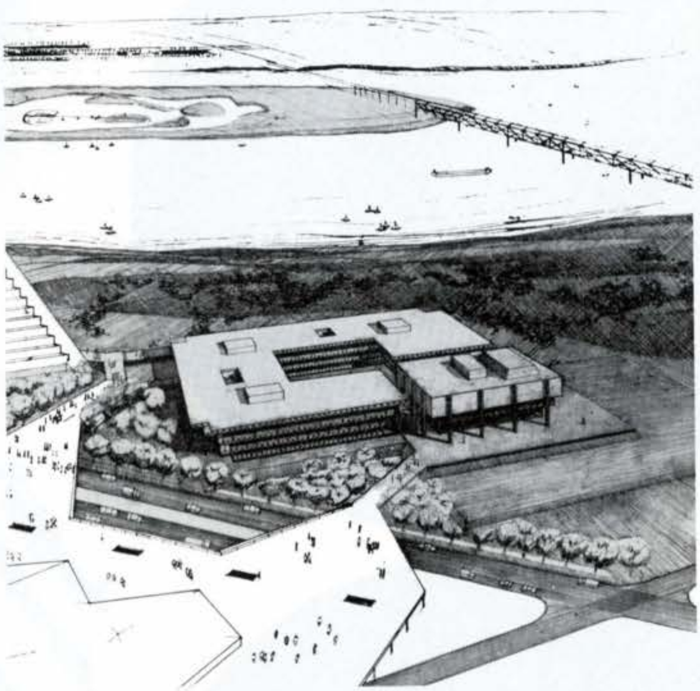
Consulting Architects/Ashworth, Robbie Vaughan & Williams
Schoeler & Barkham/Z. Matthew Stankiewicz
Arthur Erickson/Evans St Gelais

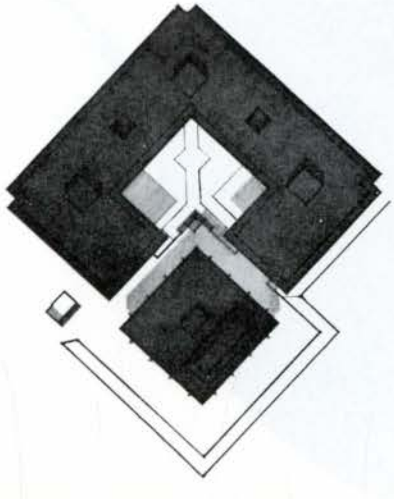
Administration & News Building Expo '67

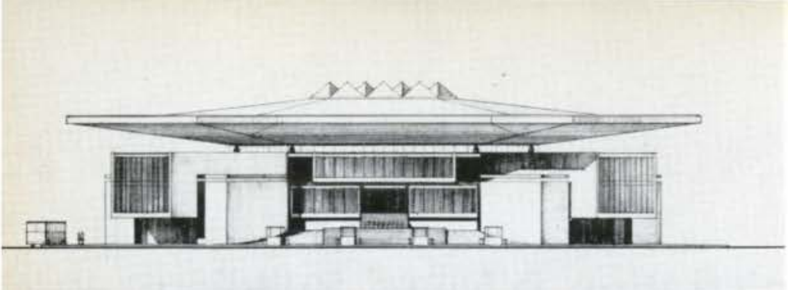
Preliminary Concept

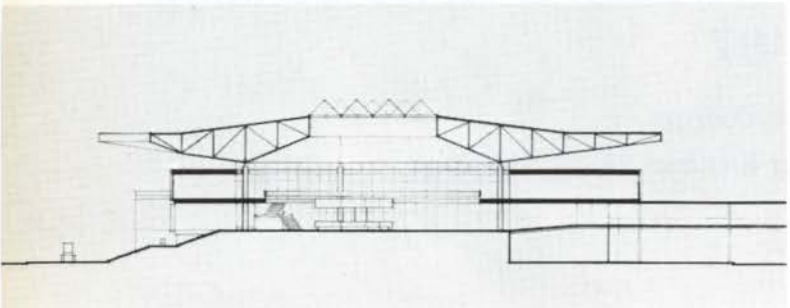
Consulting Architect/Irving Grossman



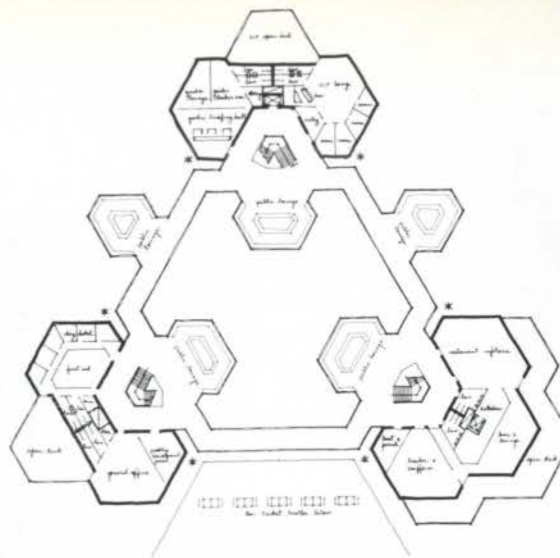




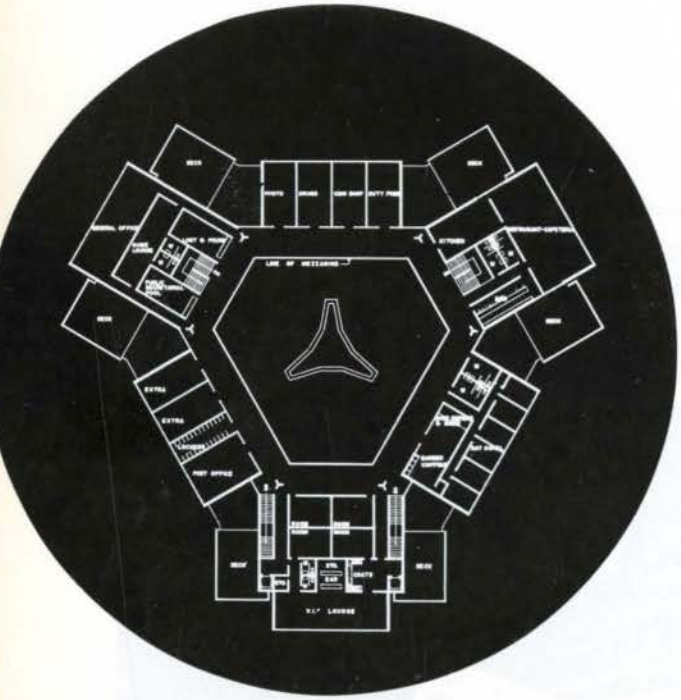


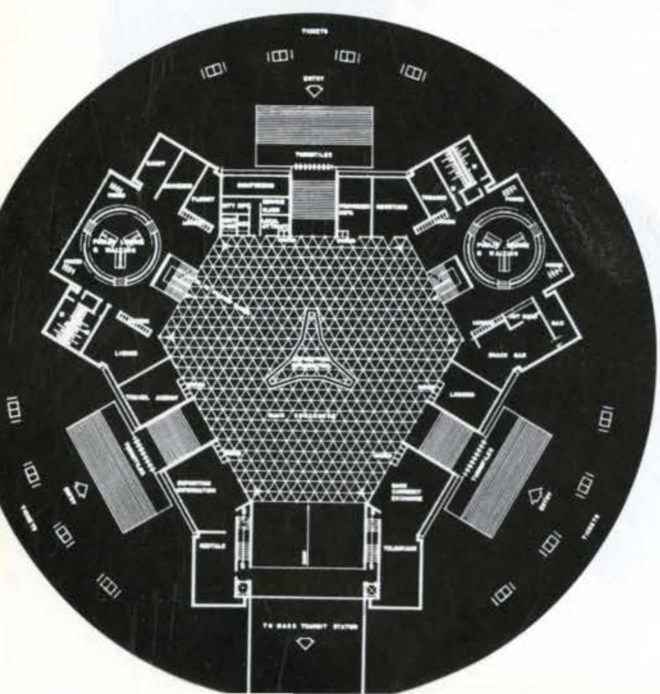


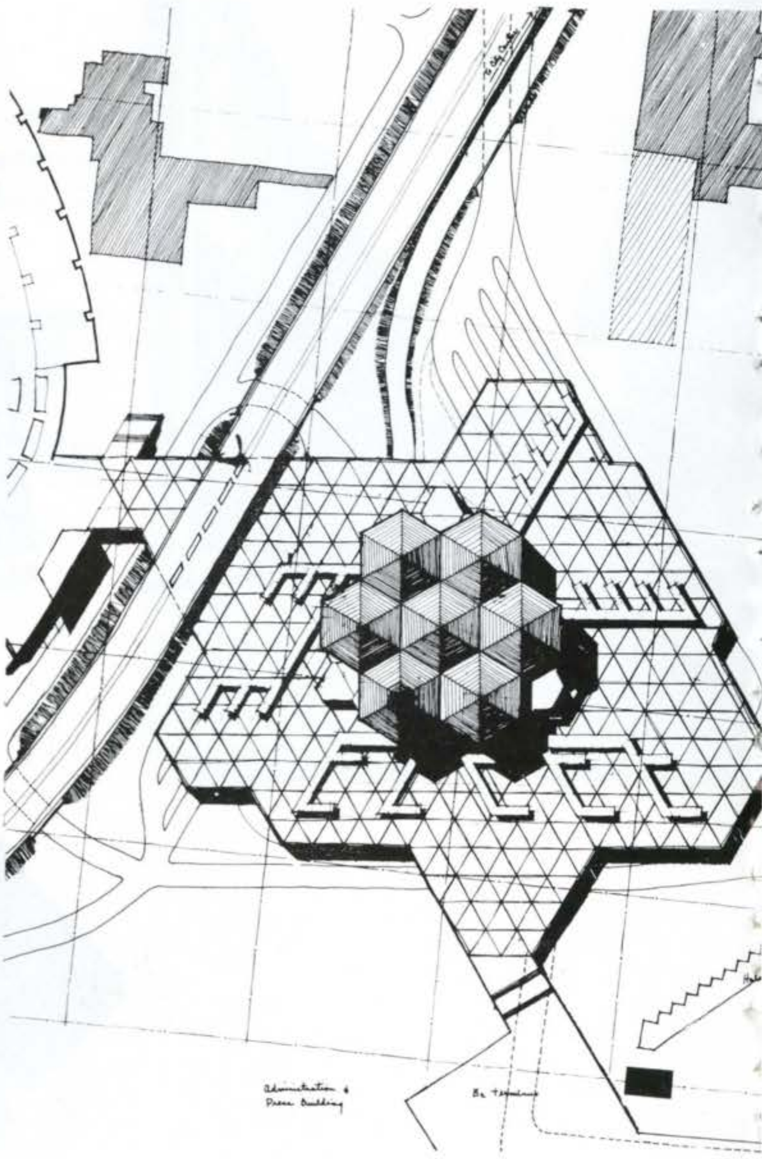
Scheme one/ above & below

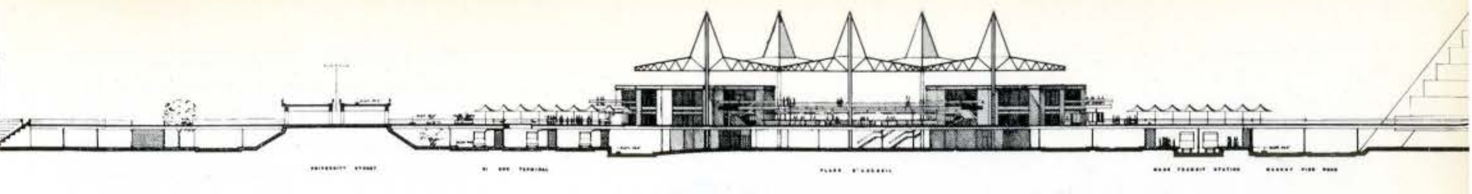


Scheme two/ above & below







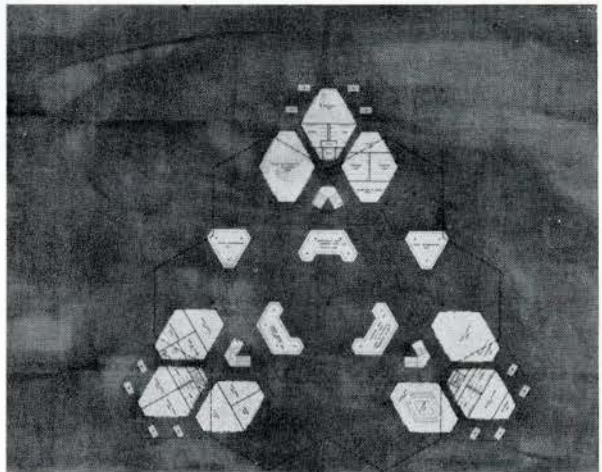


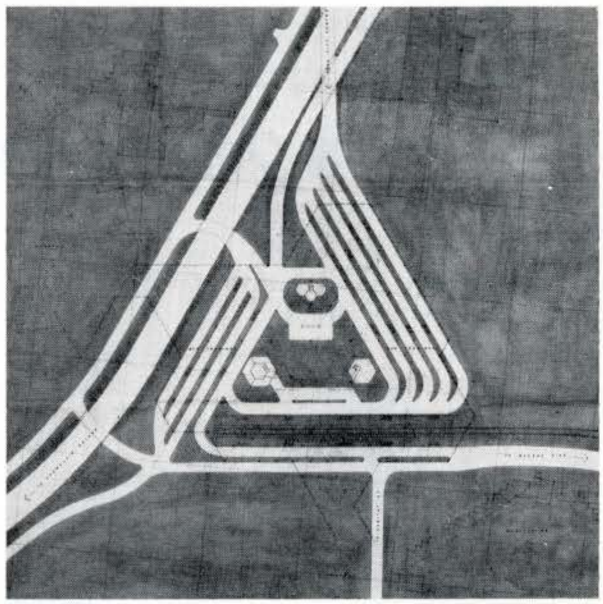
Scheme two/ final development

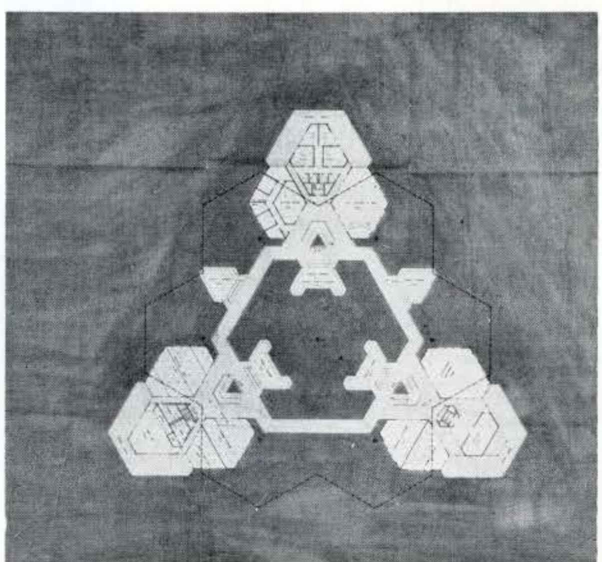
Place d'Accueil/Expo '67

Preliminary Studies

Consulting Architects and Engineers
Smith Carter Searle Associates







Place d'Accueil, to be built on Mackay Pier, is the main entrance-greeting hall entrance to Expo '67, and is expected to handle between 40 and 50 per cent of the visitors, or 125,000 persons daily. It is a temporary building, to be demolished after the exhibition and consists of the following elements: (1) an entrance hall and information centre, with maps, directories and listings, and an exit gate, offering visitors information and services concerning the City; (2) a bus and taxi terminus for public, charter and shuttle bus services, private cars and taxis; and (3) a mass transit station. The design problem was thus to provide the facilities for a transportation terminus; create a greeting and entrance building which would be a point of interest and possess the right character and atmosphere; and offer complete information about the Exhibition to the incoming visitor and exhibition and tourist information about the City to the departing visitor.

The site is a triangular piece of land defined by the proposed major road systems, and the geometry and variations of the road elevations were major factors in determining the building form and the design concept. Scheme One consisted of the main concourse level, a mezzanine level with entry and some service spaces at the ground (bus terminal) level. The mass transit station to the east is approached from the main concourse level by means of a bridge. Connection to the 25,000 seat stadium was to be by means of a tunnel from Place d'Accueil. The grand two-storey entrance hall rises over the main concourse, receiving natural light from a large translucent skylight set in the umbrella-like roof structure. The roof structure is designed as a steel triodetic space frame, carried by six built-up steel columns. The balance of the building was a light steel frame structure. Modifications to Scheme One and incorporated in Scheme Two resulted in eliminating the need for air conditioning in the major greeting hall space, further development of the bus terminus needs, the city centre and parking lot approaches and the mass transit station, and the complete separation of vehicular and pedestrian traffic. Scheme Three represents the latest development of the design and is basically approved in principle by Expo '67 authorities.

Opening New Horizons

by H. G. Fentiman

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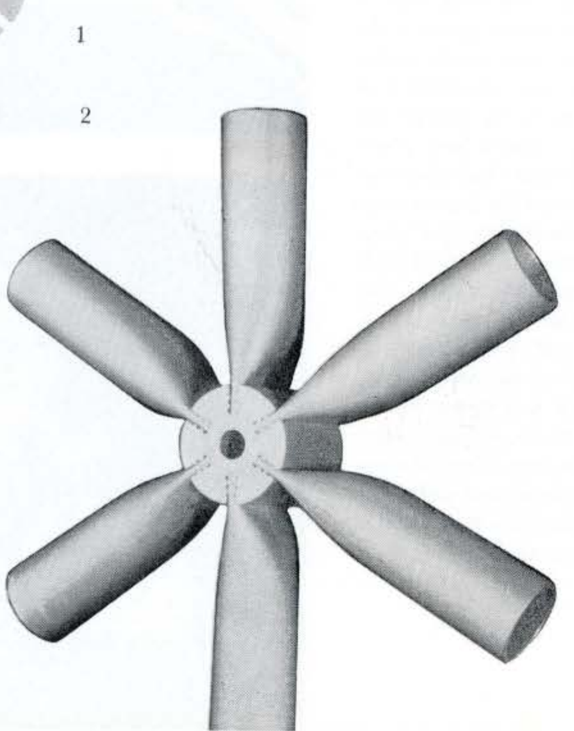

The panorama of possibilities is ever-widening for greater architectural freedom in the design of structures employing the use of free form configurations. In the past, the restrictions imposed by the materials available and the necessity for massiveness have presented serious problems.

Gradually, new concepts, techniques and materials are overcoming the necessity of "covering up" structural components in order to create an attractive appearance and in so doing are creating truly functional structures.

Developments have occurred in architectural forms employing the use of concrete, as evidenced by the increasing number of structures using this technique. Unfortunately, the cost of providing form work and the difficulties encountered, particularly during the winter in Canada with its severe climate, have restricted its widespread use. As new configurations are in constant demand for design techniques, it is obvious that new materials and new construction techniques must be used and the old ones improved. There is no doubt that this demand indicates that contemporary architecture is undergoing a marked change. Recently, industrial and technological developments have introduced a number of prefabricated systems that are directly connected with these changes. While presently competitive with standard forms of structural applications, the continued use of these systems will reduce the cost and speed acceptance and construction. With the trend being clearly toward larger span structures with a definite tendency to reduce the number of intermediate columns, space frames and reticulated shells are using tubular elements of steel and aluminum to great advantage.

Naturally, of prime importance to the practicability of such structures has been the accelerated advancement in the method of joining structural elements to allow for a simple and effective connection of the many units in space frames and doubly curved grillages. These new concepts provide a means for covering broad expanses with simple, mass-produced elements.

It is only since 1955 that any real advances have been made in the structural analysis of three-dimensional forms. Since 1960 several major publications have been issued dealing with this subject and describing the various structures that have been built in different parts of the world. Notwithstanding poor joint efficiencies and high costs, these initial space frame structures have provided a basis for a new era in architectural design and concept.

A good many of these forerunners recognized the high efficiency of tubular members but it was the method of joining these that invariably posed the real problem, as all of these configurations — space frames, domes, toroids, hypars, etc. — present the common challenge of the necessity of joining up to eight or nine structural elements in space efficiently and economically.

An entirely Canadian development, known as the Triodetic system, has recently been acclaimed by a leading world authority on space frames as "versatile, superior, . . . a real breakthrough".

The Triodetic method of connection provides the first practical and economic solution to the construction of large span space frame structures, allowing true three-dimensional frameworks of light weight to be readily fabricated in the form of grids, slabs and shells of single or double curvature. This method of connection is simple in practice, neat in appearance and will join efficiently almost any number of members of different lengths and sections, radiating at various angles.

Structural efficiency in tension and flexure at the connection is at least 90% of ultimate member strength. Structural efficiency in compression is a full 100% of pinned-pinned column strength, except in cases of relatively short stocky members where efficiency may fall to 70%.

Almost any type of member can be connected with the Triodetic system. Tubular members of steel or aluminum are most commonly used, however, because of the great structural efficiency they provide. The choice between the two metals depends upon architectural considerations, exposure, cost, etc. In a given structure, the strengths of individual members are varied to suit stressing requirements, usually by varying tube diameter, with wall thickness held constant.

These frameworks, because of the neat connections and the regular and geometric patterns formed by the members are, in themselves, pleasing in appearance. With such frameworks left open, greater freedom is provided for mechanical and electrical requirements. As to cladding, flat decks, singly curved shells (barrels) and hypars are covered most economically and satisfactorily by metal decking with conventional insulation and wearing surfaces. Other doubly curved shells (domes) are readily covered with a companion system of prefabricated laminated wood panels, finished with roofing felts and coloured aluminum shingles. Sprayed-in-place roofing, translucent panelling and metal clad panels are also available.

While some hesitation has been noted, particularly in Canada! to the use of this system because of its newness it has been possible to demonstrate its effectiveness

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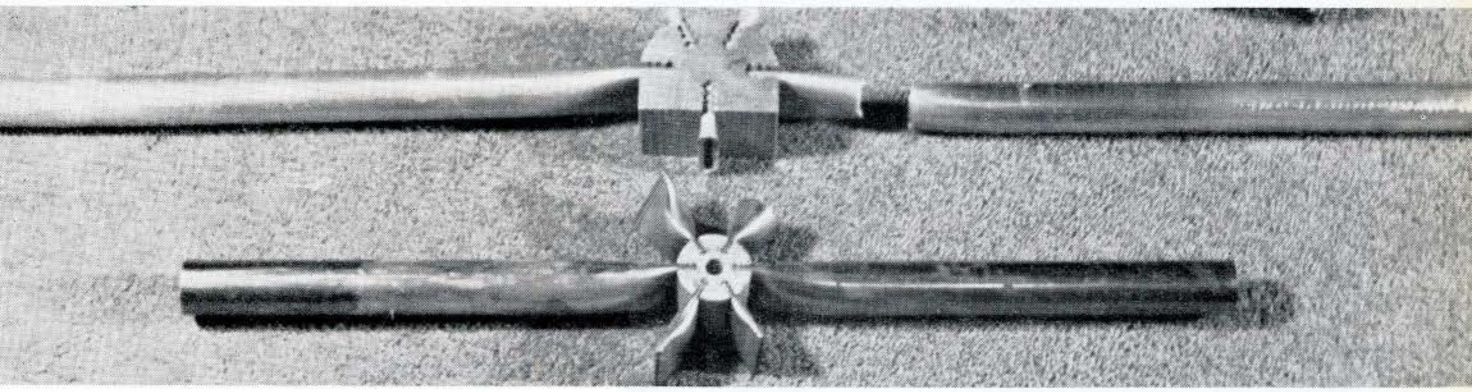

1 *Triodetic connectors.*
2 *Six slot connector with tubes in place.*
3 *Compression and tension tests in steel and aluminum tubing applied to Triodetic connectors.*

It requires no welding, bolts or rivets. Members to be joined are prepared in a pressing operation which forms the metal to fit the slots in the connector hubs. Member lengths and end angles are controlled automatically in a factory operation, giving great precision to the final structural assembly without any need for forms or jigs. In erection, the members are inserted into the hubs under slight pressure; the action of the joints prevents loosening or unlocking.

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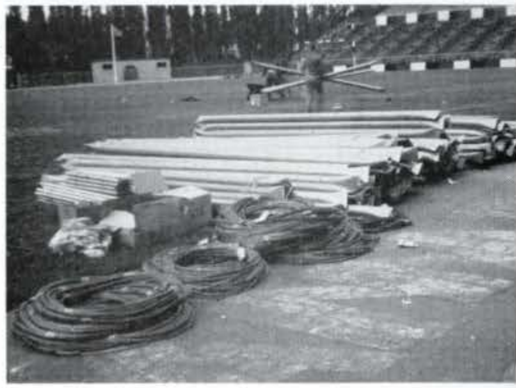

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from the far north to the tropics. The fact that contracts have been gained at distant points has helped to prove other features of the system — high density shipping, accuracy of prefabbed members and ease of erection on any site without expensive equipment or skilled labour.

Radio telescopes and communications towers, while of little interest architecturally, have pointed out the extreme accuracy possible with this method of construction — and also its durability under adverse weather conditions.

A unique "dome-like" home, in a remote location in the Bahamas was completely prefabricated and shipped from Canada. It was built to withstand hurricane winds of up to 120 mph.

The superstructure and roof of the Rideau Carleton Raceway Grandstand in Ottawa was erected in place from prefab components in just twelve days, demonstrating the speed and ease of joining a multitude of members at various angles in space.

More exotic shapes and large, clear-span structures are quite feasible with the Triodetic system. Groin arches, toroids, single and double layer domes, two and three-way space grids, provide a fascinating and unending variety of possibilities to the designer. With low cost, wide-span structures, one could conceive of entire shopping centres being enclosed — not only the stores, but the parking areas as well — at a cost that could be offset by that of snow removal alone.

This system circumvents the necessity for heavy, massive and unattractive framework; providing light, airy structures with a variety of symmetrical patterns that can be left exposed, thereby exercising true architectural effect.

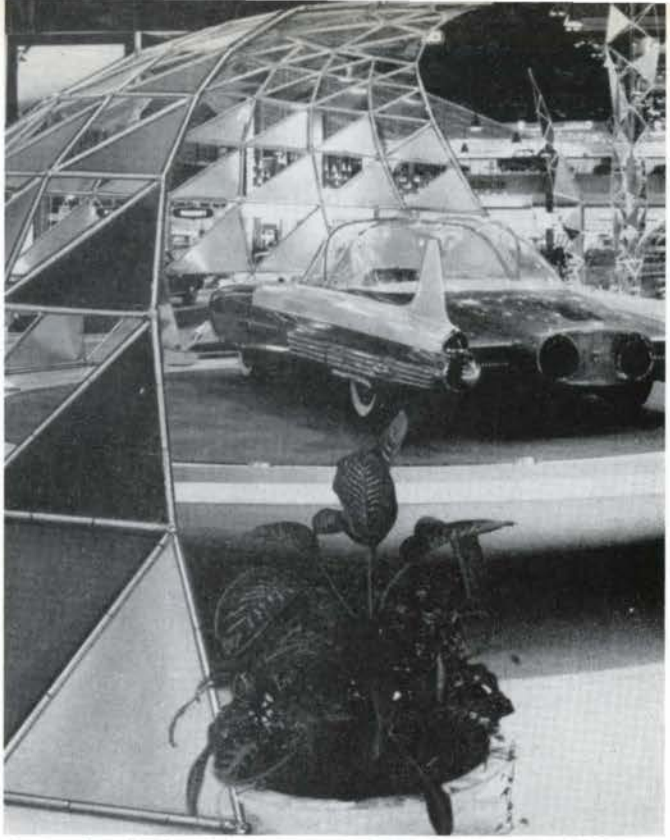
Some current projects under consideration are stadiums with roofs up to 800′ in diameter, multi-storey office buildings, theatres, factories, shopping centres, observation towers and restaurants, service stations and churches. There is literally no end to the potential of the Triodetic principle for architectural conceptions and simplicity of erection.

It has been successfully employed in smaller structures and domestic applications such as play domes, outdoor patio covers, boat docks, etc.

Successfully applied in many countries of the world in display buildings, the Triodetic system has been used twice by Harry B. Kohl, the design architect for the National Home Show; a single dome in 1962 and a triple dome House of Ideas in 1964 (M. S. Yolles & Associates, Consulting Engineers). Ideally suited for demountable as well as permanent structures, the Triodetic system provides 100% salvage and can be erected again and again. An example of this is a 100′ span by 35′ rise single shell arch provided as a stage covering for the Central Canada Exhibition in Ottawa, which has been erected and re-erected for a number of years.

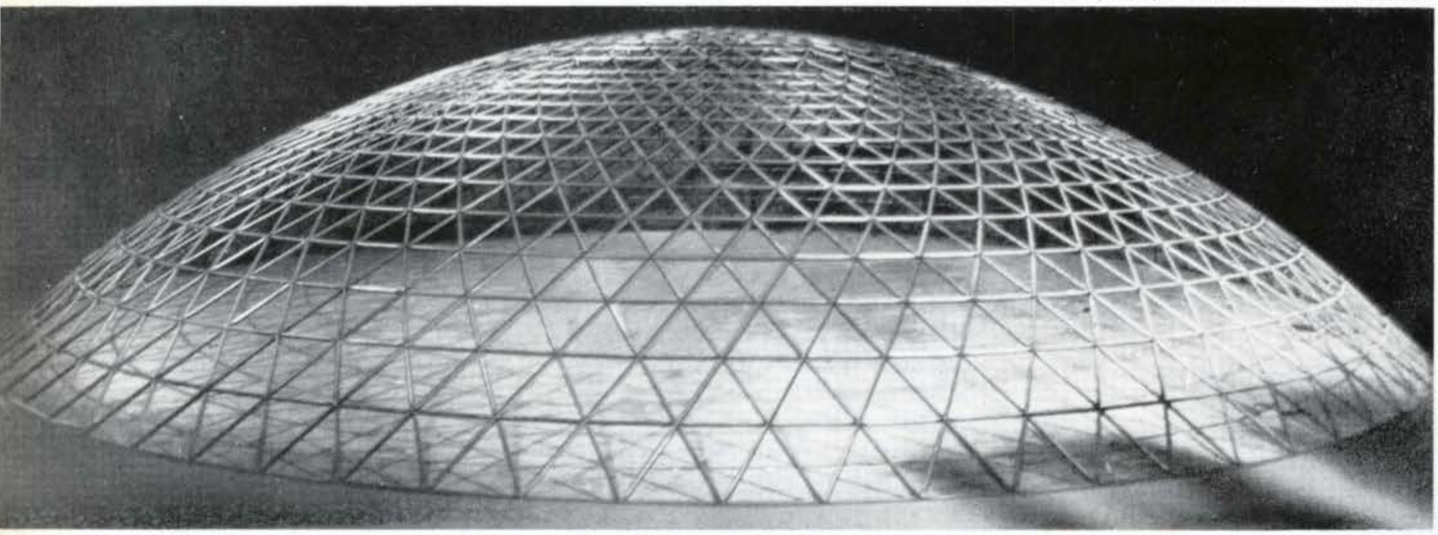
Mr Fentiman, a vice president of Triodetic Structures Ltd, 335 Roosevelt Avenue, Ottawa, has written specially for the Journal this account of a Canadian development in the field of space frame connectors. The system has been accepted and licenced in a number of foreign countries, where it is considered a breakthrough in space frame construction. (See also Journal, June, 1964, page 55 "Space Frames", by D. T. Wright.)

4 Typical example of a large, 3-way space grid, showing uniform pattern and neatness of the connector.
5 Workmen lace canvas in place on demountable stage shell.
6 The compactness of a completely demountable structure. This material, when erected, provides a structure of 100 ft span, 35 ft rise and 78 ft depth.
7 Roof structure for a dome in the Bahamas.

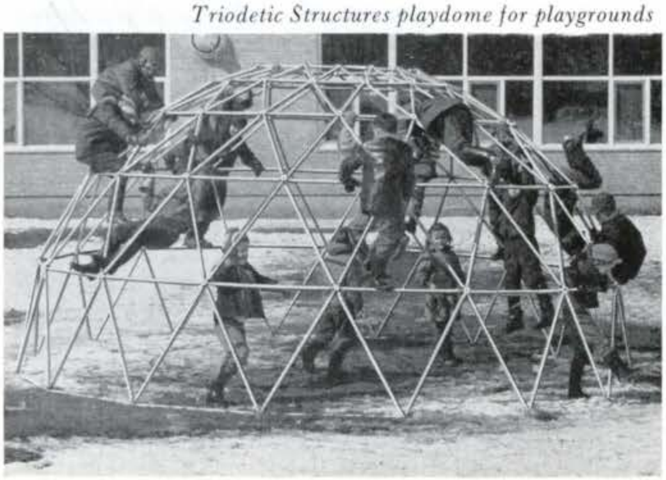


Decorative display shell structure for Ford Motor Co at CNE

Test model of 225 ft aluminum dome structure



Triodetic Structures playdome for playgrounds



The major part of construction ventures in this country occur in what have been rated as dangerous zones from a seismic and engineering standpoint. The taller structures which are now common make the more important and accurate analysis of structural stresses, soil behaviour for structure design and detailing. The author discusses several foreign approaches to the problem.

Tremblements de Terre

par Robert David

R. David, P.Eng., MEIC, is Quebec senior regional engineer for the Canadian Institute of Steel Construction.

R. David, Ingénieur, MICI, est l'ingénieur régional senior du Québec pour l'Institut Canadien des Constructions d'Acier.

Depuis une trentaine d'années on a l'impression que les tremblements de terre semblent être plus graves et plus désastreux qu'autrefois.

Pourtant les séismes ne sont ni plus fréquents ni plus intenses que par le passé. La raison est que de nombreux nouveaux systèmes de construction sont utilisés sans que l'on se soit préoccupé de savoir s'ils peuvent résister aux tremblements de terre. De plus la hauteur des bâtiments augmente continuellement et de ce fait leur résistance aux mouvements du sol diminue considérablement si des précautions spéciales ne sont pas prises.

Bien que certaines zones du Canada, comme la vallée du St-Laurent et la Colombie Britannique, soient classées zone III, donc zones dangereuses, on doit constater l'absence de mesures officielles énergiques réglementant la construction. Il est aussi pénible de remarquer que dans de nombreux pays ces mesures ne sont prises qu'après un désastre au cours duquel de nombreuses vies sont perdues. Ici au Canada, le code national du bâtiment délimite les zones sismiques et donne pour chaque ville du Canada un coefficient sismique qui sert de base à la méthode de calcul indiquée dans ce code. Malgré ces informations il semble qu'en de très nombreux cas aucune précaution ne soit prise afin d'éviter des pertes de vies humaines et de graves dommages. Certes il y a des exceptions pour lesquelles architectes et ingénieurs se sont ingéniés à adopter des systèmes de construction qui résistent aux tremblements de terre. Les grands édifices montréalais tels que le "Ville Marie", la banque de commerce et le bâtiment du CIL etc. ont été érigés en se basant sur les nouveaux principes de construction.

Si nous considérons le passé de la province de Québec, nous constatons que tous les cinquante ans environ, des tremblements de terre de grande magnitude ont violemment secoué le sol de la vallée du St-Laurent (1663, 1732, 1791, 1860, 1870, 1925) de plus il faut ajouter de nombreux séismes de plus faible magnitude qui se manifestent fréquemment.

Une question se pose: architectes et ingénieurs ont-ils la possibilité d'étudier des documents se rapportant à la nouvelle science du génie aséismique? On doit répondre par l'affirmative.

Cette science est basée sur les examens des dommages causés aux systèmes de construction dans les régions sinistrées et les études des effets des mouvements vibratoires sur les structures et matériaux dans les laboratoires des universités.

Tremblement de terre

Le glissement soudain des failles de l'écorce terrestre relâche une grande quantité d'énergie qui provoque un mouvement vibratoire des couches supérieures du sol rayonnant dans toutes les directions. Sous l'effet de la compression et dépression des roches des ondes directes et des ondes perpendiculaires à celles-ci sont formées.

Toutes ces ondes se réfléchissent ou sont réfractées par des formations géologiques diverses. Il en résults un mouvement très complexe qui induit dans les structures des oscillations verticales et horizontales désordonnées auxquelles il faut ajouter des effets de torsion particulièrement dangereux.

Au voisinage de la faille les oscillations peuvent avoir une faible période et une courte amplitude (¼ de seconde et quelques pouces) au fur et à mesure que l'on s'éloigne la période augmente ainsi que l'amplitude: à cent milles de l'épicentre la période peut être de 2 à 5 secondes et l'amplitude de 5 à 18 pouces selon la composition du sol.

La situation du bâtiment par rapport à la faille joue donc un rôle important pour la détermination du plan et le choix des matériaux.

L'architecte doit se rendre compte que dans le cas des constructions importantes, celles-ci sont appelées à être utilisées pendant deux à trois cents ans. Pendant cette période elles subiront cinq ou six chocs très sévères et si la conception et construction de l'ouvrage laisse à désirer, les dommages invisibles au début s'accumulent à la longue et risquent de compromettre la stabilité de l'ouvrage.

Intensité des vibrations et leurs effets

Nous tenons à signaler qu'il y a lieu de ne pas confondre magnitude et intensité d'un séisme. La magnitude correspond à la quantité d'énergie relachée à l'épicentre d'un séisme. Elle est basée sur une échelle logarithmique de Richter — jusqu'à ce jour le plus grand tremblement de terre enregistré a eu une magnitude de 8.7. Les séismographes disséminés de part le monde détectent les moindres mouvements de l'écorce terrestre mais ne peuvent enregistrer les mouvements de grande amplitude s'ils se trouvent à proximité de l'épicentre.

L'intensité, basée sur les impressions des témoins, est relative aux mouvements sismiques observés en un lieu donné. La table de Mercalli permet de classifier approximativement l'intensité.

L'inconvénient de cette table est qu'elle ne donne aucune indication précise sur les périodes et amplitudes du phénomène. Celles-ci étant indispensables à l'ingénieur pour servir de base à des calculs précis, il a fallu créer des séismographes à grande amplitude et ensuite compter sur le hasard pour qu'ils enregistrent les phénomènes vibratoires en un point proche de l'épicentre.

Depuis leur installation en Californie, deux séries de séismogrammes ont été enregistrées à El Centro en 1940. (Mag. 7, distance de l'épicentre: 30 milles) et à San Francisco en 1957 (Mag. 5 (faible), distance de l'épicentre 11 milles).

Séismogrammes de grande amplitude

Ceux de 1940 et 1957 ont réservés quelques surprises: Ils ont indiqué des accélérations maximales de 0.33 g pour le séisme d'El Centro. A San Francisco, on a enregistré 0.12 g pour un faible tremblement de terre. Les dommages causés par celui-ci s'élevèrent à $1,000,000.

De plus à San Francisco les séismogrammes des appareils placés à differents étages d'un même bâtiment ont indiqué que non seulement les vibrations horizontales augmentaient du sous-sol au toit — fait connu mais aussi les vibrations verticales.

Ces informations sont des plus instructives car elles prouvent que pendant les premières secondes les chocs et vibrations sont beaucoup plus élevés que l'on pensait. Les calculs basés sur les codes prenant par hypothèse .1 g au maximum, ne correspondent donc pas aux conditions optima et ceci explique souvent la destruction complète de certains ouvrages lorsque leur période naturelle est voisine de celle du mouvement vibratoire du sol, car dans ce cas se produisent des phénomènes de résonance particulièrement dangereux.

D'autrepart, les derniers tremblements de terre d'Agadir, Acapulco, Mexico et Skoplje ont mis en évidence les effets de torsion sur les bâtiments dûs aux ondes se propageant simultanément dans deux directions perpendiculaires. D'une façon générale les pierres tombales des cimetières (Cornwall 1944) tombent à terre après avoir effectué une rotation à peu près semblable.

Le problème se complique par le fait que les mouvements ondulatoires transmis par le roc aux couches superficielles du sol dépendent de la composition de ceux-ci.

Etude du comportement des sols soumis à des mouvements vibratoires

L'étude des ruptures des sols supportant des fondations lors de séismes a mis en évidence le fait que les indications données par la mécanique des sols ne sauraient convenir dans le cas des sols soumis à de violents mouvements vibratoires. Il a fallu créer une nouvelle branche de la mécanique des sols basée sur la dynamique et non sur la statique.

Dans le cas des sables, des tassements peuvent se produire, ainsi que la liquéfaction subite des terrains sablonneux très humides.

Dans le cas des argiles, leur cohésion leur permet de supporter des charges supplémentaires pendant les courts moments que dure un séisme, par contre elles amplifient considérablement les mouvements vibratoires horizontaux. Les moraines, les formations diverses rencontrées doivent aussi être étudiées dynamiquement si l'on veut éviter des surprises désagréables.

Bâtiments à édifier dans les régions sismiques

L'architecte doit avant tout se rendre compte que tout bâtiment est soumis à des mouvements alternés très violents et qu'il doit considérer la continuité de l'ossature afin d'éviter la dislocation de celle-ci. Ceci malheureusement limite considérablement la fantaisie! Tout l'ensemble, poutres et colonnes doit être relié rigidement.

Tout d'abord se pose le choix des fondations qui constituent la partie la plus délicate de l'ensemble du projet. Sur le roc, à proximité de la faille, il est préférable d'interposer un matelas antivibratoire qui aura l'avantage d'atténuer légèrement les mouvements très durs à courte période. Il ne faut pas oublier que le rocher est le médium qui transmet le mouvement vibratoire et qu'il peut agir comme un marteau pneumatique! Donc il y a lieu de réduire au minimum le contact du roc avec les fondations et séparer de quelques pouces le rocher des parois du sous-sol afin d'éviter des chocs dangereux.

Sur le sable non compact un rapide tassement peut se produire, aussi des pieux atteignant le bon sol sont nécessaires. Leur liaison à l'aide de poutres horizontales en béton armé dont les armatures peuvent prendre en tension le dixième de la charge appliquée sur le pieu, est obligatoire afin d'éviter les déplacements différentiels dangereux des colonnes.

Dans le cas des argiles, si les charges ne sont pas trop élevées un radier général avec poutres reliant la base des colonnes, est préférable. La raison est que l'effet des vibrations horizontales seront freinées le long de la surface inférieure du radier — donc amortissement des chocs.

Partout ou cela est possible, il y a lieu d'éviter tout contact latéral du sol avec le sous-sol du bâtiment afin d'éviter des chocs supplémentaires augmentant l'oscillation du bâtiment. Dans le cas des sols divers: moraines, alluviens et diluviens, une étude dynamique des sols orientera l'architecte et l'ingénieur vers la meilleure solution à adopter.

Sols en pente — Ceux-ci sont particulièrement dangereux car très fréquemment les séismes sont suivis par des éboulements (le village "les Eboulements" a été appelé de ce nom par Jacques Cartier au début du XVIe siècle).

En conclusion, à l'exception du rocher, les bases des colonnes doivent être reliées par des membrures horizontales. Dans le cas de constructions peu importantes les empattements des fondations doivent être légèrement plus grands afin d'éviter des ruptures du sol.

Charpentes des bâtiments

a) Maison unifamiliales et maisons d'habitation comportant peu de logements.

Celles-ci ne sont plus construites comme autrefois — la maison de bois canadienne avait la souplesse voulue pour résister aux tremblements de terre — seules les cheminées tombaient (567 à Montréal en 1732 d'après la soeur archiviste de l'Hôtel-Dieu) — la maison moderne est construite très rapidement, quelques clous suffisent pour conserver les éléments de bois dans la position verticale — aucune liaison solide horizontale! Le tremblement de terre de San Francisco de 1957 a sérieusement endommagé de nombreuses maisons de ce genre.

Dans les fondations quelques ronds de béton afin d'obtenir un ensemble monolithe. Si le bois est utilisé, des ferrures avec vis doivent relier les membrures les plus importantes (angles de la maison, cloisons, etc.).

Les maisons en blocs de béton doivent comprendre une lisse (fer plat de ¼" x 2") à chaque étage reliant tous les murs et cloisons — et, être jointoyées au mortier de ciment. Les toits dans tous les cas doivent être ancrés solidement à l'ossature de la maison.

Les foyers aussi doivent être bien reliés aux éléments principaux de la maison et les canalisations d'eau ou de gaz doivent avoir une certaine ductilité pour suivre les mouvements brusques.

A moins de clauses spéciales dans les contrats d'assurance, les propriétaires doivent savoir que les dommages causés par les tremblements de terre ne sont pas couverts.

b) Bâtiments jusqu'à douze étages, édifices publics et écoles. Ceux-ci doivent retenir toute l'attention de l'architecte soit à cause de leur hauteur ou du nombre de personnes ou enfants qu'ils peuvent contenir.

La simplicité du plan est essentielle — le bâtiment rectangulaire aux cadres bien symétriques donne les meilleurs résultats. Les bâtiments en T ou en L sont fréquemment endommagés aux angles. Ceci est dû aux mouvements vibratoires différentiels impartis par les ondes sismiques dans les différentes ailes des bâtiments, donc des joints plastiques doivent les séparer. Il faut aussi que deux bâtiments ne soient trop rapprochés afin d'éviter le battement des murs mitoyens.

Bâtiments au-dessus de douze étages

Il est à noter que cette classification correspond à cette donnée par l'Association des Ingénieurs Californiens et n'est pas générale. Beaucoup de pays limitent la hauteur à des dimensions plus modestes. L'Italie récemment à limiter la hauteur à huit étages dans les régions sismiques! La raison de cette classification spéciale est due au fait que plus le bâtiment est haut plus les mouvements vibratoires horizontaux et verticaux se font sentir aux étages supérieurs. Le phénomène du coup de fouet tend à décoiffer la partie supérieure de l'édifice et les effets de torsion sont très dangereux.

Il est donc essentiel que l'architecte s'assure que toutes les dispositions soient prises pour éviter un désastre. Il doit se rendre compte que l'accumulation des matériaux les uns sur les autres sans être proprement reliés et ne pouvant résister aux efforts latéraux constituent pour le public un grave danger.

Il existe deux classifications de bâtiments à étages multiples — les types flexibles et les types rigides. Les premiers ont des cadres spatiaux qui résistent aux efforts grâce à des assemblages qui joignent élastiquement les membrures. C'est le cas des charpentes d'acier constituées dans les deux sens de cadres rectangulaires qui sous l'effet des forces sismiques tendent à se déformer aux joints. — d'où résulte une certaine flexibilité. La déformation dans le domaine élastique absorbe une grande quantité d'énergie d'où dissipation de celle-ci. L'inconvénient est que ce système présente de plus grandes amplitudes qui peuvent paraître désagréables aux occupants — et exige en outre des précautions spéciales pour éviter des dommages mineurs tels que bris de glace ou fissures du plâtre.

L'autre système dit rigide comprend des éléments qui ne peuvent être déformés (contreventement ou murs indéformables en béton armé). L'inconvénient est que l'énergie ne peut être dissipée à moins qu'un élément cède. Les barres de contreventement peuvent être allongées ou arrachées, mais constituant un élément structural secondaire, elles peuvent être réparées. Il en est de même des murs résistant au cisaillement (shear walls) en béton armé dans les deux sens. Ils peuvent être fissurés diagonalement en cas de grand séisme et ensuite réparés ou remplacés.

La tendance actuelle est de combiner les deux systèmes: le cadre flexible est muni de "shear walls" — qui donnent une certaine rigidité et évitent trop de flexibilité lors des premières secondes pendant lesquelles les mouvements vibratoires sont extrêmement sévères et dépassent de beaucoup les forces qui servent de base au calcul. Après le bris des "shear walls" l'ossature flexible a une résistance suffisante à opposer aux mouvements vibratoires moins intenses.

Avant de conclure cette étude concernant les bâtiments, nous tenons à mettre en garde nos lecteurs sur le fait que les essais dynamiques sur des modèles à petite échelle ne correspondent pas à la réalité. Trop d'éléments divers ne peuvent être reproduits à petite échelle.

Matériaux et détails de construction

L'architecte a non seulement une formation artistique mais aussi une solide formation scientifique qui lui permet de juger quels sont les matériaux qui peuvent résister aux chocs et mouvements vibratoires très violents qui peuvent se produire à proximité de la région épicentrale.

Le bois à l'état naturel est un excellent matériau, de même l'acier de charpente qui résiste aussi bien à la tension, à la compression et à la torsion. Ce dernier possède aussi la propriété d'être ductile, c'est-à-dire de permettre des déformations plastiques en évitant la rupture.

L'examen des dommages causés à Agadir, Acapulco, Mexico et tout récemment à Skoplјé a mis en évidence les effets de torsion sur les matériaux qui ne possèdent pas les propriétés physiques cidessus énoncées. Il suffit de prendre une éprouvette de ciment ou un simple morceau de craie et d'appliquer une faible torsion pour provoquer une cassure hélicoïdale à 45°, donc dangereuse lorsqu'il s'agit d'une colonne d'un bâtiment.

L'examen des dommages dûs aux differents séismes a montré que les systèmes de construction ne présentant pas la continuité nécessaire n'ont pas résisté. Les éléments préfabriqués insuffisamment reliés à l'ossature ont provoqué des dommages. Une toiture en voile mince s'est effondrée à Skoplјé mettant en évidence les effets de renversement des contraintes qui n'avaient pas été prévues.

En résumé, notamment à proximité des failles où les vibrations ont de courtes périodes, il y a lieu de faire un choix approprié de matériaux ou de combinaisons de matériaux ductiles — non fragiles — aussi légers que possible. Tout matériau fragile doit être utilisé comme élément secondaire, il est souvent utile, car en se brisant il absorbe une grande quantité d'énergie et sa destruction.

D'une façon général, la continuité des éléments d'une charpente est absolument nécessaire, les éléments empilés les uns sur les autres n'offrent aucune résistance. Il est en outre necessaire que les matériaux aient une certaine ductilité et éviter d'être fragiles ou cassants (fonte, acier spécial à très haute résistance, et tout matériau n'ayant pas de ductilité).

Les japonais, à notre connaissance, ont procédé à de nombreux essais de matériaux et examiné de nombreux dommages sont arrivés à la conclusion suivante:

Au-dessus de cinq étages la solution la plus économique pour les bâtiments devant résister aux séisme est d'utiliser des charpentes d'acier — enrobées de béton. Ce dernier matériau augmente la résistance de la charpente — en cas de séisme en se brisant il absorbe une grande quantité d'énergie et après les premiers chocs la charpente d'acier résiste aux efforts suivants. L'avantage de la colonne composite (poutre H enrobée de béton) est de constituter l'élément résistant parfaitement à la torsion. Au Japon la charpente d'acier est obligatoire à partir de cinq étages.

Pour les planchers le système le plus économique est celui utilisant les tôles d'acier ondulés — recouverts d'un béton léger. Ils sont légers et conséquemment la force latérale proportionnelle au poids est diminuée.

La loi italienne exige que tous les éléments préfabriqués doivent être reliés bien solidement à l'ossature afin d'éviter les coups de butoir qui risquent de disloquer le bâtiment.

En résumé l'architecte doit être guidé par son jugement pour le choix des matériaux, en cas de doute il doit s'adresser à une personne compétente et indépendante et éviter de prendre au mot toute littérature commerciale.

CONCLUSION

L'architecte ne doit pas oublier que dans les zones sismiques les bâtiments qu'il conçoit et qu'il fait édifier doivent présenter une sécurité suffisante afin d'éviter des pertes de vies ou de graves dommages. Dans ses discussions avec les propriétaires il doit prévenir ces derniers qu'en adoptant souvent des dispositions supplémentaires, souvent peu onéreuses, il évitera des dommages considérables ou la destruction totale de sa propriété.

A l'heure actuelle la nouvelle science aséismique est suffisamment au point pour fournir tous les renseignements techniques désirables et l'"acte de Dieu" ne saurait être invoqué pour se dérober à ses responsabilités.

Steel/Recent Developments

by Derek Tarleton

One of the most significant developments in the Canadian structural steel industry was the recent debut of G40.12, the new, general purpose non-proprietary, lightweight structural steel. The new steel is especially practical in the design of structures where weight savings, space utilization and long span, column free areas are desirable. From the point of view of cost, G40.12, though priced higher, may result in a lower total cost when its special properties result in a sufficient reduction in the quantity required. The new steel is suited to modern fabrication and assembly methods, as it is of suitable chemical composition to permit both welding and gas cutting with little more than minimum standard precautions.

Strength is the second most important consideration, and with a 44,000 psi yield point in most rolled shapes and in plates up to 1½ inches thick (40,000 psi yield point for the heaviest rolled shapes and plates over 1½ to 2½ inches thick) G40.12 steel is just about at the upper limit of yield strength that can be provided in a low carbon steel. Beyond this yield strength level alloying additions are usually required.

G40.12 is entitled a "General Purpose Structural Steel". This means that compared to other currently available structural steels G40.12 offers the best combination of the yield-strength-to-price ratio and unit price. Thus if one grade of structural steel is selected for all the members of a structure, the odds strongly favour G40.12 to be most economical in terms of material cost. Some comparative current material costs and the corresponding yield-strength-to-price ratios are shown in Table 1.

TABLE 1

Steel	Minimum Yield Strength PSI	Unit Price* Per 100 lb.	Yield-Strength-to-Price Ratio
CSA G40.4 / ASTM A7	33,000	$6.50	5,080
ASTM A36	36,000	6.55	5,500
CSA G40.8A	40,000	6.70	5,970
CSA G40.12	44,000	6.65	6,620
ASTM A441	50,000	8.75	5,710

*FOB Montreal from Canadian source, optimum quantity order of 12 WF 27, Summer 1964.

As a very simple example, a summary is shown in Table 2 of comparative simple span beams required to support a load of 2,000 pounds per foot of length. The comparison is made between G40.12 steel and A36 steel (ASTM A36, minimum yield point 36,000 psi) the latter being used extensively in building construction over the past four years.

TABLE 2

Span	Total Load Based on Unit Load of 2,000 lb./ft.	A36 Beam Req'd	G40.12 Beam Req'd
28'0"	56,000 lb.	21 WF 55	18 WF 50
31'1½"	62,200 lb.		21 WF 55

Table 2 also shows that if the 21 WF 55 required in A36 steel for a 28-foot span was specified to be of G40.12 steel the span could be increased by more than three feet without reducing the assumed design safety factor. Considering only the comparison for the 28-foot span we can see that the beam depth is reduced by 3 inches or 14.3%, the beam weight is reduced by 5 lb. per foot or 9.1% and the beam cost (material only) is reduced by approximately $8.50 or nearly 8%.

With good surface preparation of the steel by blast-cleaning prior to painting, the presentability of architecturally exposed G40.12 steel structure can be of a high calibre. It should be noted, however, that G40.12 is not a low-alloy corrosion resistant structural grade and is not intended for those applications where exposure of the bare, uncoated steel to the weather is to be an intentional architectural feature.

Mr Tarleton, P.Eng., is the Chief Engineer for the Canadian Institute of Steel Construction.

Weathered Steel

Another new development by the steel industry is a high strength, low alloy structural steel which conforms to ASTM designation A-242, popularly known as "weathered steel". After thorough blast cleaning, it is left unpainted and exposed to the elements. Two or three years later the exposed steel surfaces have acquired a reddish color which looks like, and in fact is, rust. During oxidization the surface achieves a harmonious shading of brown, gray and purple metallic hues, which is permanent. From a distance the blending of colors appears gray; close up, it is red. The corrosion particles have an affinity for the metal itself and a strong tendancy to adhere. The steel has to be handled with great care during construction, as any marks or stains, even fingerprints, interfere with the weathering process, and therefore show. Welded joints, though conspicuous at first, also oxidize and when weathering is achieved, are hardly noticeable.

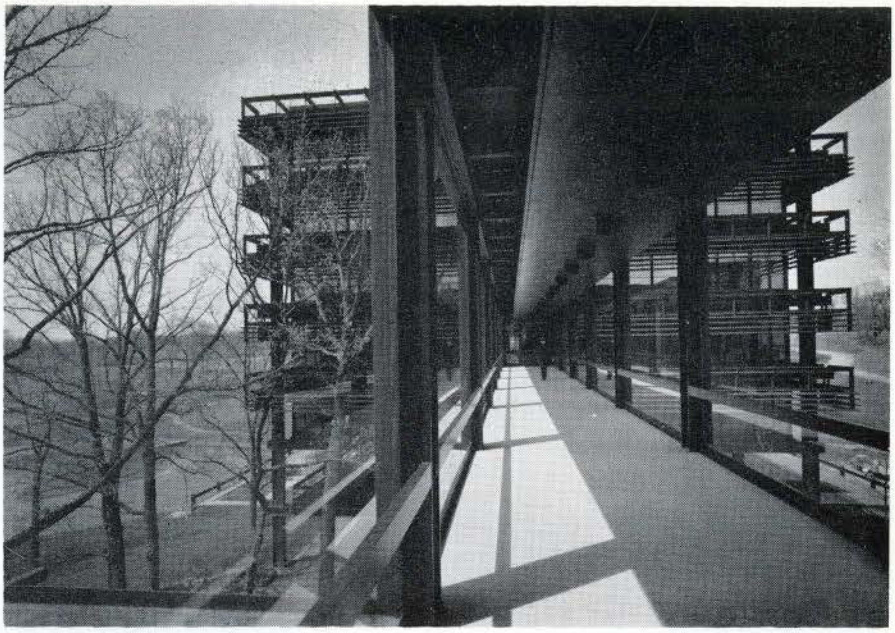
The first notable example of the use of weathered steel in the United States was the John Deere Company administration building, built in 1962 outside the city of Moline, Illinois. The architect was the late Eero Saarinen. Use of the new steel is planned for some of the buildings for Expo '67; and the latest news concerning it is the announcement of its use in the Steel Company of Canada's new research building at Burlington, for which the architects are Shore and Moffat and Partners.

1. *John Deere Company Administrative Center, Molines, Illinois. Glass enclosed entrance bridge. Architect/Eero Saarinen and Associates.*

2. *Interior showing weathered steel beams projecting through curtain wall to exterior.*

3. *Steel Company of Canada Research Centre, Burlington, Ontario. Architect/Shore and Moffat and Partners.*

1



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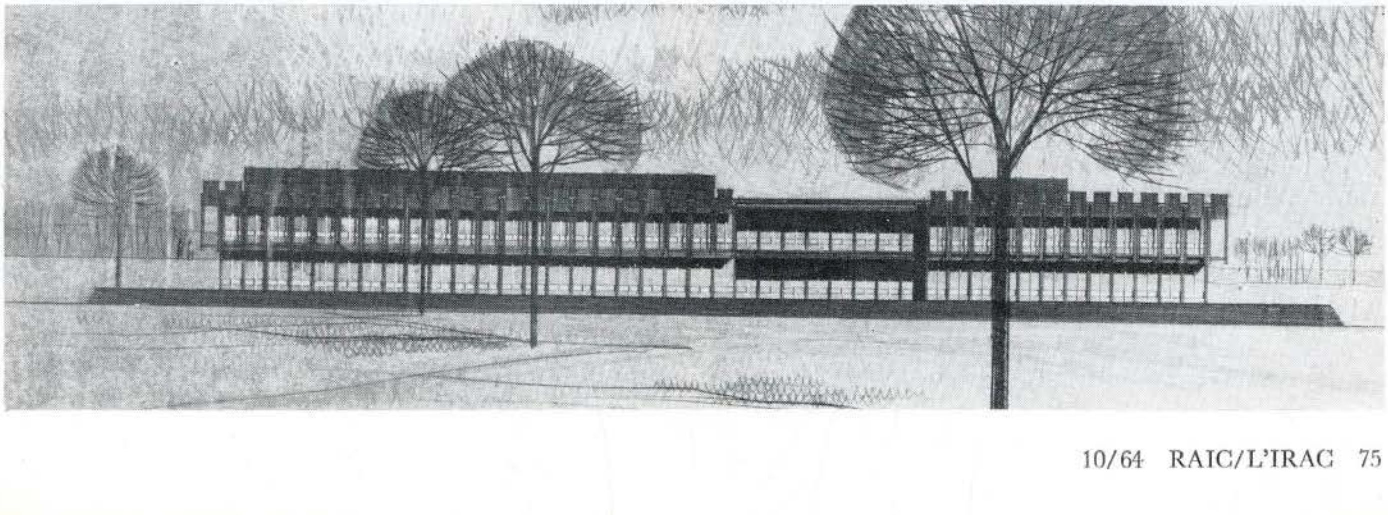


Dofasco Building

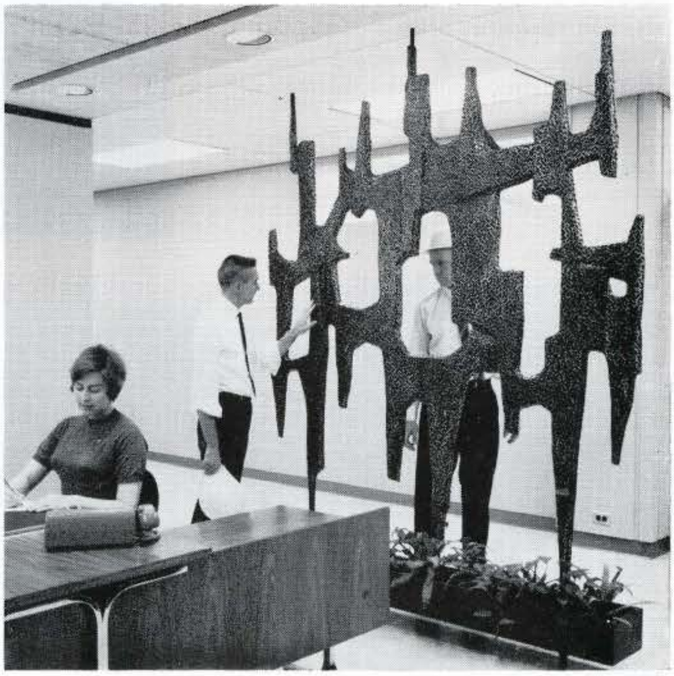
Dominion Foundries and Steel (DOFASCO) opened on October 14, 1964 their new office building in Hamilton designed to show the many uses of steel in structure and design. Architects Prack and Prack of Hamilton used steel in every possible application from the pilings that support the building to the wall finishes in work areas and offices.

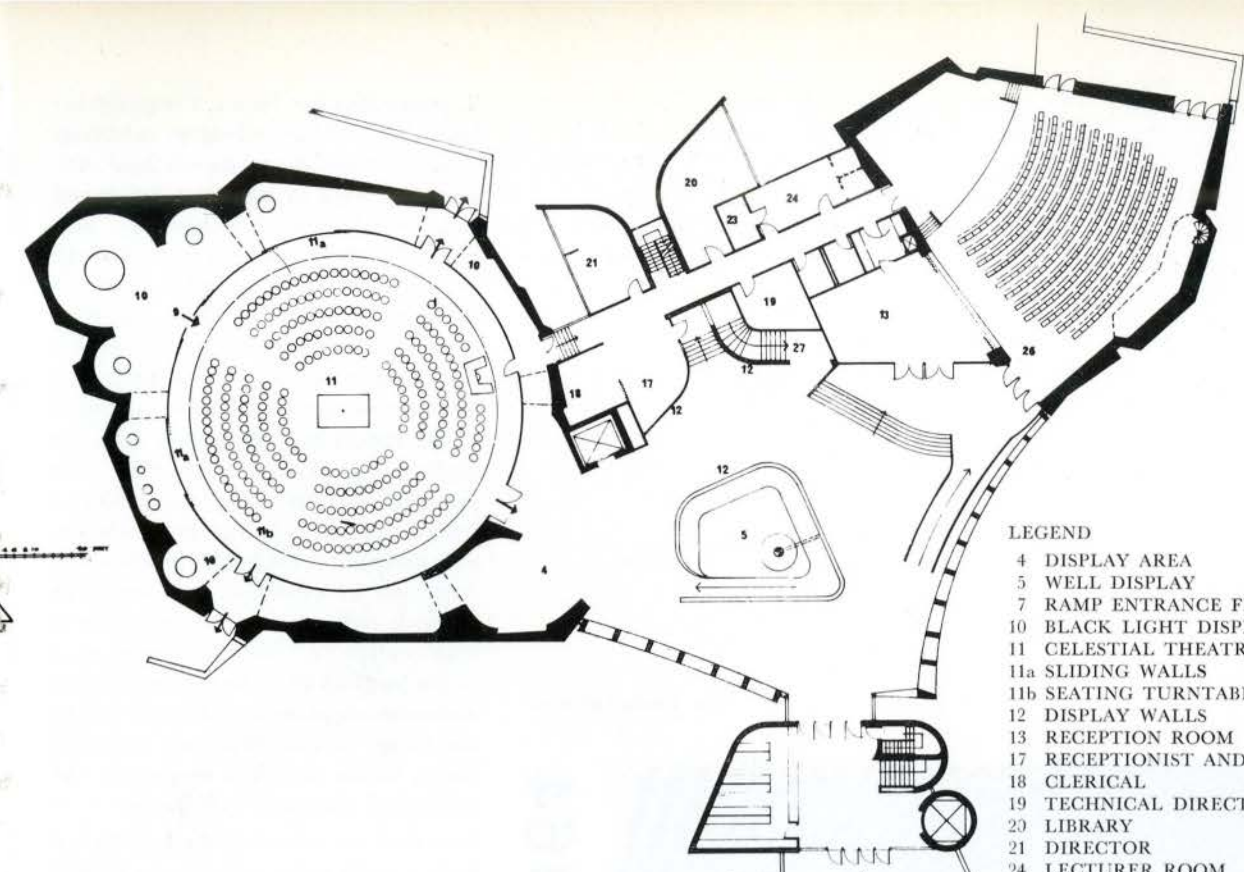
The steel framed building is set on concrete filled steel tubing piles. The 42-inch deep girders have cutouts every six feet for heating ducts, electrical wiring and piping. The "cellular" steel flooring covered with poured concrete provides raceways for wiring as well as minimizes floor thickness.

Vitreous enamel covered steel panels are used for the skin of the building. The curtain wall was prefabricated in finished units comprising inner and outer walls, insulation and window frames.

The interior was designed especially to illustrate the uses of veneers on steel. Nearly 30 different veneers including 14 types of wood, were used. Stairwells and laboratory are of steel clad block. Doors and frames, also of steel are in a variety of colors, can be moved around as needed. The moveable partitions, prefabricated to a standard width, are finished in baked enamel. Steel acoustic ceilings handle lighting fixtures and air circulation.

Below, left, main lobby, showing birdseye maple veneered steel walls and divider screens of twisted steel foil between glass; right, art in steel: sculpture by J. A. Gaise in fifth floor lobby was cast in DOFASCO *foundry.*

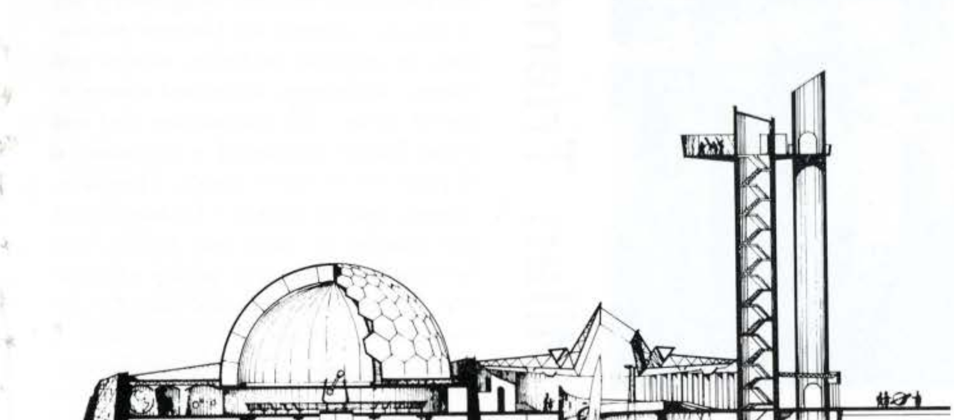




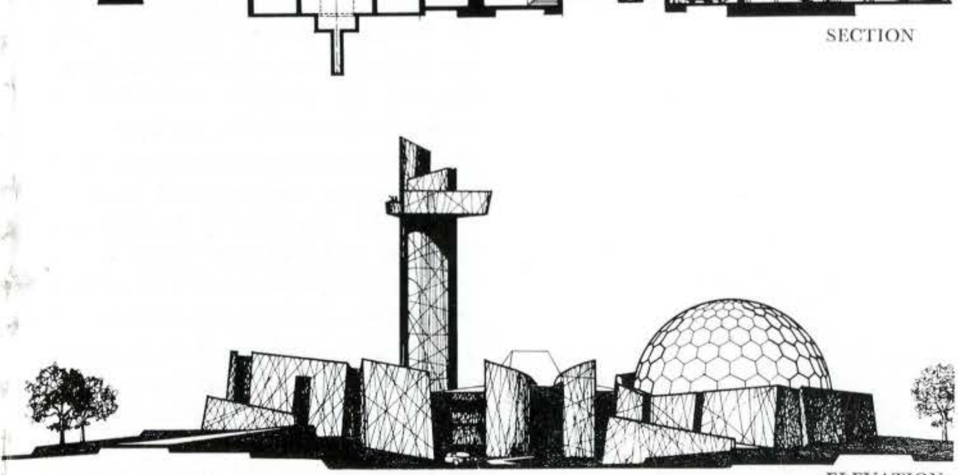
LEGEND
4 DISPLAY AREA
5 WELL DISPLAY
7 RAMP ENTRANCE FROM SITE
10 BLACK LIGHT DISPLAY
11 CELESTIAL THEATRE
11a SLIDING WALLS
11b SEATING TURNTABLE
12 DISPLAY WALLS
13 RECEPTION ROOM
17 RECEPTIONIST AND WAITING
18 CLERICAL
19 TECHNICAL DIRECTOR
20 LIBRARY
21 DIRECTOR
24 LECTURER ROOM
26 LECTURE HALL

MAIN LEVEL

Competition/a Planetarium for Calgary



SECTION



ELEVATION

First Prize

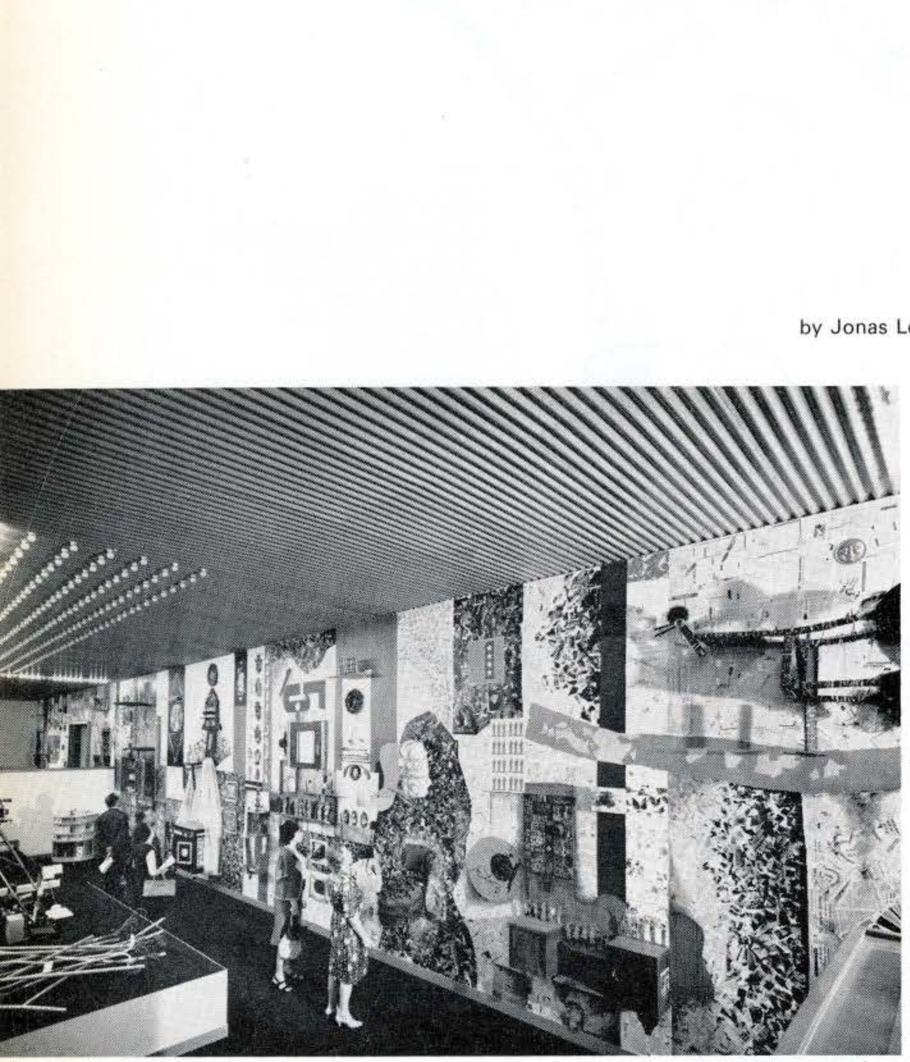
McMillan, Long & Associates

The competition, confined to local architects, was for the design of a planetarium to be Calgary's Centennial project. The Jury consisted of Prof. Henry Elder, Vancouver, chairman and professional adviser; E. J. Gaboury, Winnipeg; Irving Grossman, Toronto and L. P. Wynick. Second prize was won by Gordon L. Atkins and third by William Boucock. There were 18 entries.

Asked to comment on their winning design, Messrs McMillan, Long and Associates said "The design follows no preconceived ideas, adheres to no architectural school or prevailing architectural philosophy. Heavy and massive concrete walls grow out of terraced earth forms, and a tenuous light metallic roof spans between the three strong basic elements of Planetarium, lecture hall and tower, which are webbed together with a general display and exhibition area. The tower, on the axis of one of Calgary's major downtown streets, provides star-viewing and site seeing platforms above the glare of city lights.

Milan Triennale 1964

by Jonas Lehrman



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Traditionally the Milan Triennale has been the vehicle whereby exhibiting countries have always shown their most advanced work in industrial design and to a limited extent in architecture. Emphasis has been on cultural and social aspects rather than on trade, and the preceding Triennale in 1960 focussed on schools. The theme of this year's display was "tempo libero" — free time: the constructive use of leisure — a theme whose importance grows daily with the rapid acceptance of automation. The problem itself lies not in the growth of leisure time as such, but as to whether man accepts it to further his free development and its expression or whether he allows it to become one more vehicle of mass conformity. Ultimately the solutions to this problem lie in the spheres of social and economic planning, although through the design of communication networks, towns, homes and their equipment, the architect is considerably involved.

Free time was treated by the Italians as a serious social issue, with a great display of data and many diagrams and charts. At times, the number of industrial design items related to cultural, transport, hobbies and sport tended to become a little out of hand — a manufacturers' heyday. The UK had a mass disarray of equipment, the pressure being clearly one of export; whereas the German section, with its emphasis on ballet, theatre and camera equipment, amounted almost to one of frenzy. By contrast the cool and white Finnish display of a few selected objects of outdoor sports (javelins, canoes) placed against a background of photographs of lakes and forests, was beautifully simple and highly effective and was perhaps matched only by the Swiss, who provided little more than a calm empty space for silent meditation. This was an emphasis on the recreative aspect of leisure, and supplied one of the few answers to the problems raised by the Triennale theme. Otherwise there was little that was sufficiently far-thinking, and the questions raised had to remain for the most part, platitudes.

Out in the Park, Canada was represented by a spacious well-equipped weekend cottage (1) (designed by Schoeler and Barkham) and the United Kingdom by a mobile shelter which opened on all four sides to form a holiday home for six.

The unique contribution of the Triennale remains however, in its display techniques. These were garish yet overflowed with vitality (2); they battered the mind, yet relied on wit and fun; they were

2

highly spectacular, yet succeeded in conveying satire and social comment. A triangular hall of mirrors (3), in which films were projected on the floor and reflected, together with visitors on to the tapering walls in an endless, optically bewildering, illusionary hexagonal enigma; a labyrinthine highly polished main staircase of silver (4) whose vistas were continually terminated by giant TV screens flashing slogans; an endless stream of Milanese cars (5) coast-bound bumper to bumper, canoes, small power-boats and camping equipment strapped to their roofs, their horns blaring, their brake lights flashing on and off . . . spatial and pictorial images without number, accompanied continuously by a sophisticated mastery of the play of infinite space with

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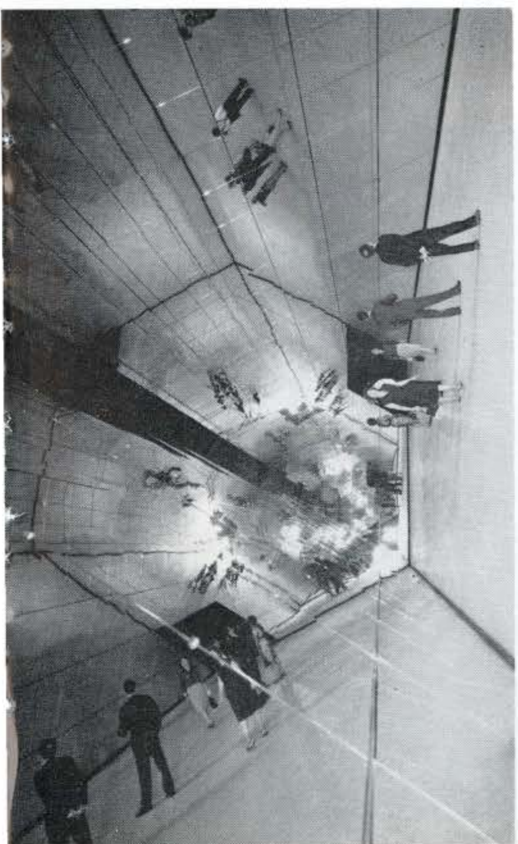

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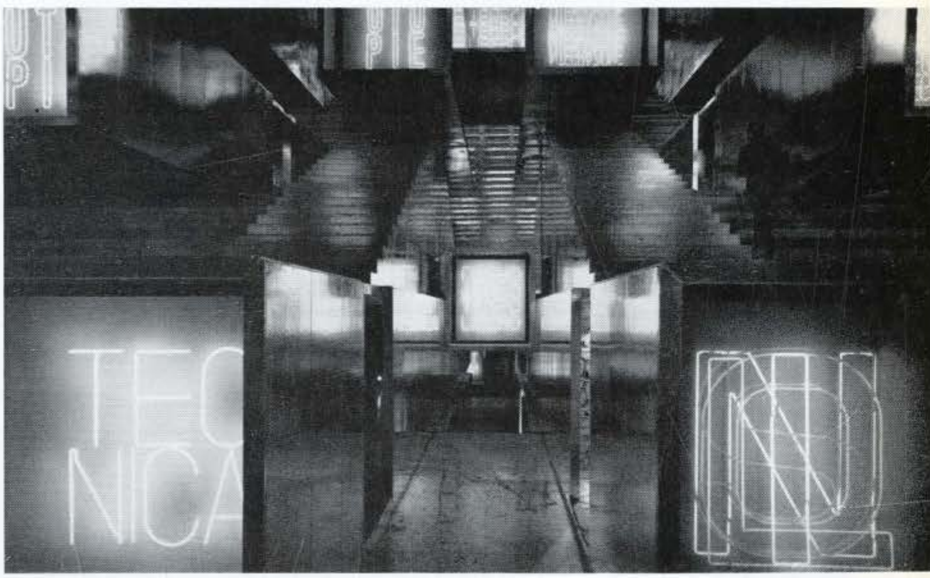

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confined corridor, brilliantly illuminated screens with dark cavernous shadows, immaculate typography on glass, with pencilled graffito on rough plaster (6); collage, montage (7), assemblage and electronic music.

The Triennale's message was received, but sophistication of the spatial and pictorial images were inclined to outdistance it — appreciated, remembered and superb in their own right.

6

(Institute News continued from page 14)

WILLIAM MICHAEL BROWN

William Michael Brown, FRAIC, age 83, son of the late Rev. Philip Brown, a former rector of French Village Anglican Church and Louise (Brine) Brown, died in Wolfville, NS on October 7, 1964. Born in Halifax, he received his early education there and attended Kings Collegiate in Windsor, NS. He was one of the oldest graduates (about 60 years ago) of the Victoria School of Art and Design in Halifax, now known as the Nova Scotia College of Art. He studied architecture in New York and worked in several leading architectural firms there for a number of years. He returned to Halifax in 1908 where he commenced to practice and designed a number of fine buildings in the Province. He enlisted in the Canadian Army for the First World War but the war ended before his unit was sent overseas.

Mike was well esteemed and on many occasions helped out in some of the local architectural offices and with the Department of National Defence. He was a member of the Maritime Association of Architects in 1930 and a Charter Member of the Nova Scotia Association of Architects, incorporated in 1932. He served faithfully on council for a number of years and was President in 1935. He was elected to the College of Fellows in 1952. William Brown and his wife will be remembered by many of the Institute's members, as they frequently attended the RAIC annual assemblies.

A. E. Priest, Halifax

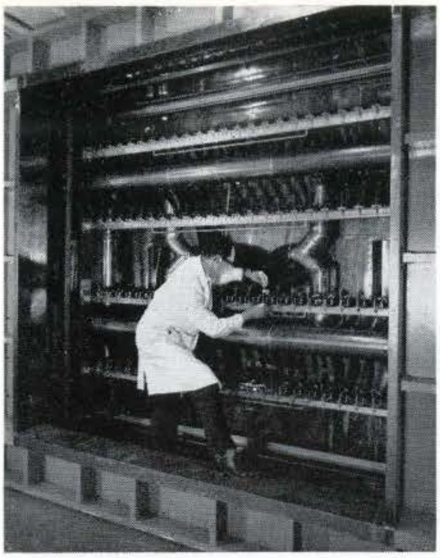
BC CLOSED COMPETITION

A contest open to all British Columbia registered architects is being sponsored by West Kootenay College Council for an overall design concept for a regional college and campus. Registration closed on November 10, 1964. All entries must be submitted by January 11, 1965.

Prof. Henry Elder, UBC; Donald H. Lutes, AIA, Oregon, USA; and James A. Gray, Chairman West Kootenay College Council (non voting) are the adjudicators. Warnett Kennedy is professional advisor. First prize is the commission to design the core building or buildings plus an advance fee of $2,500 and a cash award of $2,500. Second prize is a cash award of $1,500, third prize is $1,000.

W. LOBBAN WATERLOO PLANNER

William Lobban, MRAIC, ARIBA, former chief architect of the Royal Canadian Navy, has been appointed Director of Physical Plant and Planning for the University of Waterloo. He will be responsible for the planning of the future expansion of the university's physical facilities (property, buildings) as well as the maintenance of existing facilities.



APPARATUS FOR DETERMINING RAIN TIGHTNESS OF WINDOWS AND WALLS

An apparatus to determine the resistance of windows and curtain wall arrangements to rain penetration has been constructed by the Division of Building Research of the National Research Council of Canada. Samples as large as 8 ft square can be tested in the apparatus which simulates conditions of natural wind-driven rain.

The apparatus designed and constructed by the DBR/NRC is based on a design used by the Norwegian Building Research Institute. The apparatus appears to be the most suitable for investigating the factors that affect the design of raintight joint arrangements, factors, such as: the geometry of the rain screen, the location of the air tight barrier within the construction, and directional rain protection provided the joint.

WINDOW DESIGN BUILDING SCIENCE SEMINARS TO BE CONDUCTED BY DBR IN FEBRUARY 1965

Basic considerations in the design of windows will be the subject of the 1965 Building Science Seminars being offered by the Division of Building Research, NRC. For the convenience of those wishing to attend, the Seminar will be given in two locations: in Ottawa, 3, 4, and 5 lectures presented by members of the February; and in Calgary, 18 and 19 February 1965.

The Seminars will consist of a course of Division of Building Research, NRC, whose work is directly concerned with this aspect of building research. The subject of windows is naturally closely related to the previous Seminar subject of exterior wall design and will be of special interest to those responsible for the design and performance of windows and walls. It will, in addition, be of interest to manufacturers and suppliers of windows. The content of the lectures in the two places will be the same with the exception that, on the third day in Ottawa, those attending will be given a guided tour of the Building Research Centre and there will be an opportunity for discussions with research staff.

Accommodation at the Seminars is limited. Those wishing to attend are required to send in an advance registration form prior to the meeting. Copies of the program, which includes the advance registration form, can be obtained from the Division's administrative officer, L. P. Ruddy, at Ottawa.

INTERNATIONAL COMPETITION, CIVIC CENTER PLAZA, SAN FRANCISCO, USA

The city of San Francisco is sponsoring an international competition for the enhancement of the Civic Center Plaza by developing the central area as a major work of art. The designer's solution may be any art form including sculpture, landscape treatment or combinations thereof.

The competition is approved by the UIA, therefore the RAIC, and open to artists, sculptors, architects and civic and urban designers.

The jury will consist of Thomas Church, USA, landscape architect; Dr Lorenz Eitner, USA, art historian; Luis Barragan, Mexico, architect; Jacques Lipchitz, Lithuania, sculptor; Moses Lasky, USA, patron.

Competition prizes are; $3,750; $3,250; $3,000. The winning design will be submitted by the jury to the Art Commission of San Francisco, and if the Commission approves the winner will receive an additional $10,000. If the Commission approves more detailed studies, the winner will be required to execute his work, for which he will be paid an additional $40,000.

Closing date for registration is December 31, 1964; for questions, February 1, 1965; for despatch of entries, April 15; and for receipt of entries, May 14.

For all information, write to: The Professional Adviser, Civic Center Enhancement Competition, c/o San Francisco Art Commission, City Hall, Room 281, San Francisco, USA.

The registration form is to be sent to: Mr Henry Schubart, Jr., 52 Vallejo Street, San Francisco, USA, accompanied by a $5.00 (non refundable) fee.

CONCOURS INTERNATIONAL "CIVIC CENTER PLAZA" — SAN FRANCISCO-USA

La ville de San Francisco lance un concours international dont l'objet est de parfaire et d'embellir la Place de l'Hôtel de Ville en faisant de sa partie centrale un ensemble artistique. Les organisateurs désirent laisser aux concurrents toute la latitude possible; la solution recherchée peut revêtir n'importe quelle forme d'art, sculpture, architecture de jardins ou une

combinaison de celles-ci.
L'UIA a donné son accord au concours, ainsi que l'IRAC. Le concours est ouvert aux artistes, sculpteurs, architectes, architectes paysagistes, urbanistes.
Le jury consiste de Thomas Church, Etats-Unis, architecte paysagiste; Dr Lorenz Eitner, Etats-Unis, historien d'art; Luis Barragan, Mexique, architecte; Jacques Lipchitz, Lithuania, sculpteur; Moses Lasky, Etats-Unis, mécène.
Les prix sont; $3,750; $3,250; $3,000. Le projet du lauréat sera soumis par le jury à l'approbation de la Commission d'Art de San Francisco, s'il est approuvé, il recevra une somme additionnelle de $10,000. Si la Commission approuve les études plus détaillées, il lui sera demandé d'exécuter son projet ce pourquoi il recevra une somme de $40,000.
Date limite d'inscription 31 décembre 1964; pour poser des questions 1er février 1965; pour envoi des projets 15 avril; pour réception des projets 14 mai.
Pour tout renseignement, s'adresser: Professional Adviser, Civic Center Enhancement Competition, c/o San Francisco Art Commission, City Hall, Room 281, San Francisco, USA.
Le formulaire d'inscription doit être envoyé à M. Henry Schubert, Jr., 52 Vallejo Street, San Francisco, USA accompagné d'une somme de $5.00 (non remboursable).

CHERCHE EMPLOI

Architecte italien, agé de 28 ans, cherche un emploi dans un bureau d'architecture de préference dans le Québec ou dans l'Ontario. Il a obtenu son diplôme à l'Université d'architecture de Rome en 1962 et il s'est spécialisé dans les projets des écoles.
Adressez vous à Ferdinand Raffaelli, Via Collegiove No. 65 (Tomba di Nerone) Rome, Italie.

POSITIONS VACANT

Architects required. Apply Victor Prus, MRAIC. 1935 rue St-Luc, Montreal 6, Quebec.

NOTICE

Bregman and Hamann, 130 Bloor St. West, Toronto, announce that the following associates in the practice have now become partners: Kal Voore, B.Arch., MRAIC; R. E. Briggs, B.Arch., MRAIC; George P. Murray, B.Arch., MRAIC; Albert Rose, P.Eng., B.Sc., MEIC.

Industry

"Originator" is a new line of office furniture designed by Jan Kuypers of Dudas Kuypers Rowan, Toronto, for Dominion Metalware Industries Ltd. Pictured are an arm chair, a double pedestal office desk finished in teak, a swivel tilter arm chair, and a credenza from the Originator I series.
"Originator I" desks and credenzas come with bases of polished chrome bar stock, with handles of matching chrome finish. Desk tops and drawer fronts are solid core Arborite. Exterior panels are veneered in a choice of fine woods. "Originator II" desks are supplied with tubular legs of brushed chrome, with matching handles. Desk tops and drawer fronts are of solid core Arborite, with a balance of construction in steel finished in baked enamel in a wide choice of modern colors.
(Circle Reply Card Item 1)

NEW PRODUCTS

For schools; steel cupboard components in a complete color range of baked enamel. Designed to fit, ready to slip into place. *School Furniture Sales, 55 Research Rd., Toronto.*
(Circle Reply Card Item 2)

"Safety-Matic", an electromagnetic door holder centrally acuated by coded fire alarm stations; used to replace conventional link holders on fire doors. *Corbin Lock Division, Belleville, Ont.*
(Circle Reply Card Item 3)

A new commercial fluorescent fixture "Collegiate" features optimal light level, minimal cleaning and rapid installation. *J. A. Wilson Lighting Ltd., 2200 Lakeshore Blvd. W., Toronto 14.*
(Circle Reply Card Item 4)

"Electrac", an incandescent fixture for display; designed for total control of light pattern, intensity, color and special effects. *J. A. Wilson Lighting Ltd., 2200 Lakeshore Blvd. W., Toronto 14.*
(Circle Reply Card Item 5)

An all-steel combination cabinet designed especially to provide economical, convenient storage with maximum protection for drawings, plans and other outsize material. *W. R. Watkins Co. Ltd., 1151 Kipling Ave. N., Rexdale, Ontario.*
(Circle Reply Card Item 6)

Leaf-Lite II, non-modular luminous ceiling system with leaves incorporating a variety of unique textured lower edges. Design flexibility of mosaic tile; seamless effect. *Integrated Lighting Limited, 135 Van Horne Ave., Montreal.*
(Circle Reply Card Item 7)

Large and unusually sculptured aluminum refacing modules; low in cost, easy to erect, in wide range of colors. *C/S Construction Specialities Ltd., 895 Thermal Rd., Port Credit, Ontario.*
(Circle Reply Card Item 8)

New thermal barrier window with 33% better protection against air-infiltration and heat loss over non-thermal barrier windows. *Daycan Limited, 20 Brydon Drive, Rexdale, Ontario.*
(Circle Reply Card Item 9)

New line of sectional overhead doors; maintenance virtually eliminated by combination of modern materials. *Richards-Wilcox Company, P.O. Box 3060, Terminal "A", London, Ontario.*
(Circle Reply Card Item 10)

Crown Z Medium Density Formply, a reusable concrete form panel; exterior grade plywood overlaid on one or both sides with a phenolic resin and cellulose fibre, Crezon. *Crown Zellerbach Building Materials Ltd., 15 King Edward Ave., New Westminster, B.C.*
(Circle Reply Card Item 11)

"Buck" windows for poured concrete basements; steel frames made to full wall thickness for quick, easy installation. *Rusco of Canada Ltd., 750 Warden Ave., Scarborough, Ontario.*
(Circle Reply Card Item 12)

For use with all supply mediums, Nelson-Aire Mark II, a new thin-profile heating, ventilating and air conditioning fan-coil unit; five sizes, many models. *Herman Nelson Division of American Air Filter of Canada Ltd., 400 Stinson Blvd., Montreal 9.*
(Circle Reply Card Item 13)

A felt base flooring in new Gravure deep pile carpet effect; five muted colors. *Dominion Oilcloth and Linoleum Limited, 2200 St Catherine St. E., Montreal.*
(Circle Reply Card Item 14)

Novel door knocker, Tap-Nok, requires only a light tap instead of lifting. Spring loaded strike plate prevents rattle when door is closed. *Safe Hardware Division, Emhart Corporation, New Britain, Connecticut.*
(Circle Reply Card Item 15)

Abitibi Sales Co. Ltd, 408 University Ave, Toronto 2, announces a new prefinished hardwood plywood, "Coronet". The product is available in six woods.
(Circle Reply Card Item 16)

NEW LITERATURE

40 page booklet on pressure preservation treatment of timber. *Canadian Institute of Timber Construction, 200 Cooper St., Ottawa 4.*
(Circle Reply Card Item 17)

New bulletin from Kinnear Rolling Grilles. *The Kinnear Manufacturing Company, 3063 Dundas St. W., Toronto 9.*
(Circle Reply Card Item 18)

"Where to Buy Directory"; a listing of specialty products and species available from 56 hardwood plywood manufacturers. *Hardwood Plywood Manufacturers Association, P.O. Box 6246, Arlington, Virginia.*
(Circle Reply Card Item 19)

Technical Data Sheet showing application of standard stock door frames with all sizes of modular masonry units. *The Steelcraft Manufacturing Company of Canada Ltd., 3425 Derry Rd. E., Malton, Ontario.*
(Circle Reply Card Item 20)

Descriptive literature on the Dunbar line of contemporary and revolutionary furniture. *Office Specialty Co. Ltd., Newmarket, Ontario.*
(Circle Reply Card Item 21)

Literature describing operational and functional simplicity of DuKane Nursing Home Communications Systems. *Communications Systems Division, DuKane Corporation, St. Charles, Illinois.*
(Circle Reply Card Item 22)

4 page multi-color illustrated brochure entitled "Recessed Rounds by Art Metal". Describes complete line of decorative regressed recessed round lighting fixtures. *Wakefield Lighting Limited, P.O. Box 3231, London, Ontario.*
(Circle Reply Card Item 23)

Revised, List A of Helpful Publications for Production Men, Design Engineers, Metallurgists and metal users; catalogues 200 available pieces of literature on metals. *International Nickel, 55 Yonge St., Toronto.*
(Circle Reply Card Item 24)

"Complete office furniture guide by Royalmetal". 99 colored illustrations. *Royalmetal, Galt, Ontario.*
(Circle Reply Card Item 25)

60 page booklet "Application of B. & K. Equipment to Architectural Acoustics" free of charge. *R-O-R Associates Limited, Don Mills, Ontario.*
(Circle Reply Card Item 26)

Technical Column

Edited by Douglas H. Lee

Lightweight Aggregates

Their Characteristics and Uses in Concrete Masonry

by D. W. Lewis

Mr Lewis is Chief Engineer of the National Slag Association

Since World War II, a phenomenal growth has been experienced by the lightweight aggregate industry, with production increasing many fold in North America. Even with today's vastly increased production and increased use in structural concrete, the main part of this success must be attributed to the popularity of lightweight aggregates in concrete masonry products. In the United States, it has been estimated that up to 50% of all concrete block may be made with lightweight aggregates. Current Canadian production is undoubtedly somewhat less, but it too is making annual gains.

Among the more than 250 lightweight aggregate plants in North America, there exists a variety of types of material, with widely varying properties and characteristics. In general, the major types are as follows: —

Expanded slag is one of the important lightweight aggregates used in concrete masonry. It has been defined by ASTM in C 125 as: "The lightweight cellular material obtained by conrolled processing of molten blast furnace slag with water, or with water and other agents such as steam or compressed air or both." There are several methods for bringing the molten slag into contact with the proper quantities of water — various pit or jet processes, runners, the Kinney-Osborne process and the Caldwell and Brosius machines. All the processes result in the same end product — a lightweight, cellular slag, that is subsequently processed by crushing and screening to the required sizes.

Expanded shales, clays and slates are lightweight aggregates that may be produced by either of two methods: bloating in a rotary kiln or by the sintering process. In the first of these the clay, shale or slate is heated in a rotary kiln at temperatures of 1800 - 2200°F. to cause formation of gas bubbles that "bloat" the material by producing a highly cellular structure. After cooling, it is crushed and screened. In some plants, pre-sized material is charged into the kiln along with a more refractory powdered material to coat the particles and prevent them from sticking together. This produces a rounded, "coated" coarse aggregate; however, the fine aggregate is still principally a product of crushing.

In the sintering process, the raw materials are mixed with fuel and spread on the travelling bed of a sintering grate for ignition and burning. The mass undergoes some expansion and the particles are fused together to form a sinter cake. After cooling, the sinter cake is crushed and screened.

Cinders were probably the first lightweight aggregates employed in concrete masonry to any significant extent. Cinders are the residue from high temperature industrial combustion of coal. Although still used to some extent in a few localities, they are far past their peak use due to dwindling supplies and transportation costs.

Sintered fly ash is a lightweight aggregate that might also be mentioned. It has been produced on a small scale for some years in England, and three plants are now under-way in the United States. Some interest, at least, has also been expressed in Canada, but at the present time it has had limited use in the North American concrete products industry. Fly ash, the fine powdery residue from combustion of pulverized coal, is agglomerated or pelletized by various means, with the addition of extra fuel if required. Carbon already present in the fly ash may furnish part or all of the needed fuel. After burning on a sintering grate, the pellets are screened and crushed as necessary to produce the fine aggregate sizes.

Pumice and scoria are two natural aggregates that should be mentioned to complete the picture of the lightweight aggregates most commonly used in masonry units — or likely to be available for such use in the near future. Both are naturally occurring porous or vesicular rocks of volcanic origin. Pumice is a light-coloured, porous volcanic glass, while scoria is a vesicular volcanic lava, tending to resemble industrial cinders in many respects. Principal use of these materials is in the Southwestern United States, although some pumice is now being imported from Mediterranean sources.

DISTRIBUTION OF LIGHTWEIGHT AGGREGATE

The principal lightweight aggregate in the Maritimes is expanded slag manufactured by Dosco in Sydney, Nova Scotia. In Quebec, expanded shale and slag products are produced by the major masonry plants. Again, in Southern Ontario, slags and shales are the common available lightweight aggregates for exposed masonry, supplemented by cinder units for use principally in "backup" type work. Expanded slag units are available at the Lakehead, using material delivered by boat. From Fort William west, however, the picture is dominated by the use of locally produced expanded shale, with all major cities having their own sources. An exception to this is the manufacture of a small number of pumice units in the Vancouver area.

Let's look for a moment at the general characteristics of these materials as compared to natural aggregates with which we are all familiar — characteristics that affect their uses or the methods of using them. Although a lightweight aggregate from a given source is usually consistent in characteristics, large differences are found between different sources, even within the same general type of material; hence, only generalities are used in this discussion.

Weight—unit weight and specific gravity of the materials is quite low—a necessity, of course, if they are to be classed as lightweight aggregates. In gravels and crushed stones, small sizes of particles and the larger ones have essentially the same specific gravity. In lightweight aggregates, the larger pieces have the lowest specific gravity, with the gravity increasing as size decreases. The relationship between size and specific gravity is dependent upon porosity and the size of voids and, therefore, differs for different materials.

Absorption — water absorption is usually quite high as compared to ordinary natural aggregates, with values of 5 - 20% being common. However, both absorption and specific gravity are difficult to determine accurately. *Particle shape* is generally quite angular, rough, vesicular and irregular. This harsh texture makes consolidation somewhat more difficult than with aggregates having smoother surfaces. *Strength* of the aggregate particles, like the other characteristics, varies considerably from one lightweight aggregate to another. In general, however, the lightweight aggregates are somewhat weaker, more friable and more easily broken than are normal weight materials. Last, we might list as a characteristic the fact that the lightweight aggregates are usually somewhat more costly than normal weight materials.

SPECIFICATIONS

LIGHTWEIGHT AGGREGATE

ASTM C 331, Lightweight Aggregates for Concrete Masonry Units, is the most commonly used specification for these materials, both in the United States and Canada. There is no current CSA equivalent specification.

Grading. The ASTM specifications provide ranges for gradation that are quite broad. To limit variations within an aggregate grading, maximum changes in Fineness Modulus are restricted to 7 per cent. from the sample originally submitted for test. Maintaining the desired grading after production is more of a problem with lightweight than with normal weight aggregates. There are two basic reasons for this: (a) Variation of specific gravity with particle size increases tendencies toward segregation, and (b) greater susceptibility to breakage tends to increase degradation in size. The solutions to these problems, of course, are handling and transporting the aggregate in a damp state, the use of separate fine and coarse gradings combined at the mixer, and care in stockpiling operations.

Unit Weight. The specifications permit a maximum dry, loose unit weight of 55 lbs per cu. ft. for coarse aggregate, 70 lbs per cu. ft. for fine aggregate, and 65 lbs per cu. ft. for combined sizes. Aggregates actually available probably range from about 40 to 70 lbs per cu. ft. for various materials and sizes. For good control it is essential that the unit weight remain reasonably constant in successive shipments of aggregate. The ASTM standard specification limits the unit weight variation to 10 per cent. of the weight of the sample submitted for acceptance tests.

Deleterious Substances — the most common deleterious substances or contaminants in lightweight aggregate are: iron or iron compounds that may cause staining; and hard-burned lime, clay lumps, unburned coal, etc., that may produce popouts. In an effort to control these substances, the ASTM specification provides test methods and limits on: organic impurities, staining materials, clay lumps, loss on ignition, popout causing materials, and also limits drying shrinkage which might be aggravated by an excess of underburned clay or shale particles.

PROPERTIES OF LIGHTWEIGHT CONCRETE MASONRY UNITS

The major specifications controlling the properties of concrete masonry are ASTM C 90, C 129 and C 145, covering hollow load bearing, hollow non load bearing and solid load bearing masonry. Lightweight masonry must also meet the physical requirements of these specifications commensurate with end use.

For the past several years a CSA Sub-Committee has also been at work writing standards to cover the ground from the Canadian viewpoint. These standards now appear to be close to the point of adoption and will probably be in general use in the near future.

Appearance. While not a measurable property from the physical testing viewpoint, there is little doubt that the visual appearance of lightweight blocks contributes much to the popularity of this type of masonry. In general, the sharply tailored arrises and fully textured surfaces, combined with uniform bright colours, provide an aesthetic effect of value in architectural design.

Weight. An ordinary 8" x 8" x 16" hollow load-bearing block made with normal weight aggregates may weigh 40-45 pounds. With lightweight aggregate, a similar block will weigh from 27-33 pounds, averaging around 30 pounds. With some of the lightest aggregates, the weight may be as low as 22 pounds. From the standpoint of actual wall weights, it appears that savings of 30 to 40 per cent. in dead weight can be realized from the use of lightweight units. The lighter blocks are easier to handle and should result in higher productivity of the masons and consequently lower construction costs.

Thermal Properties. The heat insulating values obtained with lightweight blocks are far superior to those of normal weight units. Actual values of thermal conductivity are 50-80 per cent. lower than those of sand and gravel. Not all of this advantage can be used in walls, because of the heat resistance of core spaces, surface films, effects of cavity construction, added insulation, etc. In plain walls, lightweight units have about a 35 per cent. advantage which decreases to about 12 per cent. if the walls are furred and plastered over 1" solid insulation. Lightweight block, plastered directly on the block, are about the same in heat insulation as heavy units plastered on furred metal lath. Here again, construction can be less expensive for the same resultant properties of the wall when compared to normal weight aggregates.

Fire Resistance. Lower heat conductivity and probably greater capacity for moisture retention at a given relative humidity are characteristics of lightweight units. Both contribute to greater fire resistance. In structural lightweight concrete, 2″ are the equivalent of 3″ or more of natural aggregate concrete in fire resistance. The difference is somewhat less in block, due to the effect of the core spaces. However, from actual tests, shell thickness for a 4-hour certified rating by Underwriters' Laboratories is about 25 per cent. less for lightweights than for heavy block.

Acoustical Properties. This subject we must divide into two parts: sound absorption and sound insulation. Sound absorption is the reduction in echoes or reflected sound within a room, and depends upon the sound waves entering and being dissipated in porous materials. For this purpose, lightweight units are a "natural" and are widely utilized because of the combined effects of a porous aggregate with a porous, open surface texture of the unit. It should be noted that this efficiency can be destroyed by improper painting that seals the surface pores. Heavy masonry units can, with rigid gradation and proportioning control, be manufacturd to have equivalent sound absorptive qualities. In general, this is not done, however.

In sound insulation — the reduction of sound passing through a wall — the lightweights do not fare quite so well. Here a dense unit with heavier weight is advantageous, the exact opposite of the desirable qualities for sound absorption. However, a coat of plaster or of paint that does seal the pores can put the lightweights right back in the picture — and still leave good sound absorption on the unpainted or unplastered side. With a cavity wall, one inside face backplastered, we can really have both benefits — good sound absorption on both sides and good sound insulation through the wall.

Volume Change. In this respect again, lightweight units are at some disadvantage. Although they have, in general, a lower coefficient of volume change with temperature, the drying shrinkage tends to be higher than for heavy units. Two remedies exist for this situation. Autoclaving decreases shrinkage more in lightweight units than it does in the heavy ones, so that this curing procedure puts them at least on a par with the heavier materials even when the normal weights are also autoclaved. In low pressure cured units, tendencies toward shrinkage cracking can be minimized by lowering the moisture content at the time the blocks are laid. The effects of the higher shrinkages are also somewhat mitigated by a decreased modulus of elasticity and increased extensibility in the lightweights. There is, in the final analysis, little advantage either way between the lightweight and heavy weight units from this standpoint.

CONCLUSION

In the future years we can all look forward to a continual and rapid increase in the use of lightweight aggregates, not only in concrete masonry units but also in all types of concrete construction. The use of lightweight concrete for structural purposes in Canada has been slower than formerly anticipated, due in large measure to the relatively high cost of the concrete, combined with design and other technical difficulties. Future demand in this direction will be increased slowly and will be based on sound technological decisions. Lightweight materials vary considerably in characteristics, and differ in many respects from the so-called "normal weight" aggregates. In some respects they should be handled more carefully, and in a somewhat different manner from the natural materials. However, their disadvantages in masonry are few and easily remedied with proper recognition of their particular properties; while their advantages are many and far outweigh the effects of differences from ordinary aggregates.