Summary

Our Issue

An international competition of architects of world-wide renown resulted in the construction of one of the most characteristical business premises of modern times: the town-hall of Toronto. Our pictures represent this recently terminated building and show, moreover, photos made of the building under construction and others which were shot after completion of all buildings.
Due to the unambiguous interpretation of the building's genuine character, its almost symbolic value is undeniable. The two towers which emerge from the crescent-shaped ground-plan protect the centrally located council-chamber where the resolutions are passed after the projects have been duly prepared in the various stories of the towers.
A firm of world-wide reputation, Gebr. Sulzer, Winterthur, sucessfully tried to impart to their business premises the symbolic character of greatness by elevating the massive building to considerable height.
A third imposing builder-owner, a large insurance-company of Düsseldorf, set the architect the arduous task to erect an administration building of "uncommon" shape. Thus, The Rhenish administrative metropolis brought into focus, at the very issue of an important express motor road, the ARAG-Haus, an unmistakable eye-catcher. Here too, the architect tried to find an adequate form to express in some way the importance of its combine.
A small building of classical style intended for a welfare organization may lead over to the building of a packing material manufacturer who required a large operational floor area without any supporting pillars. Experiments made on a model resulted in this new statical conception.
The review reaches its close by issuing a detailed report on the actual state of contemporary architecture in Spain and, in fact, this Mediterranean country shows surprisingly new achievements of engineers and architects such as Torroja, Sert and others. The Editor

V. Revell, Helsinki, J. B. Parkin & Assoc., Don Mills, Toronto

New City Hall in Toronto

(Pages 287–293)

The site of the new City Hall is located at the North-West corner of Bay & Queen Streets in down town Toronto, just West of the present City Hall. There are four main elements in the design of the new City Hall: the Civic Square; the Podium; the Council Chamber and the Office Towers. Two crescent shaped buildings enclose a low, dome-roofed structure. These are the Towers and the Council Chamber respectively. These superimpose the Podium. The Civic Square, located in the South portion of the site, forms a forecourt to the City Hall. It contains a reflecting pool which is to be used as a skating rink in winter. Three precast arches span the pool. These arches contain lights on the underside, Both to enhance the beauty of the reflecting pool and to provide illumination for night skating. The Civic Square is connected to the building by an elevated walkway, surrounding the square on three sides, and connected to the South-East corner of the Podium. The floor of the Civic Square is composed of a number of precast concrete paving slabs. Beneath the Civic Square is an underground parking garage, operated by the City for use by the public.

Podium

The Podium is two stories in height above the street level, and in addition, contains a basement and subbasement floor. The construction of the Podium floors is for the most part a system of reinforced concrete joists supported by reinforced concrete beams and columns.
The allocation of space in the City Hall relates closely to the system of government in Toronto. The urban heart of the Metropolitan area is the City of Toronto, which is governed by a Mayor and Municipal Council. In the years before 1953, a number of independet municipalities developed around the boundaries of the City. In 1953, these area municipalities, 12 in number, and the City of Toronto itself, amalgamated to form the Municipality of Metropolitan Toronto, sometimes called "Metro". The result of this amalgamation is that Toronto has a dual system of government, consisting of both the City of Toronto and the Municipality of Metropolitan Toronto. This dual aspect of the government of Toronto is implied by the two towers themselves, which enclose the unifying aspect of the design, the Council Chamber.
On the second floor of the Podium, the government offices for both the City and Metro departments are located, including the offices of the Mayor and the Metro Chairman, as well as the Board of Control. The first floor is the public access area, with entrances from both the street and the Civic Square. Contained on the first floor are such items as a library, a registry office and a land titles office.
The basement contains a parking area, with accommodation for parking 75 cars. In addition, there are a number of miscellaneous offices. The subbasement contains mechanical equipment.

Council Chamber

At the back of the Civic Square enclosed in the towers is the low dome-roofed Council Chamber. The Mayor or Metro Chairman and the corresponding Councillors will sit in the Council Room in a slightly sunken area in the centre of the Chamber. Around them and at a higher elevation is a semi-circular seating gallery which will accommodate the spectators. Behind the Mayor is a curved dividing wall, on which can be seen the crest of the City. The wall separates the Council Room from the second story Member's Lounge and Kitchen. At the second floor level is located the Gallery Slab, behind the public seating gallery, and the Members' Lounge behind the dividing wall. In the centre of the Members' Lounge is a small kitchen which is covered by a shell-like plastered ceiling. Beneath the kitchen is an executive elevator which will transport the executives from the parking area in the basement of the Podium to the Main Council Floor.
The Structure of the Council Chamber consists esentially of three portions. The first portion is the roof which is a reinforced concrete dome with a prestressed ring beam, supported on inclined precast concrete struts. The second portion is the main body of the structure, an inverted cone with two prestressed ring beams. The generator of the cone is inclined at an angle of 30° to the horizontal. This cone is supported by the third portion of the structure, a cylindrical reinforced concrete shaft which passes down through the Podium to a foundation on shale.
The radius of the mid-surface of the dome slab is 150 feet, and the plan diameter, measured to the outside of the ring beam, is 155′-3″. The thickness of the slab varies from 4½″ at the top to 10 in. at the edge. The perimeter ring beam of the dome is prestressed by means of eight circumferential post-tensioning cables, and the magnitude of the force in these cables is such that the resultant reaction is directed axially along the supporting struts. These struts are pin-connected at each end, are inclined at 30° to the horizontal, and are arranged in a zig-zag pattern around the circumference of the ring beam, thus providing torsional resistance in order to withstand unsymmetrical loading.
The core slab in 18 inches in thickness, and is stiffened by means of two prestressed ring beams, one at the upper edge of the cone, and a second at its mid-height. The former is prestressed with five circumferential cables, the latter with three. In addition to these beams, there is a third ring beam at the junction of the cone and the supporting shaft. This beam is subjected to radial compression as a result of the nature of the superimposed loads, and hence does not require prestressing.
The cylindrical supporting shaft is designed for the applied axial compression and bending moment, and rests on a rectangular footing which is keyed and dowelled into solid shale. Because of the unbalanced dead and live loads within the council chamber, the footing is located eccentrically with respect to the shaft.

Office towers

Enveloping the Council Chamber are the two curved towers. Structurally, each of the two Towers consists of a convex curved reinforced concrete wall referred to as the "back wall", and an interior line of columns. Each floor is supported on the back wall, and cantilevers beyond the columns to the glass line on the concave face of the Towers. The length of the East Tower, measured along the centre-line of the back wall, is approximately 325 feet, and the corresponding length of the West Tower is approximately 255 feet. The back walls of the Towers are faced with precast concrete panels, themselves faced with strips of Botticino Marble. These provide insulation for the walls, and at the same time, a pleasing visual relief to the continuous expanse of concrete. The West Tower contains 20 floors plus a mechanical room at the top, and rises to a heigh of 260′-6″ above the first floor or street level. It has an intermediate mechanical floor at approximately the mid-height of the building, and the other floors contain offices for the many city and Metro departments.
The East Tower contains 27 floors plus an upper mechanical floor, and extends 326′-6″ above the street. It also has an intermediate mechanical floor, and on the other levels are located the remaining city and Metro offices. The East Tower is considerably larger than the West Tower but the two are similar in design and construction.
The structural framing system of a typical East Tower floor consists of a continuous one-way reinforced concrete slab, six inches in thickness. This slab is supported by radial reinforced concrete beams which span from the back wall, over the interior columns, and cantilever 15′-7″ beyond the interior face of the columns. The thickness of the back wall is 18 inches, and the column dimensions are 24 inches by 78 inches. The beams, which are 24 inches wide, taper in depth from 9 inches at the end of the cantilever to 36 inches at the face of the column.
For design purposes, the Towers were considered to be vertical cylindrical shells reinforced by a series of transverse diaphragms (the floor slabs) and also reinforced by longitudinal columns or buttresses. The presence of these reinforcing elements transforms the classical cylindrical shell into an orthotropic shell structure subjected to the action of vertical (gravity) forces and horizontal (wind) forces. The Towers were analysed according to the theory of Vlasov, making use of the following assumptions:

(1) Straight elements of the shell normal to the middle surface before deformation are streight after deformation and do not change their length.
(2) Normal stresses acting in planes parallel to the middle surface may be neglected in comparison to other stresses.
(3) The middle surface of the shell is inextensible in the transverse direction.
(4) Due to the presence of the rigid horizontal diaphragms, the contour of the shell remains unchanged, so that the transverse bending strain equals zero.

The normal stresses, that is, stresses acting normal to the cross section of the Tower, have a non-uniform distribution under the action of live load and dead load. The maximum magnitude of the normal gravity stress is 700 p. s. i. and occurs in the back wall at the mid-point of its length.
Because of the unusual shape and height of the Towers, it was not possible to predict the magnitude and distribution of the wind loads which might occur. Accordingly, it was decided that it would be necessary to conduct wind tunnel tests on a scale model of the structure. These tests were carried out by the Institute of Aerophysics of the University of Toronto. A model for the tests was constructed of solid mahogany, to a scale of 1 in. equals 23 ft. Pressure taps were located in horizontal rows at three levels on both the inside and outside walls of each tower. Each row contained 20 static presure taps, spaced evenly along the arc of the tower. These taps were then connected to a multiple-manometer board.

The model was mounted on a circular plywood base plate, and was placed in the wind tunnel at varying angles to the direction of flow, in order to obtain the critical wind directions. The most critical wind direction was found to be approximately parallel to the tangent at the mid-point of the wall length.
In order to convert the wind tunnel tests results to design pressures, an assumed wind velocity distribution was used based on information obtained from the National Research Council which varied from 110 miles per hour at the top of the Tower to 60 miles per hour at the bottom. This produced a maximum wind pressure of 31 pounds per square foot, and a maximum suction of 72 pounds per square foot, and created torsional moments on the towers. The torsional moments per foot of height at the top and bottom of the East tower were 810 ft. kips and 200 ft. kips respectively.

If the towers were constructed as free standing shells from the foundation to the roof, the horizontal deflection at the top would be excessive. In order to reduce the deflection to within tolerable limits, and at the same time to limit the maximum stress, the East and West Towers were connected together by the Podium Roof or third floor slab. The assumed boundary conditions for this combined structure were that the back wall of each Tower was fully fixed at the base, where it was keyed and dowelled into solid shale, and in addition, that fixity against torsional rotation was provided at the Podium Roof. The shear stresses in the back wall were calculated separately for tangential, normal and torsional components of the most critical wind loading condition. The maximum intensity of the combined shear stress caused by the wind is 125 p. s. i.
In addition the wind loading creates normal stresses across the section of the Tower. The principal cause of these normal stresses is the resistance to torsional warping which is provided by the rigid connection at the base. The calculated maximum normal stress, caused by the combined effects of gravity and wind loading is 1220 p. s. i. This maximum stress occurs at the end of the East Tower.

Suter and Suter, Basel
Responsible associates: P. Suter, R. Böckli, M. Füssler, O. Brandl, W. Neeser
Engineers: Emch and Berger, Berne and Solothurn

Sulzer office building in Winterthur

(Pages 294–302)

Planning:
The long-term planning involving two stages comprising 1000 work-places each was based on empirical data and modern organization methods.
Exterior givens:
site in the town: the town of Winterthur is surrounded by wooded hills 150 to 200 meters high (recreation area for the town). Thus a high-rise building presents a minimum optical obstacle.
Interior givens:
as for questions of organization, concentration in one single building presents functional advantages.
Plan: To get maximum flexibility, no definite programm was insisted on, but determination was made of the different types of tract required as well as their interrelationships. The square plan around an installations core and central communications permits the greatest possible number of combinations among the different types of tract: individual offices (management), technical offices and business offices (large premises), conference rooms.
The spatial unity is thus determined by a module depending on the required surface relative to a work-place and to lighting: i.e., module for width of window (185 cm), module for depth of work-places (3×185 cm: 1 to 3 places = 1/3 of total: 4×185 cm: 6 places and more = 2/3 of total).
With use of mobile partitions, we get the following utilization rates:
a) large offices only:
net utility surface: 78%
b) large and small offices:
net utility surface: 60 to 63%
c) small offices only:
net utility surface: 53%
65 work-places (9 sq. m) per standard floors.
Net utility surface of conventional offices: 50 to 55%.
Construction:
solid decks of reinforced concrete poured on site supported in centre by the reinforced concrete core and by parapets on face pillars.
Criteria behind the choice of this type of construction:
cost (= construction of steel); execution time (= metal construction); special features of the elements selected (solid decks permitting greater flexibility of interior utilization and smaller storey height); plastic structuring of the faces by visible concrete pillars; functional face: good heat insulation, dampness insulation, protection from solar radiation, minimum maintenance).
Heat insulation: exterior skin fireproof and separated from caulking of eloxidized aluminium (facing on pillars) and of aluminium silicon alloy Grinital (parapets).
Antisolar protection: double insulating panes and exterior Venetian blinds (tests in lab determining thicknesses). Settling is checked.
Interior arrangements:
Model of office on scale 1:1.
Intermediate insulating partitions, absorbent suspended ceilings, detachable, installations ducts in the parapets with removable copings.
Distribution of mail and documents:
Connections: from floor to floor in the office high-riser, between floors and third basement level (records), with the central post office of the concern, with the blueprint shop and the exterior communications network.
The automatic conveyor can be complemented by a pneumatic system capable of transporting loads of up to 15 kg (type A 3), rolled plans Ao). The floor stations located in the central core are connected with the horizontal systems by monorail transporting the same types of loads as the conveyor.
Fireproofing:
Interior stairways surrounded by locks to prevent escape of smoke. Air-conditioning mains with exhaust air vents protected from smoke infiltration. Emergency lift connected with emergency power system. Fireproof partitions.
Technical data:

Width of square high-riser:	30.55 m
height above ground:	92.40 m
constructed cubic volume above ground	85,700 cu. m
constructed cubic volume below ground	41,000 cu. m
gross surface of standard floor:	932 sq. m
total gross surface:	24,000 sq. m
net utility surface of standard floor	650 sq.m
total net utility surface	16,00 sq. m

Constructed volume:
3 basement levels, ground floor with gallery, 24 upper floors, 2 underground garage levels (capacity 150), underground corridor connecting high-riser with old offices.
Execution time:
rough work (up to datum line ± 0) about 1 year – rough work (up to roof level) about 1 year – finishing of first stage: after 3rd year.
Method of execution:
3-level scaffolding. Turning crane outside. Assembly of faces from above downwards (= successive dismantling of sections of scaffolding). Work lifts for interior finishing.
Installations:
electric: 4 transformer stations, 2 emergency power networks.
Ceiling light with reflectors (800 lux).
Heating and air-conditioning:
air-conditioning on two systems, remote heating and cooling.
Vertical transport facilities:
6 lifts with capacity of 18 each, 1 service lift with capacity of 4 persons (emergency lift).
Interior finishing materials:
floors: PVC, central core: plastic rendering, mobile partitions: facing of artificial leather, banisters of aluminium, parapets of eloxidized sheet metal painted, windows of natural eloxidized aluminium, panels of suspended ceiling of eloxidized white perforated metal.

Paul Schneider-Esleben, Düsseldorf

New construction of an insurance company in Düsseldorf

(Pages 303–308)

General plan:
The town reorganization plan calls for a traffic nexus consisting of bridges at several levels north of Düsseldorf, with underpasses for pedestrians connecting up with the underground railway system. The ARAG (insurance company) office building is sited in close proximity to this highway intersection point. The high-riser rests on a rather broad foundation structure, with a mushroom deck covering shops.
Programm and plan:
Work premises adapted to specific activities, disposition of departments of varying importance with but little conncetion with one another.
The complex is made up of a series of volumes which complement one another, subordinated to the given town-planning exigencies, the result being the accent on the vertical.
Basement:
The entire site is utilized below ground level, with garages, technical installations, storage facilities and shelters.
Foundation:
at three levels with personnel services, public restaurant, canteen with cafeteria, and on upper levels large office premises (61/25 m.) for 200 persons, entirely air-conditioned and arranged about cores measuring (7.20/7.20 m.
High-riser:
with 12 levels constituting a prominent feature in the local skyline.
The second floor is connected via a footbridge with the broad foundation tract. The floor surfaces diminish in area upwards. The management offices are situated at the top, as well as the conference room and the technical installations.
The roofs are employed as continuations of the interior office areas.
The emergency stairways follow the staggering of the levels.
Construction:
Skeleton of reinforced concrete. Parapets of reinforced concrete with pre-fab facing (concrete with Carrara gravel). The interior structure is discernible from the outside and supports concrete slats serving as sunbreaks.
Windows are of aluminium and thermopane glass. Supplementary sunbreaks of aluminium (Motor-driven).
Interior is entirely air-conditioned: high-speed system (Velovent). Cooling system with towers integrated in the construction and refrigerating machinery.
Oil heating (3 tanks with capacity of 80,000 l each).
Independent emergency power system.
Lighting: foundation tract: 500 lux, high-riser: 350 lux.
Colour scheme: white.
Windows: panes 6–8 mm. (high-riser) and 8–10 mm. (foundation tract). Neoprene joints. Floors: carpeting in large offices, PVC in individual offices, artificial stone in communications areas. Metal suspended ceilings in large offices with mobile partitions with glasswool insulation. Other premises: rendering. 3 lifts (1.8 m./sec.). Structure is clearly apparent on the inside as well. Pillars and partitions on inside faced with washed rendering.
Constructed volume: 82,200 cu. m., utility surface: 15,770 sq. m.

F. W. Kraemer, Günter Pfennig, Ernst Sieverts, Braunschweig

Social Centre of the aluminium works in Singen

(Pages 309–315)

This project by the Kraemer-Sieverts team was awarded first prize in a competition open to architects in West Germany; it presents the conception of a spatial structure of aluminium rods supported by a number of aluminium tubes over the dining halls. Around this construction there are the adjoining lower volumes comprising the annexes. For the execution project, these premises were arranged in the form of a square base surrounded by exterior spaces enclosed by high walls, the base supporting the dining halls, which are entirely glazed and grouped about a central kitchen. The final solution, unfortunately less generously conceived, is made up of a complex of glassed-in rooms, 7.20 m. high, grouped about a central service core and disposed canopy fashion 3.50 m. above the annexes situated on the interior periphery.
The spacially conceived aluminium structure has ended up as a building of reinforced concrete.

Plan: Heinz Isler, Burgdorf
Architect: Paul Wirz, Solothurn

Finishing shed for building insulation materials, Recherswil

(Pages 316–320)

The neoprene factory required a free space 400 sq. meters in area, well lighted and secluded.
The shell construction without peripheral reinforcement was satisfactory from the functional, aesthetic and economic standpoints.
Since there are very few scientific bases for constructions of this type, the engineer worked essentially on the basis of models, on which he studied the different loads, the results being translated on a computer.
The problem here was to discover a synthesis of the givens of the program (height beneath ceiling, lighting, drainage, proportions, slopes) and the givens having to do with the very special static situation obtaining for shells without peripheral reinforcement.
The shell of the Kilcher factory has a thickness of 8 cm. only with light stanchion reinforcement around periphery.
The coffering, which generally presents a financial handicap, are studied with particular care: they are made up of glued wood elements and an economical lattice structure, and they can be employed directly for other shells even of different shapes (the coffering of this factory was reemployed for a gardening centre near Paris).
Execution time: 2 months for the rough work (basement and shell) plus 2 months for finishing (production under way after 4 months).
This construction demonstrates that the employment of shells can be as economical as traditional or pre-fab construction methods.