THE MANITOBA

Professional Engineer

OF THE PROVINCE OF MANITOBA

June, 1987

NORTHERN TRANSITIONS: Celebrating One Hundred Years of Professional Engineering in Canada

Engineering Exhibit to Open June 26th, 1987

by Sharon Reilly, Curator of History and Technology Manitoba Museum of Man and Nature

This year Canadian engineers are celebrating the centennial of engineering as an organized profession in Canada. Nationally history of Canadian engineering has been written, a major national conference has been organized, a special stamp and medal will be issued, and many other centennial activities are underway at a regional and national level across the country. In Manitoba, the week of June 22nd has been proclaimed Engineers' Week by Premier Howard Pawley, and on June 26th, the Manitoba Museum of Man and Nature's newest permanent exhibit, ***Northern Transitions: Engineering and the Development of Northern Manitoba,*** will open to the public. Located at the far end of the Arctic-Subarctic Gallery, adjacent to the Boreal Forest Gallery, the exhibit is the product of over two years' planning and research.

In late 1984, Robert Foster, then President of the Association of Professional Engineers in Manitoba, approached the Museum with a proposal for a Manitoba engineering centennial project. The national Engineering Centennial Board had specified that local centennial projects, which they too wished to support, would be of substantial scope, visible to the public and have a long-lasting impact. Manitoba engineers, the only committee across the country to take such an approach, proposed to the Manitoba Museum of Man and Nature that they undertake fundraising for the construction of a Museum exhibit that would feature some aspect of the contribution of professional engineering to the development of the province. Realizing that such an exhibit was, indeed, within its terms of reference, the Museum suggested that the exhibit be constructed as a part of its permanent exhibits, within the Arctic-Subarctic Gallery, and that it concentrate on engineering and Northern Manitoba.

In considering Manitoba's past and present, it is clear that engineering skill and technology have played a major role in the development of the North. The huge mining operations north of The Pas, the vast hydro construction projects still under development across Northern Manitoba; and the historically-significant grain elevator and port of Churchill are among the outstanding achievements that came to be featured in the Museum's "engineering exhibit". Linking these themes together, as it literally ties Southern Manitoba to the North, is the exhibit's central focus of the Hudson Bay Railway. Constructed in the 1910s and 20s, when many considered it impossible to lay track across the hostile subarctic terrain of muskeg and permafrost, the Hudson Bay Railway remains today as one of the most outstanding achievements in Canada's engineering history.

In the past, historians of northern Manitoba have limited their attention to the political machinations that influenced the development of this railway. Beginning in the 1870's, western farmers, businessmen and politicians joined voices to demand an alternate link to Europe, to Central Canada's transcontinental railway. It was not until 1929 that the product of this effort, the Hudson Bay Railway, was completed. Recently, Manitobans have begun to consider the astonishing feat of human labour and engineering skill that made the construction and operation of the Hudson Bay Railway possible. It is this aspect of the railway's

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PROVINCE OF MANITOBA

Proclamation

ENGINEER'S WEEK

WHEREAS the centenary of engineering as an organized profession in Canada is being observed this year; and

WHEREAS throughout the nation the mark of the engineer is visible everywhere, in roads and railways, in office buildings and factories, in mines and hydro projects; and

WHEREAS while these stand out as recognizable symbols of the nation's development, the work of engineers in contributing to Canada's progress takes many additional forms, and helps to underpin our economy; and

WHEREAS in Manitoba the 100th anniversary celebrations will include a number of events, highlighted by the June 25th grand opening in the Museum of Man and Nature of a diorama on engineering in northern Manitoba, featuring the Hudson Bay Railway, mining and hydro development; and

WHEREAS it is in the public interest to give official recognition to the past contribution of engineers which have played such a part in our growth and progress and to the challenging role of engineers over the next one hundred years.

NOW THEREFORE BE IT KNOWN THAT I, Howard Pawley, Premier of Manitoba, do hereby proclaim that the week of June 22 to June 26, 1987, shall be designated as

ENGINEER'S WEEK

in Manitoba, and I commend its thoughtful observance to all the citizens of our province

Howard Pawley

PREMIER

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Professional Engineer

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Notices

Payment of Outstanding Fees

Members are reminded that if outstanding annual fees and/or administration fees are not in the office by June 30th, the member's name will be removed from the Association Register.

Code of Ethics Review

At its meeting of January 12th, 1987, Council established an Ad Hoc Committee to review the Code of Ethics and to bring forward recommendations to revise the Code as warranted.

Members of the Association are invited to submit written concerns, comments, questions, and/or suggestions related to the revision of the current Code of Ethics, a copy of which was sent to each member with the last issue of *The Professional Engineer*. Please address your submissions to the APEM office to the attention of the Code of Ethics Review Committee.

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Congratulations to the following people who achieved 100% on the Professional Practice Examination

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With deep regret, the Association records the passing of:
W.J. DUNLOP
S. PURMALIS
P. SHANE
J. PEACOCK

Celebrating 100 Years

(continued from page 1)

history that the present exhibit focusses u — the work of the surveyors, the Native Metis guides, the roadbed labourers, and the construction crews — all of whom braved the isolation and hardships of the North to open the region to southerners.

While its focus on the Hudson Bay Railway is set in the early 20th century, the exhibit's emphasis shifts to the present day in considering mining and hydro developments in Northern Manitoba. As with the Hudson Bay Railway, engineering skill and technology have played a major role in making these industries viable in Northern Manitoba today.

The Museum has been very pleased to have this opportunity to work in co-operation with the engineering community in Manitoba, and joins with them, in this, their centennial year, in celebrating the accomplishments of the engineering profession. □

New Members Registered in April and May '87

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If you know the whereabouts of these members, please contact the Association office.

Letters to the Editor

The article by Mr. P.L. Fraser ("There is not a great deal of time") in the April issue of 'MPE' agrees closely with my own views and I wonder how many other Manitoba engineers also agree?

Perhaps, a provincial informal referendum could be started through your monthly newsletter. Having certain overseas engineering connections, I have maintained my United Kingdom Chartered Engineering status. This is by Royal Charter to the Queen, and thus, escapes provincial affiliations exploited in some parts of Canada. The Canadian Council of Professional Engineers recently decided that as only a small percentage of engineers changed provinces, national recognition is not a priority at this time. While this may be true, I would suggest that this small mobile group of engineers is concentrated into the primary resource industry, forestry and mining. These areas are poorly represented already in professional circles, thus, special attention should be given to this group. Education may be a provincial responsibility, but accountability for public safety is a federal concern. Already some provinces such as Ontario are questioning the plausibility of faith in self-regulating bodies such as provincial Engineering Associations.

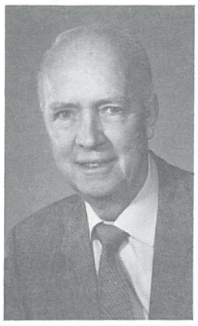
If engineers lament their lack of pu profile, then it is up to engineers to sh a willingness to face the challenges. This could be resolved by a referendum, and I look forward to further correspondence on this subject.

P.J. Broad, P.Eng.
Lynn Lake, Manitoba

Software Dependency: A Substitute for Responsibility?

President's Message

Ted Speers, P.Eng.



One of the advantages of this position is that one gets a chance to consider the viewpoint of engineers in other associations on problems that are under consideration here. Thus, at the APEO Annual Meeting in Toronto on April 24th, there was a President's Forum on the subject "The Relationship of the Computer to the Engineer". This is a very timely subject, particularly for the younger engineers raised with computer training.

The thrust of the Forum was on the concerns of how to control the development and use of engineering design software, liability and legal aspects, the industrial approach, and the consultant's approach.

The issue of professional responsibility, and hence liability for the use of computer software revolves around who designed the software — possibly a non-engineer in some cases and/or outside the province or country. There is no regulatory control exercised directly in this area. But is this where the responsibility lies for an engineer?

Two illustrations were given at the Forum on software dependency. One involved software malfunction during a computer-controlled cobalt radiation treatment for a man's brain tumor. The resultant overdose was tragic. It was determined, subsequently, that there was no backup software to prevent an overdose.

The second illustration concerned a spaceship that would not lift off. Three months before, a technician in modelling software changed a timing by 1/64th of a second. As a result, when the countdown commenced, the five computers on board the spaceship could not communicate with the base computer and the months of preparation resulted in an aborted effort.

Where does the responsibility and the liability lie? Is it with the technician involved in the designing or the operation of the equipment, or with the engineer in charge of the development?

It rests with the engineer.

In the final analysis, computers and their software are tools, just as the slide rule and the calculator are tools. It therefore behooves the engineer to run tests on any software being relied on to ensure reliability. The watchword is "eternal vigilance."

This subject was well-considered by our APEM Committee in the Ethical Use of the Seal, chaired by W.R. Newton, P.Eng., and is covered in the resultant publication available from the APEM office. Copies of our publication on the Ethical Use of the Seal have been sent to APEO with our compliments.

Speaking of the seal, APEO Council passed a motion to adopt an elegant new seal. However, at the Annual Meeting, a resolution was easily passed requesting that the new seal "be abandoned in favour of the previous design in use for many years." Tradition has a place in Ontario. □

A.P.E.M. Act Administration Officer: David A. Ennis, P.Eng.

by W.B. Mackenzie, P.Eng.

It is a pleasure to announce that David Ennis is now a member of the APEM staff. Dave fills a very important slot in our Association and his major duties will relate to Act Enforcement activities. (See separate article elsewhere in this issue).

The Association has been fortunate to obtain the services of such a highly qualified engineer who has an impressive record of past involvement in the engineering field and in Association committee service.

Dave is a Manitoban; born and raised in McCreary—which he says is "The Ski Capital of Manitoba" (an interesting observation since McCreary sits on the flat prairie just like so many other prairie towns). Dave was educated in McCreary and Winnipeg and obtained a B.Sc. in Civil Engineering degree from the University of Manitoba in 1961.

After graduation, Dave worked for four years in the Highways Department of the Province under the tutelage and supervision of George DePauw, P.Eng. and Walter Saltzberg, P.Eng. Much of his work in the department related to the construction of Winnipeg Floodway crossings.

In 1965 Dave moved on into the private sector with Macaw & Macdonald Limited. Dave worked with this firm until he came on staff with APEM. During these years Dave gained valuable insight into such engineering and contract matters as bridge construction, drainage structures, wharf construction and other engineering-related work. Dave is a member of the Canadian Society of Civil Engineers and the Canadian Geotechnical Society.

He has served on the Salary Schecule Committee and has been a valuable member of the Practice & Ethics Committee for 14 years; serving as Chairman of this committee for two years. Dave's qualifications make him admirably suited for the position of Act Administration Officer.

Dave is a family man, residing in Fort Garry with his wife Melita, daughter Janine and son John.

Dave Ennis, P.Eng., now a member of the APEM staff.

I am looking forward to working with Dave and I am certain that he will make a significantly important contribution to the essential activities of our Association. □



Line Building in

You wouldn't be far wrong if you called it the "Polar Bear Line" — Hydro's new 138 kV transmission line between Gillam and Churchill, now in service.

Its uniqueness at being the furthest north transmission line on Manitoba's system doesn't end there. The line features at least three other "firsts" that place it in the forefront of high voltage powerline technology and the project is one which has already drawn a lot of interest from other Canadian utilities, to say nothing of the citizens of Churchill.

The line's Y-shaped single-pole transmission towers, for example, are of special tubular construction with distinct advantages for traversing the 306-kilometre-long route and will be the only guyed tubular towers on Canadian transmission lines. Because northern construction costs can run high, they are designed to provide considerable savings in assembly time without sacrificing strength and utility. Each tower can be assembled in less than 30 minutes compared to seven or eight hours for comparable lattice structures used elsewhere on the Hydro system.

Travelling as it does for a long stretch through continuous "permafrost" terrain, the towers are set on a special insulated base that will leave the premafrost intact and avoid destabilizing the ground and causing movement in the transmission towers.

The line also utilizes a new design in self-damping conductor having special properties which tone down the destructive whipping action developed by powerlines in high winds.

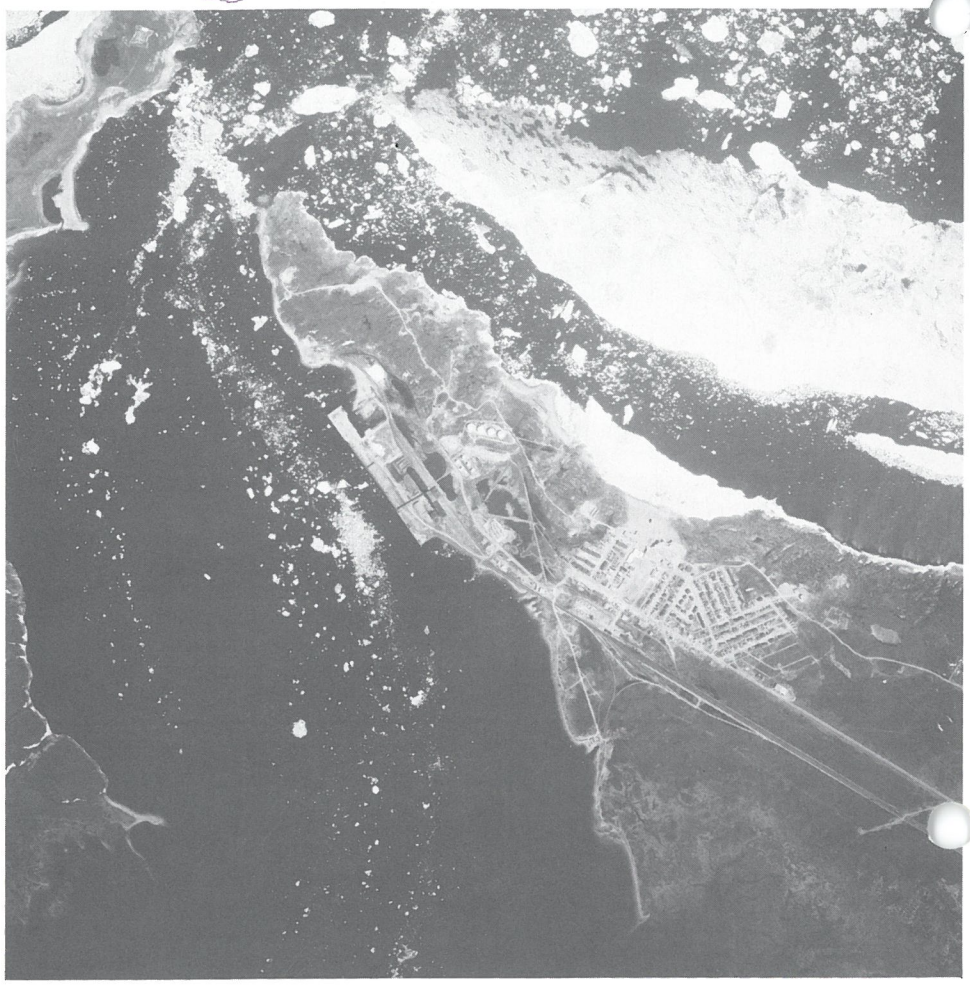
The towers for the Churchill line range in height from 16.9 metres to 22.9 metres; they are supported by four guy wires. Anchors for the guy wires have to be sunk anywhere from 8 to 26 metres depending on the terrain, its soil type and the depth of organic overburden along the route. The anchors consist of long steel rods embedded in a grout core.

Hydro structural design engineer Carry Wong, P.Eng. points out that the towers also have considerably less wind resistance and are much easier and relatively inexpensive to transport from factory to worksite.

Towers on the final 50 km of the Churchill route have been designed with an extra measure of strength to stand up to heavy icing which is characteristic of this area. Moisture-laden salt sea air from Hudson Bay can often cause serious icing in the vicinity of the port and to accommodate this, the line was built to withstand a 19 mm ice thickness on the conductor under a wind gust of 130 km per hour.

By comparison, transmission lines located in southern Manitoba are designed for only a 12 mm thickness of ice. Without icing, the Churchill line is built to take wind gusts up to 190 km per hour.

The base on which each tower rests represents a new departure in tower base construction that was specially designed for installation in permafrost locations. Each summer the ground thaws to a depth of a few feet and then refreezes in the winter.



An aerial view of the Churchill townsite.

The installation of a 150 mm thick styrofoam layer at the base of each tower is designed to eliminated the freeze-thaw cycles and therefore maintain the stability of each tower. For each base, the construction crew scrapes away overlying organic matter, sets in the special tower base, and then backfills the organic matter back to ground level, plus a 300 mm mound to accommodate eventual settling. Within the base, the weight of the tower is distributed over the styrofoam pads using steel H-beams and timbers so that a pressure of only 48 kilopascals (seven lbs. per square in.) actually comes down on the styrofoam.

According to design engineer Andy Staudzs, P.Eng. the insulation actually stops two things from happening. It prevents the ground under the footing from thawing, causing the tower to settle. "Also we want to prevent refreezing and the powerful upward movement this can cause," he says. Thick steel plate has been sheared like paper by this powerful frost action on towers, he points out.

Andy notes that the northern third of the Churchill transmission line is on continuous permafrost which only thaws about two feet in summer and may extend downward as frozen soil to a depth of over 30 metres. Such soil is hard as concrete when it comes to excavation.

The tough permafrost is really just one indication that this section of the line passes through what is easily the coldest area in Canada for this latitude.

Andy points out that the temperatures normally occurring in the Churchill area are very similar to those in the coldest parts of Alaska which is actually several hundred kilometres north latitudinally.

With a reputation for being one of the windiest areas of Canada in winter, design for standing up to severe wind conditions was one of the important requirements for this line.

When completed, the new towers will be strung with a new type of self-damping conductor — type 477 MCM — with a built-in air cushion which reduces movement of the line during a windstorm. This avoids the need for installing more expensive dampers used in much transmission line construction.

Transmission design engineer John Chan, P.Eng. notes that still another unique feature

Polar Bear Country

the Churchill line is that, along its entire route, site selection for each tower was worked out by computer.

Taking into account such inter-dependent factors as terrain elevation and line capacity, exact location and placing for each tower was worked out for the complete route within the space of just four months.

If it weren't for the computer, the same process would have taken well over a year with the same number of staff, Chan says.

Construction of the line began in early January 1986 with drilling of anchors and installing of tower bases at intervals of 350 metres over the 270-kilometre route.

The major part of this operation was carried out at night-time because day-light hours extended only till 15:30 at the 56th parallel location. Anchor drilling was carried out on a 24-hour basis.

"With the bitterly cold temperatures the crew has been working in, some equipment has to be run 24 hours a day or the oil and hydraulic systems would just freeze up and you wouldn't be able to start them again without throwing a shroud over them and heating them up," says Garry Harmeling, Transmission Line Construction Superintendent. Temperatures of -40°C are quite common there and occasionally the mercury drops to -50°C. "Besides," notes Garry, "we have to make the best use of time in a limited construction season."

According to Garry one of the toughest things the construction crew has to face is continually being out in the open — there are no trees to provide shelter from the high amount of wind and blowing snow typical of this stretch of terrain.

The blowing snow slows the construction job considerably because equipment has to be diverted from the job to keep roads open at all times to Gillam from which supplies such as food, parts and fuel are continually brought in. "And the farther away from Gillam we get, the longer it takes," notes Harmeling.

Insulation in place to prevent thawing causing the tower to settle.

The sand-cement ground mixture that is poured into the 150 mm anchor columns drilled at the site is mixed in heated vans to keep it fluid. Even the anchor rods have to be kept warm despite the weather or they won't bond to the grout surrounding them when poured.

Construction of the new line involves a score of environmental concerns with special precautions taken to make sure that the plant, bird and animal life of the region are affected as little as possible by the construction operation, according to Rich Gittins, P.Eng., Projects Construction Engineer.

The line crosses such habitat as a cariboo migration route along which herds totalling 20,000 to 30,000 of these animals make an annual seasonal trek. The Churchill area is also home of the extremely rare Ross's Gull, unique to the area except for Siberia. A weekly check is made on the construction operation by federal wildlife fieldmen to make sure all environmental concerns are met.

Construction crews will likely be more than cautious as the line nears Churchill since its route passes through a major polar bear denning area.

Building the line and supplying new power to the town of Churchill from Hydro's integrated power system will be accompanied by a changeover in the town's electrical distribution system. Eastern region crews will be changing the present underground Delta system to a grounded Y distribution which is considered safer than the present one. The distribution change alone will be a $100,000 cost item over and above the $35.9 million needed to build the line. Funding of the Churchill line is being shared with the federal and Manitoba governments who together are paying $19,200,000 of its cost with the remainder taken by Manitoba Hydro.

In preparation for bringing line power to Churchill, miles of 12 kV feeder line are being constructed from the terminal substation on the south edge of town to existing distribution in the town, at the grain handling port and also to the airport.

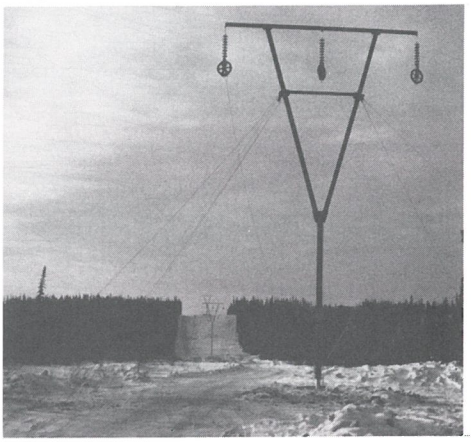
A nine-kilometre portion of the feeder line from the substation was placed underground in order not to disturb communications for the nearby Churchill airport and to reduce the incidence of power outages should severe icing occur.

Eastern Region's Distribution Engineering Manager Bert Epp, P.Eng. points out that electrical distribution at the town has to stand up to yet another climatic condition that doesn't affect other Manitoba locations — salt sea air.

Windstorms off the bay, when it isn't frozen over, cause a salt deposit to form on everything. This can cause a type of electrical shorting or "tracking" on electrical equipment because it is conductive. For this reason, insulators on the new feeder lines built for the town have to be double the usual length for the voltage level used in order to cut down on tracking problems.

Feeder lines have been "doubled-up" wherever practical to provide back-up electrical feed should various portions of the feeders be knocked out by an ice storm.

Three large portable diesel generators currently used to supply power for the town will initially be retained as a back-up power source for the entire town. With this source available to feed the town's large recreational centre, this site could be used as emergency shelter by local residents should the power supply be knocked out for any reason.



Unique tubular single pole towers are noted for speed of assembly.

Most local residents and commercial people in the town have looked forward to the commissioning of the line for several reasons. When Hydro line power replaces present diesel generation most residents will see the rate they pay for power drop from the present 20.9 cents per kilowatt hour under the diesel rate to the "R2" rate presently paid by all Manitobans for centres of Churchill's size — approximately four cents a kilowatt hour. Just as important will be the unrestricted use of power available to Churchill residents and commercial operations which will likely result in a large scale conversion to electric heating.

Jack Dent, Hydro Business representative at Thompson points out that heating electrically will be considered more advantageous to local residents than the oil most presently use with the cost of heating electrically a good 50% under that of oil heat.

A changeover to electric heating is also expected at scores of commercial locations throughout the town in addition to such larger facilities as the airport, ship loading at the port and at the town's large commercial centre which presently houses a hospital, restaurant, school and arena. □

Musings on the Engineer and War

By V.L. Dutton, P.Eng.

A Centennial Year is a time for reminising, of recalling our past efforts, and, hopefully, of giving some thought to the future as a result of that history. May each of us make, as a Centennial resolution, a determined effort to work for peace in a time when peace appears to be a diminishing commodity.

Engineers have always played an active role in time of war. How far does one go back in history? The Egyptians? The Greeks? Yes, after all, that Athenian General must have been something of a genius when he had his 1st Field Company, Royal Athenian Engineers, build that huge wooden horse. General Wavell used much the same technique, several millenia later, when, in the North African campaign, the Royal Engineers produced cardboard tanks which fooled the German reconnaissance planes at a critical time in that war. The book "Pipeline To Battle", written by an engineer, is devoted to the many achievements of engineers in North Africa during World War II.

"General Wavell used much the same technique, several millenia later, when, in the North African campaign, the Royal Engineers produced cardboard tanks which fooled the German reconnaissance planes."

Not the least of these achievements was the critical role played by the engineer-constructed pipeline used to supply water to the troops. It happened to be filled with sea water, during testing, when its western end was over-run by the advancing and very thirsty Germans. These men simply shot holes in it and gulped down the water — before they discovered it was brine. The result was a lot of sick soldiers and the stalling of their eastward push. Was this the straw that broke the back of that particular camel? Fascinating history!

The military engineers of Judah were contemporaries of the Greeks. The Bible is full of their exploits. It tells of how when Sennecharib was running rampant with his Assyrian army, King Hezikiah had his military engineers divert the water of Gehenna into the town, thus denying the Assyrians something even more valuable than gasoline is to today's armies. That ancient tunnelling job must surely rank with the great feats of engineering of all time.

Then there was Vinci's favourite son and distinguished engineer cum artist, Leonardo, who's genius contributed so mightily to the science of war during the Middle Ages. Even the appelation "sapper", which is used to describe military engineers, derives from their duties during those never-ending wars, fought as feudalism died, when a major activity of the engineers was to dig the saps and place the explosives under the besieged fortresses.

Our own national history is replete with examples of engineers and their activities, if not in war, at least in preparation for war. One has only to recall the extensive engineering works at Louisburg, Quebec, Prescott, and Manitoba's own Fort Prince of Wales.

The Rideau Canal is surely one of the world's great monuments to military engineering and one of which our profession may be justly proud.

The Great War saw further examples of the genius of engineers with the development of the large Dreadnoughts, the first "tanks", and the development of the aeroplane as a machine of war. In 1917, the R.C.E. established, at Camp Petawawa, the Royal Canadian Flying Corps which, eventually, became the Royal Canadian Air Force.

In the 21 years between the World Wars, life had speeded up but it was still on a human scale. With the help of the metallurgists, new alloys were produced which led to the design of the famous Bailey Bridge without which one can scarcely conceive of World War II having been fought — or Northern Manitoba's winter road to Oxford House being the success it is. The new steels also led to the famous tanks, particularly those of the German's with their superb guns. The mechanical engineers continued to develop new engines and improved manufacturing methods. Development of new aircraft continued during the hostilities with Sir Frank Whittle's new concept in propulsion being especially significant. The German engineers were, at that time, taking the first pioneering steps in rocketry which has led to immense activity in space since then.

Canadian engineers should remember, with pride, Ms. Elsie McGill who became Canada's first lady aeronautical engineer and, during the war, served as chief engineer of the aircraft plant at Thunder Bay.

It was World War II that brought the Electrical Engineer into the battle, if I may use that phraseology. While the Signal Corps continued to look after field communications, electronics had developed so significantly that Canada followed the British in establishing the Royal Canadian Electrical and Mechanical Engineers — the "Reemy". Many a soldier who became well-versed in radar during the war, entered electrical engineering after, because of his wartime experience.

Educating these "returned men" presented our universities with many problems after the cessation of hostilities. To recent graduates of our University of Manitoba, it is hard to visualize the open spaces that existed on the campus in that fall of 1945 when the first veterans began their studies. The Engineering Building was still the original brick structure that had been built when the university moved from Fort Osborne to the empty spaces of south Fort Garry. The first-year classes were held at the Junior Division — where the fountains and walks of Memorial Park now grace Memorial Boulevard. However, there simply was not room for more students "downtown" so space was found on the top floor of the Fort Garry building. The making of the additional draughting desks received top priority in those days of a scarcity of everything. Cheek by jowl, these young men commenced their studies on "civvy street".

I obtained an early discharge from the R.C.E. in order to return to the University as a demonstrator that winter. Yes, Dean MacDonald pulled some strings — many, I would guess — in order to obtain enough instructors for that huge class of beginning students.

While we tend to talk only of the happy times in our lives, there was a sad side to helping these men adjust to the realities of a student's life. Many of these men had had very responsible jobs in the services and many were married (which was an uncommon situation amongst students in those days). The steady grind of studies proved to be too much for some of them, capable though all of them had been while in the services.

I have more hobbies than I can handle as it is, so I have no intention of becoming an historian of engineering during wartime. However, it has become obvious that, if we want to stop wars, it is up to the engineers to say "Whoa!" □

U.S. Output of Engineers to Drop

The enrollment of engineering students in U.S. colleges and universities has peaked, and the number of graduating engineers will begin to drop in the 1986-87 academic year, according to new studies now being released by the American Association of Engineering Societies (AAES).

In an analysis of trends in enrollment, AAES' Manpower Commission noted that the number of engineering students in the class of 1987, who were freshmen in the fall of 1983, has been consistently smaller than in the preceding classes of 1985 and 1986.

Diminishing participation in engineering programs is related to general declines in college enrollment caused by falling birth rates in the 1960's and early 1970's and effects on the supply of new engineers could persist well into the 1990's.

Engineering enrollment at the graduate levels reached record highs last year. However, the commission indicates that masters and doctoral enrollment may also decline as a result of diminished pools of potential students in the years to come. □

Manitoba's Link with Indonesian Water Resources Development

by Glenn Morris, P.Eng.

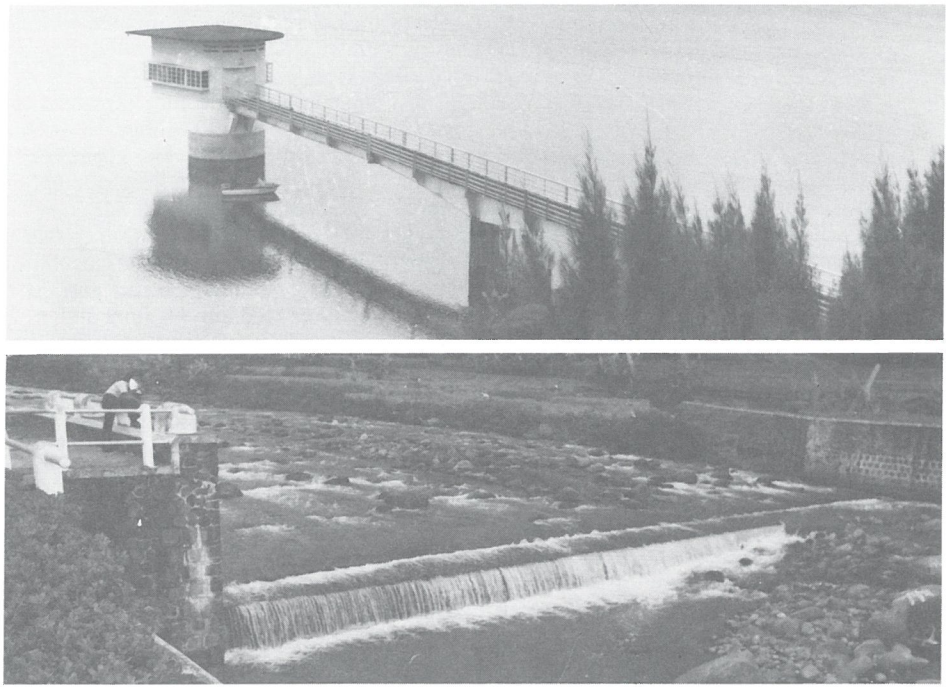
It's a long way from the snow banks of Manitoba to the scorching sun of South Sumatra. Nonetheless, Manitoba expertise is helping to provide an improved quality of life for thousands of new settlers in that large equatorial island in the Indian Ocean. The Indonesian Directorate General of Water Resources Development (DGWRD) has undertaken a project to irrigate a large tract of land in South Sumatra and to resettle 50,000 people from overpopulated areas of Java. The chief engineer on the project is one of two hundred Indonesian engineers who, during the past dozen years, have received post graduate instruction in water resources development from Manitoba engineers.

In 1975, professors Ed Kuiper and Cas Booy of the Civil Engineering Department at the University of Manitoba entered into a contract with the Canadian International Development Agency (CIDA) to provide post-graduate instruction to engineering staff of the DGWRD. In the summer of 1976, Kuiper and Booy spent six weeks in Indonesia presenting courses in Engineering Hydrology and Water Resources Project Economics to a group of 50 engineers. The top ten students from the group then spent the 1977 and 1978 academic sessions at the University of Manitoba, where they completed M.Eng. programs. The program was repeated between 1981 and 1984, this time with nine University of Manitoba M.Eng. and M.Sc. degrees awarded.

Then in 1985, both the DGWRD and CIDA sought changes to the program. The former wanted more students to have access to it, while CIDA, which had previously administered the program, wanted the University of Manitoba to assume complete responsibility for it. Consequently, early in 1985, the University of Manitoba entered into a contract with CIDA to provide a comprehensive four-year academic, professional and English language training program for Indonesian engineers. Between 1985 and 1989, about 100 Indonesian engineers will receive advanced training in water resources development in their home country and 20 will pursue M.Eng. studies at the University of Manitoba.

The new program has incorporated a group of 45 engineers from the DGWRD and Indonesian Universities, who attended a three-week seminar given by Professor Kuiper in Jakarta in February, 1985. Ten of the most successful participants were selected to receive three months of instruction at the English Language Training Centre of the British Council in Jakarta. While at the Centre the students were also briefed on living conditions and customs in Canada. The students completed their language training in August 1985, in time to begin the Fall Term in the Engineering Faculty at the University of Manitoba.

Prior to the arrival of the students in Manitoba, a comprehensive support system had been put in place. A half-time program administrator (a Manitoba engineer) had arranged living accommodations with English speaking families. As well, a special study room, with appropriate computing facilities, had been constructed in the Faculty of Engineering. Local consulting engineering firms had arranged social events and tours of treatment facilities and water resources projects.



Indonesian Projects—Top: Cacaban Reservoir. Bottom: Tapakmenjangan Weir.

The students' programs at the University of Manitoba span two academic years. In the first session, they complete eight post graduate courses under the supervision of the three Civil Engineering staff members assigned to the program. Two Civil Engineering post graduate students act as half-time tutors and academic counsellors to the participants. They have developed excellent rapport with the Indonesian engineers and their support has been most effective.

An important feature of the project is that it has a substantial professional training component which complements the academic component. The former is necessary because unlike their Canadian counterparts, many Indonesian engineers have not had the opportunity to assume significant professional responsibilities and make professional decisions. In the past, many Indonesian engineering projects have been designed and supervised by foreign engineers, with local engineers acting only as advisors and associates.

Fortunately, the M. Eng. program at the University of Manitoba includes a compulsory engineering project. Thus, the Indonesian students return home for the summer between their two sessions at the University of Manitoba. There they compile information that would be necessary for the design of a substantial water resources development project. On their return to Manitoba, they spend an entire academic session carrying out the design of the project. While doing so, they work under the supervison of two senior Manitoba consulting engineers who are attached part-time to the project.

In July 1986, the selection process began for the group of 10 Indonesian engineers who will be admitted to the University of Manitoba in September 1987. Professor Cas Booy, the project director, and Professor Ian Goulter visited the Indonesian Government Training Centre in Bali where they presented short courses in Engineering Hydraulics and Water Resources System to a group of 50 engineers. The top 12 students were selected for the English language training program in Jakarta. Ten of those will arrive in Manitoba in August 1987, to complete a cultural and professional orientation program before beginning engineering classes in September.

The "Indonesian Project" has obvious benefits for Indonesia and for the students. As well, there are substantial benefits for Manitoba. The University and the staff members who have participated are extremely highly regarded by the Indonesian government and civil engineering community. In 1986, when Mr. Suyono, the Indonesian Minister of Public Works visited Canada, high on his list of priorities was a meeting with Professor Ed Kuiper.

The program is highly regarded in Indonesia because, unlike many aid programs, it is designed to provide maximum long-term benefit to the receiving country, with "no strings attached". On the other hand, many of the Indonesian participants now occupy senior positions, and the contacts that they are developing with Manitoba consulting engineers could be of future benefit to Manitoba. □

Finding of Professional Misconduct by the Discipline Committee of the Association of Professional Engineers of Ontario — Summary

Council, at their meeting on January 12th, 1987, decided that the following summary of an investigation by the Ontario Association's Discipline Committee, be reprinted in our publication in its entirety. —Ed.

At a Disciplinary Hearing held in October, 1985, a professional engineer was found guilty of professional misconduct relating to design documents produced by him for balcony additions to a large existing arena in order to provide considerable additional seating capacity.

The particulars pertaining to the allegation of professional misconduct that were brought before the Committee may be summarized as follows:

(i) design notes and calculations contained discrepancies in live and dead loads and certain arithmetical errors;

(ii) material accompanying a letter from the engineer to the municipality addressing in part the diaphragm resistance of the seating deck to lateral forces was based on suppositions and contained significant arithmetical errors;

(iii) the design documents contained no rational analysis for the diaphragm action of the seating deck, including the calculation of lateral deflection, residual stresses caused by the deck's resistance to jacking forces, anchorage connections to the supporting frame, and transfer of horizontal sheers to the end supports and thence to the foundations;

(iv) the documents contained no calculations for the assessment of the ability of the existing structural framing to provide sufficient strength to resist, without significant deflections, the tie forces necessary to stabilize the new columns supporting the main trusses against lateral movement and capacity of the roof framing to resist the forces necessary to stabilize the top chord of the main longitudinal truss against lateral buckling and for checking the strength of the existing structure to support the additional loads; and

(v) the requirements of the applicable building code were not satisfied: (a) in the calculations of the holddown force for the anchorage of the cantilever frames; (b) in that the design incorporated no bridging members or other load sharing provisions to prevent progressive collapse of the entire balcony by the failure of the tie down device located where the end of each transverse balcony frame terminates at the exterior wall; (c) in that there were no calculations for horizontal forces, deflection limitations and vibration of floor systems; and (d) in the use of a design live load of 50 psf for the floor of the seating areas.

Exhibits filed at the Hearing included a set of structural drawings containing 13 sheets of structural details, five pages of calculations and a copy of a letter from the engineer to the municipality in part stating that "we have checked the drawings for the project and have carried out site inspections and are satisfied that all work carried out and completed on the site is in accordance with our design drawings and meets the requirements of all applicable codes and by-laws..."

The engineer in his defence explained that generally it was not his policy to provide detailed calculations to his client or to building authorities, nor to keep calculations once a project is completed. He admitted that his calculations did indeed contain certain errors; however, he noted that the calculations were of a very preliminary nature and the errors were not carried into his final design. He claimed there were sufficient loads indicated on his drawings for a fabricator to produce shop drawings. It was his policy to permit a fabricator to make changes to structural members and details for his approval. He further explained that in a number of areas no detailed calculations or analysis was necessary as he considered that his past experience with similar structures permitted him to make certain assumptions. These included:

- the diaphragm resistance of the seating back to act as the equivalent of a flat slab;
- the expectation of no lateral or longitudinal movement;
- the stepped continuous concrete structure of the seating area to adequately take the loads for the spacing of the two trusses, thus preventing any progressive collapse; and
- no vibration effect on seating area as he had never seen any vibration in any arena in North America with similar construction.

The expert witness for the Association interpreted the Building Code as requiring 100 psf live load for the balcony as this loading is listed for assembly areas including arenas, balconies and rinks. The municipal building department also considered that the design live load should be 100 psf for the seating area. The engineer had interpreted the Code as requiring 50 psf live load as it was an assembly area with fixed seats that had backs over at least 80% of the assembly area and further stated that for similar types of structures he had used 50 psf and had never been challenged.

The engineer made the statement that the actual structure was never revised or altered from his design. However, in cross-examination, he admitted that after completion, the structure to support the first row of seats was removed and post-tensioning was applied to the trusses.

According to the engineer this remedial action was not required; however, it did in part compensate for the use of 50 psf of live load requirement.

The Discipline Committee considered that the evidence presented did not support the particulars dealing with the suppositions made by the engineer and his failure to provide with the design documents a rational analysis and calculations for certain portions of his design.

The Committee concluded that the evidence did support the particulars pertaining to discrepancies and errors in the engineer's calculations and his failure to comply with applicable building codes.

In conclusion, the Committee found the engineer guilty of professional misconduct with specific reference to the following provisions of Ontario Regulation 538/84 made under the Professional Engineers Act.

Section 86(2)(a): Negligence which means "an act or an omission in the carrying out of work of a practitioner that constitutes a failure to maintain the standards that a reasonable and prudent practitioner would maintain in the circumstances."

The Committee considered that the engineer's calculations in no way met the standards expected of a reasonable and prudent practitioner in that they were incomplete, contained many errors and were very difficult to understand. His non-conformance to building code requirements in many areas also contributed to the finding of negligence.

Section 86(2)(b): failure to make reasonable provision for the safeguarding of life, health or property of a person who may be affected by the work for which the practitioner is responsible.

The Committee did not consider the evidence before it indicated that the life or health of a person or persons was ever in jeopardy; however, the engineer's non-conformance with applicable codes and standards resulted in the arena containing less seating than expected or paid for.

Section 86(2)(d): failure to make responsible provision for complying with applicable statutes, regulations, standards, codes, by-laws and rules in connection with work being undertaken by or under the responsibility of the practitioner.

Section 86(2)(j): conduct or an act relevant to the practice of professional engineering that, having regard to all the circumstances, would reasonably be regarded by the engineering profession as disgraceful, dishonourable or unprofessional.

The Committee did not consider that the engineer acted in a disgraceful or dishonourable manner, however, his non-conformance to applicable codes could reasonably be regarded by the engineering profession as unprofessional.

The Committee considered that the engineer was not guilty of Section 86(2)(h) as charged, being the "undertaking of work the practitioner is not competent to perform by virtue of his training and experience."

The Committee in reviewing the evidence was of the opinion that the engineer in his practice as a structural engineer should institute improved procedures for processing projects through design and construction with emphasis on the keeping of records, particularly with reference to the idenfication and retention of calculations. He should provide more details and information on his own drawing and not rely so heavily on the steel fabricator.

(continued on page 11)

The Ten Most Exceptional Feats of Canadian Engineering's First Century

This issue, we feature the following two engineering feats in our continuing series begun last issue.

THE DCH-2 BEAVER

Built by De Havilland Aircraft of Canada Ltd., this plane is tough and tenacious, and almost destined for immortality. Even while some of these 1,000-pound marvels are in museums, others are still logging thousands of miles daily.

Let's go back to Downsview, Ontario, just after the War. A team of engineers got together to try and come up with a new design for a bush plane with a metal body. The result was innovative: metal framework, aluminum body, panels and doors up front, unibody construction at the back, fixed and slotted wings with slanted ailerons. In 1947, 15 Beavers were built and sold in Canada.

Solid, with a strong undercarriage and a slanted fuselage on its side, the Beaver could carry six passengers and a pilot. Well constructed for cargo, it quickly opened up such areas as Alaska and was used for all purposes, including fishing expeditions. Very popular with the U.S. military, it was bought in large numbers south of the border in peace time. This was an unprecedented event in American history, as an Act of Congress was needed prior to any purchases being made.

The "little flying jeep" met all requirements and demands made of it during the Korean War. By 1968, some 1,631 Beavers had come off the assembly lines. Its international reputation is yet another symbol of Canadian engineering ingenuity.

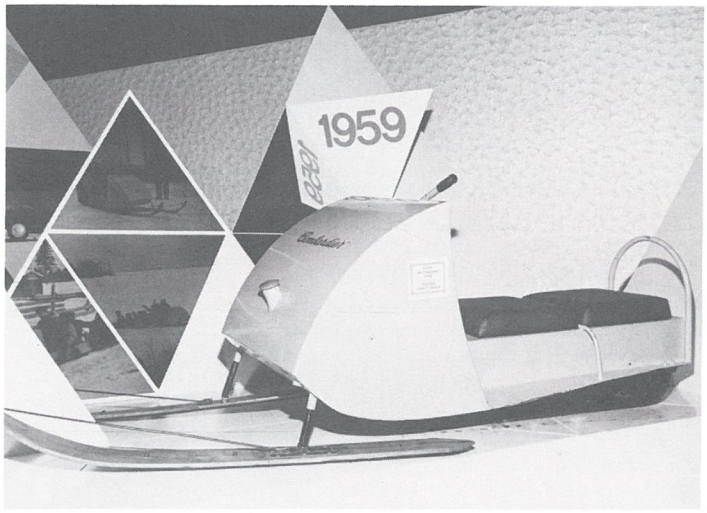
The "little flying jeep".

THE BOMBARDIER SNOWMOBILE

Even if we dream of space and interplanetary travel, it is essential that we keep two feet firmly planted on the ground and find practical ways to live with cold and snow.

Armand Bombardier discovered ways to make these two his allies. The price paid was 30 years of research.

From 1927 to 1935, diverse occurrances led to a decisive step: for the first time, a rubber-covered tractor wheel was designed and patents for caterpillar-type wheels, a new kind of suspension system and a drive wheel were obtained. It wasn't until 1959, however, that the small individual motorized sled called the SKI-DOO arrived: a steel framework, a moulded plactic 15-inch wide tractor wheel, wood skis, a 7.5 horsepower front-mounted engine and bicycle-type handlebars. Design improvements in engines and suspension systems, several-speed transmissions, polycarbonate-injection casing design, important gains in soundproofing, new manufacturing methods, improvement of materials and existing products, all of these benefits led to the creation of small, lightweight, quiet, strong and resilient machines. The lifestyle of native people in the Arctic has been profoundly changed by this invention. And the tourism industry has profited fully from it, also. □



The "Ski-Doo" circa 1959.

The Third Decade of A.P.E.M.: *1940-1949 The War-Torn Forties*

by D.N. Spangelo, P.Eng.

The next decade in the series of historical notes is the War-Torn Forties. As mentioned in previous publications, these highlights are taken from Council Meeting Minutes in celebration of the Centennial of Engineering in Canada.

The War Years 1940 - 1949

In 1940 the APEM wrote to the Department of National Defence to point out that there were Professional Engineers who were not members of the E.I.C. The Department had ruled that only graduates of Royal Military College or members of the E.I.C. could hold commissions in the Engineering Corps. The membership was 226 that year.

At the 1941 Annual General Meeting $200.00 was set aside to cover the dues of any member in the forces.

In 1943 membership stood at 215, with 26 members serving in the Armed Forces. Due to rationing regulations, tea and coffee could not be served at joint E.I.C. and APEM meetings. The President reported in his annual report that there were few members under 40. Postwar reconstruction already seemed an issue since Council appointed a representative for a committee dealing with this subject.

A motion to implement a joint agreement between E.I.C. and APEM was defeated at a special meeting on March 28th, 1944. In that same year, Council decided to send out "framed" certificates to the 10 new members.

The E.I.C. 59th Annual Meeting was held in Winnipeg on February 7th-9th, 1945. Dean Fetherstonhaugh, of the University of Manitoba, was elected President of the E.I.C. that same year.

During 1946, 35 applications were received. Council required an applicant to be a resident before registration could be granted.

Golf tournaments, which were suspended in 1941, were revived in 1946 with 26 attending.

In 1947 Council decided that Geologists are included under the definition of the practice of professional engineering, and if not registered, were practising illegally. The President reported that Council's work had increased to the point where it was necessary to set up committees.

In 1948 it was decided to switch to rubber stamps instead of impression seals. In the same year, APEM withdrew from the Canadian Council of Professional Engineers and Scientists.

The next issue will cover the beginning of the Baby Boom, 1950-1959. □

Soil Failure of Transcona Elevator

by D. N. Spangelo, P.Eng.

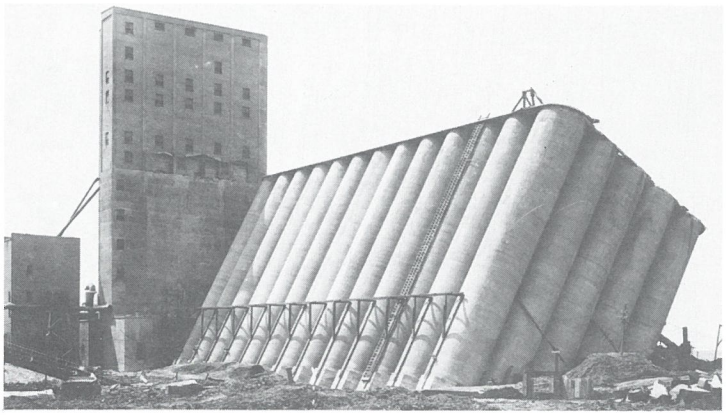
In 1913, a grain elevator near Winnipeg experienced a soil bearing capacity failure during its first loading. The foundation consisted of a large rectangular raft, 77 feet by 195 feet resting on a plastic clay deposit 12 feet below grade. The structure consisted of 65 bins, 92 feet in height and 14 feet in diameter with a total capacity of a million bushels of grain.

On October 18th, 1913, after 875,000 bushels of wheat had been loaded in the elevator, settlement was noted. Within an hour the settlement had increased uniformly to about one foot. This was followed by a tilt toward the west which ceased after 24 hours an angle of over 26 degrees.

The significance of this failure was realized almost immediately. Early interest centered primarily on the ability of the structure to remain intact during failure and on the unique righting and underpinning to bed rock operations.

Subsequently, in the early 1950's when soil mechanics had provided a basis for computing ultimate bearing-capacities, it was realized that the Transcona failure afforded one of the best opportunities for a full-scale check on the validity of such computations. The net unit-load at failure was accurately known at 2,340 lbs. per square foot. The theoretical bearing capacity was calculated through bore hole testing at 2,570 lbs. per square foot, which compares favourably for practical purposes.

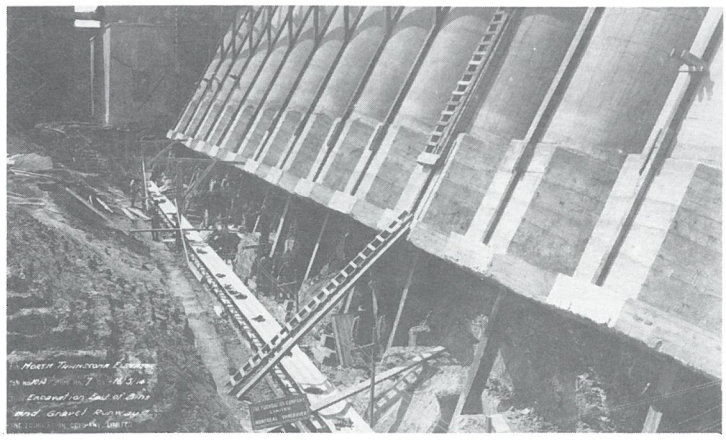
As the pictures indicate, the righting of the elevator was a major engineering feat. The structure is still in use today after 73 years.



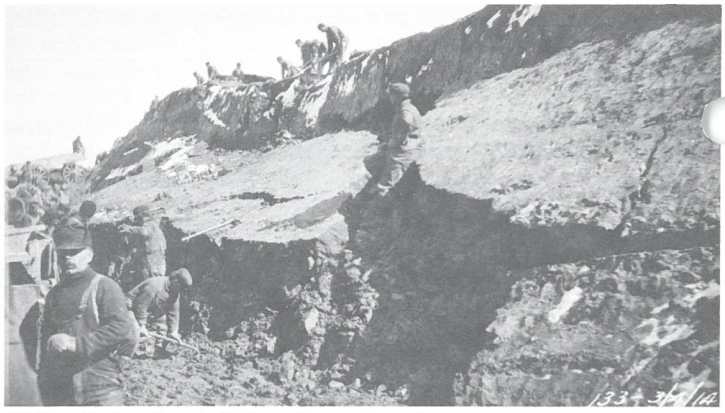
A view of the elevator from the northeast after the failure.

The west face of the elevator with the "pushers" installed.

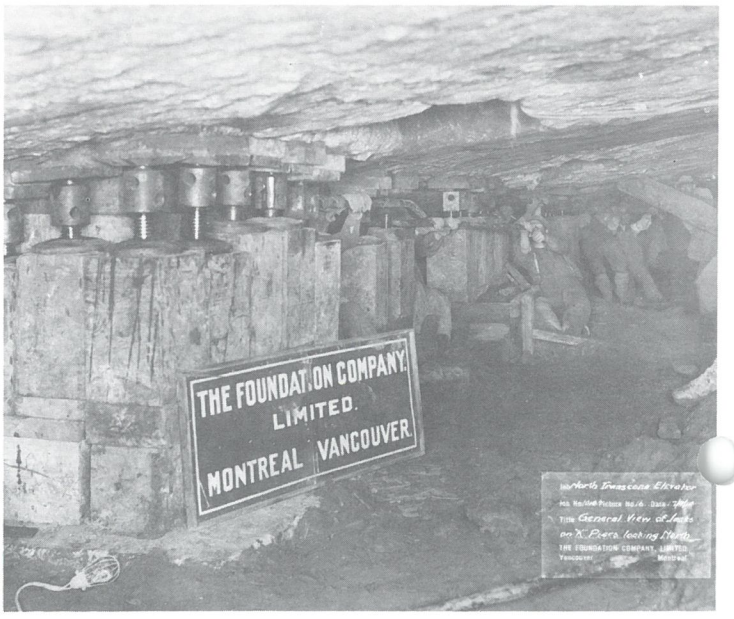
The east trench showing excavation by horse and cart.



East trench after installation of gravel "runway".



Sliding displaced material into the east trench.



Men working below the elevator hand-jacking the raft.

Sweating the "Performance Review"

s they were moving from the departure gate the plane, the older man made a few comments to the younger man about the previous day's presentation; he muttered a few more words about events in the past two months, offered one minor suggestion, and then they were in their seats. Thinking later about the episode, the younger man realized that he had had his annual performance review, and that all was well.

"Survey after survey highlights that ... managers do a poor job of communicating to subordinates."

Survey after survey highlights that, by and large, we managers do a poor job of communicating to our subordinates what we think of their performance and how it could be strengthened. Those surveyed seem invariably to say that they have not had a performance review for two years, or only one in the past five years. I have never seen a companion survey that asks managers for their views. I suspect that such a survey would find that we are convinced that our subordinates are fully aware of where they stand, and that there is no need for annual performance reviews.

When we are satisfied with the quality and antity of work done by a subordinate, we tend to maintain a generally positive relationship with him. If we are given to openness, we may occasionally compliment him on a good report or presentation. And if, in turn, the employee is sensitive to our moods and attuned to our comments, he may be completely aware of our evaluation and be satisfied.

Many of us, however, find it hard to be complimentary. My mother once said to my father: "How come you never compliment me on a meal?" he replied: "When it's not outstanding, I'll let you know." And she said: "That's not good enough." I presume the discussion was continued later, but that's all I remember.

We convince ourselves that by not being too free with our compliments, our employees value them all the more. But we lose track of how many compliments we have doled out, and end up not giving them. Conversely, most of us are too civilized to be free in our criticism. So we're proud of our forebearance, and bury the negative observations. As a result, employees are left wondering where they stand.

Even those among us who are open and free to comment have periods when we are distracted. We have worries, too — sick children, bills to pay, various tensions to survive. It is human nature to withdraw somewhat at times like this, and we simply do not recognize that our subordinate is probably aware of this and may assume that it has to do with him. He has been comfortable in an open and mutually supportive relationship. Now you are silent, on edge, withdrawn. Obviously he has screwed up; somehow your regard for him has changed.

A formal performance review is necessary. The winds of personal relationships are so shifting that they cannot be relied on; they will not be consistent.

Discuss rather than preach. Do not be reticence about being critical, as long as criticism is presented as a problem to be solved jointly, not a judgment to be announced. The employee cannot change some things — physical appearance, speech patterns, nervous mannerisms — and these, in all fairness, should not be dwelt on. Everything else is open to discussion: He can be on time, he can be neat, he can be honest. He can work hard, and — assuming that he's the right person for the post and that you've done an adequate job of communicating — he can in time meet your expectations.

In order to insure that the employee knows what's going on, make an appointment with him and tell him the subject. Do your homework and, when he arrives, put on your suit jacket, place a Canadian flag on the table, and announce: "This is your Annual Performance Review." You will still come out ahead. □

Professional Misconduct

(continued from page 8)

As a result of its finding of professional misconduct the Committee ordered that:

(a) the engineer be reprimanded and that the fact of the reprimand be recorded on the Register of the Association for an unlimited period of time;

(b) the finding and the order of the Discipline Committee be published in summary, without including the name of the engineer, in the official publication of the Association; and

(c) that there be an undertaking by the engineer that for a period of two years he will have verification of calculations, drawings and specifications by a competent licensed engineer to ensure conformity to codes and ndards.

The Committee handed down its decision verbally at the conclusion of the Hearing, at which time counsel for the engineer informed the Committee that the engineer waived all rights of appeal to the Decision.

The Committee met in camera with the engineer and verbally issued the reprimand.

A.P.E.M. Establishes Research & Development Committee

by M. Kauldher, P.Eng.

The Research and Development Committee has been formed by the A.P.E.M. and its members have been holding regular meetings for the past three months. The terms of reference and the duties of the committee were passed at the April 24, 1987 Council meeting, and are as follows:

Terms of Reference

The R&D Committee is constituted to keep Council and members informed of research, development and innovation activity and identify and draw to the attention of Council areas requiring stimulation within the Province and advise Council of the implications of research and development relating to current technological and environmental issues and make a contribution to Council for inclusion in an Association Brief to the Provincial Cabinet and to arrange workshops and meetings relating to research and development for Association members and the public.

Duties

1. To encourage a high-tech environment in order to:
   a. create more jobs
   b. keep technical talent in Manitoba
   c. continually upgrade safety of the general public
   d. disseminate information on new and improved technology to the membership and to the general public
2. To inform the Provincial Government by contributing Briefs on the subject of research and development.
3. To encourage the Government of Manitoba to contribute a greater percentage of the Manitoba income to research and development.
4. To be available to assist in creating rules and regulations for the proper use of government grants and funding for research and development projects.
5. To keep APEM membership aware of the R&D activities by:
   a. regular contributions to the *"Manitoba Professional Engineer"*
   b. seminars
   c. meetings
   d. other pertinent information

The current members of the R&D Committee are: Bob Hamlin, Chairman
Mohinder Kauldher
Dave Fedirchuk
Dr. T. Hsu

The R&D Committee calls upon all APEM members to help make research and development a priority in Manitoba. The R&D Committee is currently in the process of soliciting new members from various engineering disciplines. Interested APEM members are requested to contact Bob Hamlin, R&D Committee Chairman at 474-3868 or Mohinder Kauldher at 261-9620.

The Research and Development Committee will be holding its first P.D. breakfast meeting on November 3, 1987. Details of the meeting will be mailed out sometime in October. □

A Question of Enforcement

by W.B. Mackenzie, P.Eng.

In our society, in these turbulent times, change has become a byword. We are faced on all sides by a bewildering array of changes which affect every aspect of our lives.

Along with everything else, the way in which the practice of engineering is being carried on is changing. In our small part of the world the practice of engineering is regulated, in the public interest, by APEM. This has not changed. But the way we perform this vital and important function must change and adapt to the changes taking place in the real world. It has become increasingly obvious across the country that new initiatives and priorities must be instituted by the various Provincial Associations in the field of what we refer to as "Act Enforcement".

The term "Act Enforcement" in the broad sense means enforcing the provisions of the Engineering Profession Act as they apply to everyone — whether they be members of a Provincial Association or whether they be members of the general public. In the sense most commonly used nowadays by Provincial Associations, "Act Enforcement" refers to the process of enforcing the various provisions of the Provincial Engineering Statutes as they apply only to members of the public. Provincial Engineering Associations, including ours, have adequate procedures in place to deal with Act violations by Professional Engineers.

For better or for worse, it has become an accepted fact of life that Act Enforcement in the field of engineering is the responsibility of the Provincial Association. These activities will not normally be carried out by the Attorney General's Department.

"Act enforcement refers to the process of enforcing the ... Statutes as they apply only to members of the public."

Act Enforcement procedures by the various Provincial Associations are becoming a high priority. Our Council has responded to this situation by bringing a Professional Engineer on staff whose primary responsibilities will be the implementation of Act Enforcement activities as they apply to the general public. It should be obvious to all of us that one man cannot investigate and institute correctional procedures across the whole province. In order that our Association fulfill its important role in this field of Act Enforcement the cooperation of each and every member of our Association is essential. The role which individual members can play is to identify and advise the Association, through the Registrar, of suspected or actual violations of the Engineering Profession Act by non-professional engineers. Such information should be sent to the attention of the Registrar in a confidential envelope. Such advice will be treated in a confidential manner so that the name of the person providing it can be kept confidential; or such advice may be provided anonymously. It should be emphasized that Act Enforcement by the Association is not designed to be punitive. Rather, Act Enforcement is a requirement to assist us in carrying out our primary mandate which is simply to protect the public in the field of engineering.

It is not always clear as to what does and what does not constitute the Practice of Engineering. In this context members are somewhat unclear in their own minds as to whether or not certain types of engineering work are required to be done or directly supervised by professional engineers. Members are urged to contact the Registrar for advice and guidance where such doubt exists.

Further articles will clarify some of the specific types of Act violations which are taking place and which must be identified so that corrective action can be taken.

The cooperation of all members of the Association is solicited to enable us to address this vital function adequately. □

What Goes Up ... Must Come Down: University of Regina Replaces Gymnasium Roof

by R. Menon, P.Eng.

The University of Regina has recently sued a number of companies involved in the planning, design and construction of a gymnasium building constructed in 1966. The University of Regina wants $1.0M in compensation for the cost of replacing the old roof with a new concrete roof and for financial losses suffered after the gym was closed for safety reasons in 1979.

The original roof consisted of a "space frame" — metal tubing joined with hub-like connectors. In July, 1979, an electrician fixing a motorized basketball backstop noticed that a piece of tube was hanging loose. A further investigation revealed that a number of the connecting hubs were probably defective.

The trial started in Regina in October, 1986. Lawyers for the University of Regina produced evidence to indicate that the companies involved in the construction of the gym knew about a sag in the structure's roof during construction, but never informed the University.

The University considered options for making changes to the frame to ensure its stability. One option was to repair the space frame from inside. However, this would have lowered the ceiling by three feet. Another option would involve repairing the roof from the outside with trusses, which could be "disguised" using reflective plates. This option was rejected for esthetic reasons. Eventually the frame was replaced with a concrete roof which had been originally considered in 1963, before the space frame idea was adopted.

One by one, the five defendants in the law suit dismissed allegations that they are to blame for putting up an "unsafe and inadequate" gym building at the University of Regina. The defending architect testified that a faster and cheaper option to replacing the roof would have been to either stabilize from the inside or the outside, and referring to the roof replacement, said "I knew removing the roof would be disruptive and extremely costly. It struck me as an effort to kill a fly with a sledge hammer".

In his decision, the presiding judge found no negligence on the part of any party except the fabricator of the space frame. The fabricator of the space frame is appealing the judgement of about $1.0M. The appeal will likely not be heard until 1988. No professional disciplinary inquiries ever arose as a result of the situation, partly due to the time between construction and the discovery of the problem. □

PROJECT MILE: A Step Forward For Alternative Fuels

Canada has taken a giant step forward in the development of alternative transportation fuels with the launching of the first phase of Project Mile (Methanol in Large Engines).

The $8-million program, initiated by Energy, Mines and Resources Canada in cooperation with the energy transportation industry, is to research and demonstrate the viability of methanol as a fuel in large trucks and buses.

As a vehicle fuel, methanol reduces emissions of nitrogen oxides and eliminates hydro-carbon, particulate and lead emissions associated with conventional petroleum derived fuels. Most methanol is produced from natural gas but can be manufactured from almost any other energy source including wood, coal oil and even municipal waste.

During the next two years, truck and bus fleets in Winnipeg, Vancouver and Medicine Hat will operate methanol-powered vehicles. New York State has also made a commitment to provide funding to this project and convert bus fleets to methanol.

Sypher-Mueller International Inc., an Ottawa-based engineering firm handling overall project management, will conduct extensive testing, analysis and evaluation of methanol as an alternative to diesel fuel. □

We Cannot Save Our Way to Continued Prosperity

Peter Urban
Reprinted from the Toronto Star

By the end of this decade — only three years away — Canada will have almost no markets left for its resource industries and its manufacturing will be rendered non-competitive.

Many bankruptcies will be straining the country's financial system. There will be more than two million unemployed.

An unlikely scenario?

Not entirely, if we continue to ignore the problems in our international competitiveness and the way we organize ourselves.

We do not equip our students and work force with the proper skills and knowledge. We do not streamline our plants and processes. We do not embed the growth bias in our organizations and institutions.

We do not invest enough in research and development. We do not acquire and install enough of the new technologies.

In short, we do not provide enough world-class input to create the world-class output necessary to maintain our way of life, our standard of living.

We view our shift to the so-called "service economy" as almost inevitable or God-given.

Foreign competition

We have lost faith in manufacturing and, frequently, when facing foreign competition unsuccessfully, rather than finding out why we are unsuccessful and correct the situation we close the division or the plant, we divest, we get out of the business, leaving the field to the competition.

We are not investing enough in manufacturing. Over the last 30 years or so, Canada was well below its foreign competitors in investment in machine tools or machine tool consumption. Machine tool consumption indicates the rate of modernization and the seriousness with which the country views manufacturing and its competitiveness.

Canada is using 10 times fewer robots than Japan, six times fewer than Sweden and twice as few as West Germany, Czechosolvakia, France or Belgium.

The start-up costs of a manufacturing operation are too high. For a potential investor, it is less risky to open a hamburger stand — with an almost immediate positive cash flow — than a manufacturing plant.

There is no significant help to people willing to get in manufacturing in terms of tax relief or special subsidies. The level of knowledge and sophistication in manufacturing as compared to service industry is more demanding and with a higher complexity of skills. Who, then, in his right mind, would prefer to get in manufacturing?

The image of the career in manufacturing industry is that of the least desirable and rewarding, therefore our bright young people are starting more as lawyers, accountants, doctors or MBAs going into consulting rather than manufacturing.

As a matter of fact, there is actually no undergraduate, graduate or postgraduate degree offered in the discipline of "manufacturing engineering" in any Canadian university.

Educated people

Eighty per cent of the Canadian manufacturing companies do not have any technically highly educated persons on their staff. Very little is understood about the impact of the technologies on the relative competitiveness of any given firm. As a result, more manufacturing firms succumb to well-trained and well-oiled foreign competitors, with further loss of Canadian jobs and opportunities.

What should we do to reverse the tide?

- The situation we are dealing with is nothing short of national emergency and we should treat it as such. Governments at all levels should say so and should focus maximum resources to that end. Public awareness and understanding of the issues involved should be promoted through media and educational systems.
- Tax incentives should be created promoting investment in manufacturing, new technology, research, development and innovation.

New technology

- New curricula should be launched at primary, secondary and post-secondary educational institutions dealing with technology, manufacturing, innovation and strategic thinking.
- Government programs with incentives should be initiated in order to support getting more engineering talent to those manufacturing plants which do not have or cannot afford any.
- Growth bias and global orientation in our organizations should be promoted, nurtured and supported through courses upgrading the management skills in our manufacturing.

These are a few of the necessary things we have to do immediately in order to start providing the world-class input to provide Canada with world-class output.

We are not going to save our way to success, much less prosperity — or survival. We simply must put more resources to it — while there is still some time left. □

Optical Research Laboratory Newly-Established at the University of Manitoba

The newly-established Electron Optical Research Laboratory in the Faculty of Engineering at the University of Manitoba provides the university with state-of-the-art equipment capable of supporting new initiatives in research into the study of microstructures of materials.

Electron optical equipment is used in materials research because scientists and engineers must observe and correctly explain phenomena occurring at the micro level to understand the behavior of materials. This information is used in manufacturing quality control, and the development of new materials.

With the Canadian Mint, a steel rolling mill, several aerospace firms, and several foundries located in Manitoba, there is significant industrial acitivity in metallurgy. Accordingly, the new lab will be useful to engineering consultants working for both producers and fabricators.

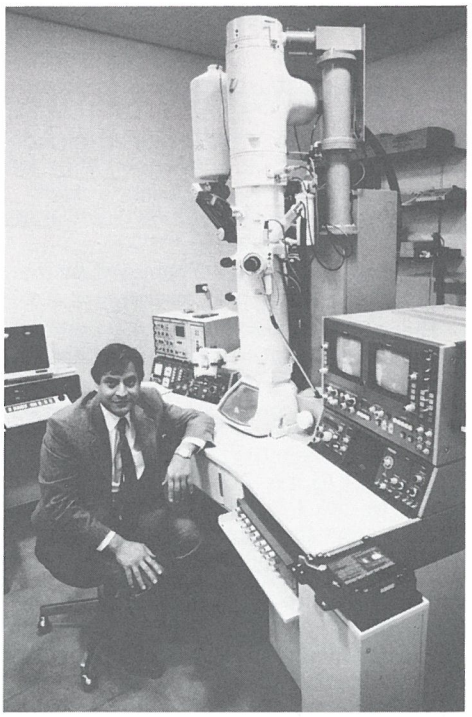
Dr. M.C. Chaturvedi, Associate Dean of Engineering, said the facility "gives us a tremendous opportunity to do research we couldn't do before and ... and provides Manitoba industry with the opportunity of getting involved in high-tech materials."

An essential aspect of the lab's mission is to serve both industry and industry research activities, providing both with facilities they might otherwise do without.

An early priority will be to reach out to potential industrial users and materials engineers and describe to them the equipment and its potential use. Dr. Chaturvedi observes that the lab will be a good point of "technology transfer."

Because the facility is part of the metallurgy section of the department of mechanical engineering, the new lab's research and services will emphasize metals. However, equipment can also be used for studies in ceramics, plastics, and other materials.

For further information contact Dr. M.C. Chaturvedi at 474-9809. □



Dr. M.C. Chaturvedi with the scanning transmission electron microscope.

News from the North

by Alex Murchie, P.Eng.

Amid upsetting news on trade relations between the US and Japan, and further outbreaks of famine in Africa, our scoop from the north can, at best be described as, quiet. In fact, it is just that contrast which is disquieting, especially when the news bodes for a weakening of the economy. Falling Canadian and American dollars imply increased interest rates and other barriers to growth. Despite these problems we northerners live in expectation of upswings in metal prices and such palliative, and nourished with a guarded optimism, engineers in Thompson continue their application to a healthy stream of projects and activities.

Last year saw the main thrust directed at the completion of the new Thompson Open Pit and associated works. This year a variety of lesser schemes, including the Anode Casting Automation should set new standards for better production levels with sparing employment expansion. One might wish to say more about the Anode Casting and that will be forthcoming when it has matured to a properly commissioned completion.

Turning however, from the weighing of our overall direction let me bring news of some engineers plying their fortunes (or misfortunes) in the risky business of mining. Milt Goble, formerly Manager of Process Technology has recently changed offices and now wears the hat of Mill Superintendent. Not so recently Dr. Ron Orr presented a paper on pyrrhotite rejection after a lengthy preparation. The value of the paper undoubtedly warranted the time devoted to its cause.

Brothers (John) Greenhill, (Mike) Mular, and (Brent) Campbell devote much of their time lately to the dissemination of statistical approaches to quality control. To clarify, the plant has adopted much of Dr. W. Edwards Deming's principles of management, and there is a Messianic following, likened to that found in Japan where Dr. Deming is respected and honoured for his views. The 'Deming Way' was scouted and put into play here through the efforts of Inco president Lorne Ames with assistance from vice president Gerry Marshall. The cause has been picked up in the plant with near religious fervor.

In the engineering department, Don Smal spoke of a need to straighten things out. Don following his own advice reviewed the jacking of the T-3 headframe complex. Settlement had caused the building to list and the solution was simply to saw through the supports and jack the building straight. Don has sent his credentials to Pisa in case town officials there see a need to bring the Leaning Tower into line. He can probably expect a slow reply.

If one feels tension within the mining industry causing one to breath a little harder, then Rodger Blunden is in a position to bring relief from that tension. He is into designing major ventilation changes at Thompson Mine; about 380,000 cfm's worth.

And in an engineering crowd there's always a good chance of finding an old rake. Here's a twist though. In general engineering its a new rake. Richard Osiowy will soon see his cable torque rake (partial credits to Dorr Oliver Ltd.) being installed in the In[illegible] Smelter. I still think he's an old rake thoug[illegible] for skipping his team to 3rd event winnings at the engineer's bonspiel.

Alan Vernon and Gerry Koroscil have just completed computerizing controls on the Smelter furnaces. These guys might have made a difference at the Chernobyl power plant. By the way, Gerry, this year's organizer of the General Engineering bonspiel guided it to another success; at least for Gerry it was. He skipped the successful 2nd event team.

Bryan Clements has been converted from advising on engineering overseas to overseeing Anode Casting Automation. And as usual there are engineers plying service to the community. Smiley Hallam is president of the Thompson Rotary Club and Dave Nicholls is president of the Thompson Golf Club. Strange that this year 14 Rotarians went on an exchange to South Africa which happens to be Smiley's birthplace. Must be pure luck, Smiley! If Dave Nicholls could arrange for an exchange to play in the 'Masters' at Augusta, it would be much appreciated. We could provide Nicklaus with an interesting Inco plant tour. But Ray Prochera and the Setting Lake cottage owners have found a practical way of extending the golfing season by kicking things off in March, o[illegible] ice. The ultimate environmentalist, Ray, w[illegible] discovered carrying a sign urging replacement of divots.

It was an uphill battle for Greg Bowland to

(continued on next page)

Council Reports

MARCH 9th, 1987 *by D. Cross, P.Eng.*

Where Council abolishes the Ad Hoc Self-Interest Committee.

Under Business Arising from the Council meeting of January 12th, 1987 the Registrar reported that:

1. The Research and Development Committee is now in place with Mr. Bob Hamlin as Chairman.
2. The APEM Guidelines for the Ethical Use of the Engineering Seal are being printed and will be distributed to the membership with the next regular mailing.

Requests for Funds: A request for funds from the National Studuent Centennial Committee was approved. The President cast the deciding vote to split a deadlock. The amount approved was $500. A request by the University of Manitoba Engineering students for funds to assist their group to attend the Centennial Convention in Montreal was not approved.

Annual Brief to Government: Council again discussed the President's suggestion that APEM present an annual brief to the Provincial Government. A brief by the Saskatchewan Association was considered. The concensus of Council seemed to be that, if a brief is submitted, the items should relate to the public interest and must not be perceived as self-interest items relating to the Association.

Association's "Guide for Engagement of Engineering Services": Dennis Whittaker, the Chairman of the Consulting Engineers Committee, joined the meeting. He presented the committee's proposed revision to the APEM publication "Guide for the Proposed Engagement of Consulting Professional Engineering Services". Many of the revisions were grammatical and of a housekeeping nature. The major item for consideration related to a revision to the schedule of fees. To illustrate the rationale for the proposed change, Mr. Whittaker suggested that a project completed in 1975, might cost twice as much if built but, due to the sliding percentage arrangement, the fee would be less. Council laid over its consideration of the matter until its next meeting.

Self-Interest Committee: Councillor W.R. Newton presented a report and a motion relating to the Ad Hoc Self-Interest Committee. The motion stated that APEM should only be the instigator in establishing a forum for engineers interested in a self-interest group. Once this forum had been established APEM would no longer be involved. The self-interest group would proceed on its own. After long discussion Council decided that the APEM should not be involved in any respect and the motion was defeated. Council also rescinded the motion of December 8th, 1986 that had established the Ad Ho[illegible] Committee.

Committee on Group Practice Strikes Terms of Reference: Councillor W. McGilvery, the chairman of the Ad Hoc Committee on Group Practice reported that the Committee has struck their terms of reference and expected to have a report for consideration by Council by September 1987.

News from the North

(continued from previous page)

the contractor, Litz Ltd., to pull the 1,000 ton dredge from the pit. There were 288 wheels on the haulage trailers and a few modern horses involved, engine power that is (3 Terexes, 1 Tandem, 1 Michigan, and a Cat D-9).

And finally Malcolm McKenzie continues to spearhead the engineering baby boom. The latest edition Dayna, 6 lb., 11 oz. arrived 17 January, mother and baby doing fine, and on that glorious note we end. □

News from the West

by Dick Menon, P.Eng.

It has been a long time since I wrote news about West-Man members. As a matter of fact, it has been so long, that Mulroney actually was popular in Canada the last time my West-Man news article appeared in the Manitoba Professional Engineer.

Well, we have certainly put Brandon on the map this past winter with Brandon University Bobcats winning the C.I.A.U. Basketball championship and Fowlers rink winning the Tankard.

Former colleague of ours at The Manitoba Water Services and an APEM member, Wayne Slack, was back in Brandon over Christmas after a two year stint with C.I.D.A. in Kenya. He had a lot of stories to tell us and thousands of slides which were really fascinating. To make a long story short, Wayne liked it there so much that he accepted a two year extension.

Last year, three new Engineers joined The anitoba Water Services Board in Brandon. Ray Foreman left Ducks Unlimited in Alberta to come home. Having grown up in Arden, about 100 km northeast of Brandon, an opportunity to come home was a once in a lifetime opportunity. Foremans are also expecting their third child in about a month.

Like Ray Foreman, Glen Newton also grew up in the Neepawa area and was working in Winnipeg when the opportunity to move to Brandon came and he accepted it quickly. Newtons had a new addition to their family in October, a baby boy, their second child. Glen is an avid outdoorsman and hunts with bow and arrow. Lately he has been hobbling around on crutches and I am not sure if he didn't shoot one through his foot!! Anyway, he won't tell us much about the injury.

Stella Fedeniuk accepted a position in Brandon as well. She had been employed with Manitoba Hydro in Winnipeg. Her husband is employed with the Brandon Research Station (Agriculture Canada) and they had been keeping a long distance relationship between Winnipeg and Brandon for over two years. To say that Stella is pleased about the move to Brandon would be an understatement.

Finally, I would like other West-Man members to call me at 728-0053 (office) or 728-6500 (home) with any newsworthy items for publication. □

From of Old:

The following two notes were found in one of the first issues of the Manitoba Professional Engineer, Vol. 1, No. 3.

Contest

It is doubtful whether the "40 Beer Contest", which was held last year at one of the local parlors, will take place this year. The object of the contest is to see which of the students can consume 40 or more beers in 12 hours and last year's winner was a second year student who ended up with a total of 64. The event received much publication and one Ontario student, who had a low opinion of Manitoba beer, wrote in saying he had sent a sample to an analyzing lab and received a report that *his horse was sick.*

PUZZLE

A perfectly flexible rope hands over a frictionless pulley. A weight is tied to one end and at the other end hangs a monkey of equal weight. The rope weighs four ounces per foot. The combined ages of the monkey and its mother equal 4 years and the weight of the monkey is as many pounds as the mother's age. (The mother is twice as old as the monkey was when the mother was half as old as the monkey will be when the monkey is three times as old as its mother was when she was three times as old as the monkey was). The weight of the rope plus the weight is half as much again as the difference between the weight of the weight and the weight of the weight and the weight of the monkey. How long is the rope? Answer to follow.

APRIL 6th, 1987 *by V.L. Dutton, P.Eng.*

At which Council begins deliberations on the problem of Technologists and Technicians.

Association Membership: Licences and Renewals — 24; Engineering Graduates — 6; Transfers — 2; Registrations — 16.

Two of the applicants for licences had submitted identical "papers" in reply to the examination that is required of all applicants for a licence. After some discussion, Council agreed to a new set of instructions to accompany all future examinations.

Act-Administration Officer: Mr. David Ennis commences his duties, as our Association's Act Administration Officer, on Easter Monday. One of his first tasks will be to address the work of the Liaison Committee which has been handling the problems presented by the Society of Engineers of the Manitoba Telephone System (SEMTS). Council disbanded the Watching-Brief Committee.

Visit To Thompson: The letter from Mr. Robert Cotterrill, President of the Thompson Chapter, in which our Councillors were invited to visit Thompson and, possibly, Flin Flon, was considered. The Registrar is pursuing this. Your Reporter, who does little flying, was interested to learn how the availability of commercial flights into our north-country has been reduced in the recent past.

Guide for the Engagement of Consulting Professional Engineering Services: The final form of this document was accepted by Council.

Social Committee: Having decided not to attend the Cabaret last March, your reporter had lost track of the fact that this social event had been cancelled. It appears that there were two reasons for this cancellation — a conflict with a somewhat similar acitivity in the Highways Department, which drained off a number of potential "customers", and an apparent lack of interest by the majority of our members. As a result of this experience, members of the Social Committee are concerned about what approach they should be taking in the future. Consideration is being given to a questionnaire but the cost of distributing it is a concern. More, on this subject, will likely appear in *The Professional Engineer.*

Technologists: It is always a heady experience to watch history unfurling in front of your very eyes, and this meeting of Council was just such an event. The deliberations of your Councillors, on the changing relationships between the professional engineers and the technicians and technologists, could well form a chapter in such a book.

The situation reminds me of Jerome K. Jerome's "Three men in a boat:" the technicians and technologists, we engineers, and society.

Then there are the politicians with their various philosophies. Watch this space for the next installation of the story of the play in which we are all actors, whether we wish it or not.

Council meetings are open to all members of our Association. Plan on attending the next meeting, to be held on July 13th, 1987.

News from other Associations

The Ontario Association reports a **membership growth of 2.55%** in 1986 compared to 0.69% in 1985. Our Association's figures are 1% and 1.75% for the corresponding periods.

Nova Scotia's **Act Enforcement Committee is now 20 strong,** with more members being welcomed to the extremely active committee.

The Northwest Territories Association's Eastern Arctic Branch has been **active in promoting our profession** at a Career's Day in Iqualuit.

Ontario's Attorney General has announced a **government review of entry requirements for professions** and trades. The study is intended to identify those requirements which may act as barriers for members of ethnic and minority groups who have obtained their qualifications abroad.

Alberta Association's Annual General Meeting is to be held June 25th to 27th at the **Jasper Park Lodge,** with the attendant advantages of such a site being obvious.

The Nova Scotia Association has passed a motion which **prohibits an engineer in training** from using the words "engineer in training" or "E.I.T." after their name.

The New Brunswick Association has established a **Long Range Planning Committee** to prepare a report on the future direction of that Association.

Two resolutions were presented at the Ontario Association's Annual Meeting. Both dealt with **nuclear disarmament.**

Professional Development

Breakfast Meeting: You Should Have Been There!

by Len Ganetsky, P.Eng.

On Tuesday, May 5th, 1987 at 7:00 in the morning some 60 plus engineers gathered at the Viscount Gort for another in the successful series of professional development breakfast meetings. The topic was Environment, Workplace Safety and Health and the Professional Engineer.

After a pleasant buffet breakfast, Stuart Ursel of the Professional Development Committee began the meeting by introducing the keynote speaker, who unfortunately had mysteriously disappeared. Stuart did an admirable job holding the groups' interest until Thomas H. Owen, Ph.D., Deputy Minister for Environment and Workplace Safety and Health was found.

Mr. Owen first spoke on the topics of noise and inner air quality. In this decade especially, we have been designing "tight" buildings and this seems to be causing problems that are difficult to diagnose. Fifty percent of the problems encountered by Mr. Owen's department are due to ventilation problems. It is a difficult problem to work with as the cause and effect are not always clear. The problem is an interdisciplinary one and all involved must work together to develop tools to identify the problem and its solutions.

Due to our smaller industrial base, we have it good in Manitoba relative to other provinces. Mr. Owen quoted that in a recent U.S. survey, 60% of the people surveyed want increased pollution control and only 6% didn't. People are willing to live with voluntary risks but won't tolerate involuntary risks. Last year Workers Compensation had 50 thousand claims for injury on the job and CSA estimates that losses due to workplace safety and health total around 15 billion dollars.

Mr. Owens emphasized that hazards must be eliminated from the work place. People cannot be used as measuring tools, as a medium for counting the number of injuries. He spoke of four steps he sees that must be implemented in the work place: a) we must eliminate the hazards from the workplace; b) if that is not reasonable we must then try to enclose the hazard with a cover or guard; c) failing that we must train personnel to work safely in the presence of hazards; and finally, d) if nothing better can be done, we should equip the workers with personal protection equipment.

It is our jobs as engineers to design the hazards out of the work place. Over time we should be replacing old equipment with equipment which eliminates hazards. This type of problem should be addressed from the front end when a facility is being designed instead of fixing the problem which arises after the fact. Mr. Owen suggested that we establish committees to work with his department similar to what the medical profession has done.

The meeting was an enlightening 60 minutes and I would recommend all of you to come out and participate in these informal gatherings.

Make your plans to attend the next breakfast meeting!

SEMINAR in Winnipeg from June 24th-June 26th, 1987
on
MUNICIPAL ENGINEERING
—CHALLENGES IN THE 90's—

As the next decade fast approaches, recent studies have estimated that $87 billion will be required to maintain an adequate infrastructre level in Canada.

The challenge facing municipal engineers throughout the world during the 1990's will be the rehabilitation of an aging infrastructure combined with the assimilation and utilization of rapidly developing innovative new technologies. The application of these technologies to existing and future installations must increase their longevity and decrease their cost of maintenance to most effectively utilize already strained municipal budgets.

The exchange of ideas and experiences between municipal engineers on an international basis will benefit engineers and those charged with the responsibility of dealing with the infrastructure crisis.

For more information contact: Ken Moore, Registration Chairman, 284-0580.

Third International Conference on Advances in Production Management Systems
August 11-14, 1987
Winnipeg, Manitoba

The first International Conference on Advances in Production Management Systems, APMS 82, was held in Bordeaux, France. APMS 85 was organized in Budapest, Hungary, jointly with the Seventh Compcontrol Conference.

The APMS 87 Conference will bring over 60 speakers from 15 different countries.

The purpose of the APMS 87 is to present new results in the area of production management and information systems for the factory of the future. The conference will provide a very important forum for manufacturing, computing and production management professionals from academia, industry and government.

Conference Location
Holiday Inn — Downtown
350 St. Mary Avenue, Winnipeg, Manitoba R3C 3T2
Telephone (204) 942-0551

For more information contact: Andrew Kusiak — Conference Chairman — 474-9839.