Canadian Prairies Group

NEWSLETTER

of Chartered Engineers

Winter 2011

ice
Liaison
Nigel Shrive

Institution of MECHANICAL ENGINEERS
Liaison
Dave Elson

IET
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Ray Marsh

IChemE
Liaison
Alan Rhodes

IStructE
Liaison
John Charrett

Chairman's Notes

Dear members, 2010 was a stressful year in many ways, so we can but hope that 2011 will be better. The optimist in me looks for positive things to occur.

Certainly we had some positive events in the fall of last year – over 70 people attended the talk on the Peace Bridge and almost as many came to Randy Stubbings' talk about the electricity grid in Alberta – does the Province really need that second transmission line between Calgary and Edmonton? The talks were well presented and generated substantial discussion. There are talks on more controversial subjects in the coming session – for example on whether nuclear energy would be a good investment to supply base power to the oilsands projects. Look on the website and do attend – the meetings are accepted for CPD units for APEGGA and you will always be welcome.

The AGM will be held later this month and a new executive will be formed. I am grateful for all the hard work and support from your current executive members over the last year, many thanks to all of them. They put together the excellent technical programme already mentioned by selecting topics of interest and finding speakers who are both knowledgeable on the subject and willing to present their opinions. Andre van Dijk is stepping down after several years because of pressure of work – we offer sincere congratulations on his promotion –but has indicated that when he has his new job under control, he may well be prepared to rejoin the executive. New members of the executive are needed, so if you can afford a few hours every month for about ten months of the year (we close down in July and August), please let Colin Pollard know and join us. Similarly, if you have a topic on which you would like us to organize a talk – perhaps with your help – please let one of the executive know.

Your executive looks forward to seeing you at the AGM and technical meetings throughout the year – if you can spare a few hours, please do consider joining us. All the very best to all members in the coming year

Nigel Shrive

IN THIS NEWSLETTER

Annual General Meeting (AGM) and Dinner

Saturday 29th January 2011

Officers' Mess
750 9th Avenue SE,
Calgary, AB, T2P 2M5

Meet at 6:00pm

AGM at 6.30 pm
Buffet Dinner at 7.00 pm

RSVP CPGCE Secretary via

E-mail: Secretary **on the CPGCE website** http://www.cpgce.org/AGM%202011.htm

or phone Tel.: 403 254 3315

Please confirm your attendance before 22nd January 2011.

There will be a presentation by Dr. Francis Hartman, "Oscar the Grouch's Project Management" Professor at the University of Calgary, Project Management Specialization.

Francis Hartman is an internationally renowned Management Consultant. He is an extremely entertaining speaker and is a proponent of SMART™ Management which to many any engineers is an oxymoron.

CANADIAN PRAIRIES GROUP OF CHARTERED ENGINEERS (CPGCE)
AGM AGENDA for
Saturday, January 29, 2011 6.30 PM

APPROVAL of AGENDA
2. APOLOGIES for ABSENCE
3. MINUTES of PREVIOUS MEETING
4. MATTERS ARISING FROM MINUTES
5. APPROVAL of MINUTES
6. CHAIRMAN'S REPORT
7. TREASURER'S REPORT
8. SECRETARY'S REPORT
9. ELECTION of OFFICERS

Chairman	Nigel Shrive
Vice Chairman	Vacant
Past Chairman	Roger Frayne
Treasurer	Bob Enever
Secretary	Colin Pollard
Members	Adrian Dumbrava
	Mohamed Jaffer
	Arun Kumar
	Tom Martin
	Alan Deazeley

INCOMING CHAIRMAN'S REMARKS

2011 TECHNICAL PROGRAMME

Wednesday, 19th February 2011

Materials for Oil & Gas Projects – Traditional and Modern

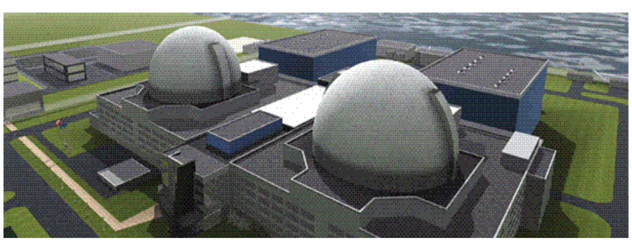
Speaker: Allan McIntyre, P.Eng., Corrosion and Materials Engineer, Cenovus Energy Inc.

Oil and Gas projects are challenging opportunities for materials engineers. Carbon steel is usually selected for pressure equipment and piping systems. Chrome-molybdenum and stainless steels are selected to meet ever more demanding process conditions of higher temperatures, and high corrosion rates. Materials can be "customized" to suit specific project requirements. Examples are carbon steel pipe internally lined with stainless steel, and carbon steel plate clad with stainless steel. These offer high performance at lower cost compared to full thickness stainless steels. The material engineer uses skill and experience to select the "best fit" material from a range of options. The presentation provides a link between traditional and newer material selections for oil and gas projects.

Wednesday, 9th March 2011

Common Misconceptions about Nuclear Energy

Rene Godin, P.Eng. (Retired President and CEO of Canatom)



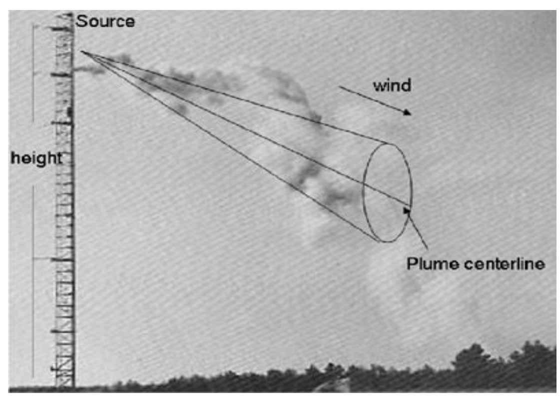
Nuclear energy has been generating clean, safe, economical electrical energy for over 45 years, in 30 countries and represents 16% of the world's electrical energy. There exist many misconceptions in the general public regarding Nuclear Energy. These misconceptions are often generated by the media which seeks sensationalism.

Rene Godin's presentation will outline a brief history of Nuclear Energy, identifying countries which use Nuclear Energy extensively and the planned new plants. He will compare Nuclear Energy with other forms of generating electricity, outline the safety aspects of Nuclear Energy and address how spent fuel is managed. The economics and benefits of Nuclear Energy, its acceptability in society, and reduction of greenhouse emissions will be covered. It will conclude with an update on Nuclear Energy for Alberta.

Wednesday, 13th April 2011

Plume Modelling for Oil & Gas facilities

Kurt Hansen, P.Eng. President, Green Inc & Dr. Piotr Staniaszek, Ph.D. Senior Air Quality Scientist, Millennium EMS Solutions Ltd



The presentation will provide a basic overview of current scientifically accepted plume dispersion models. These are used to predict downwind ground level exposure to various emitted air pollutants, with an emphasis on odour emission constituents. A modelling and predictive case history (for a SAGD and Oil Sand Mine facilities) will be presented.

Wednesday, May 11, 2011.

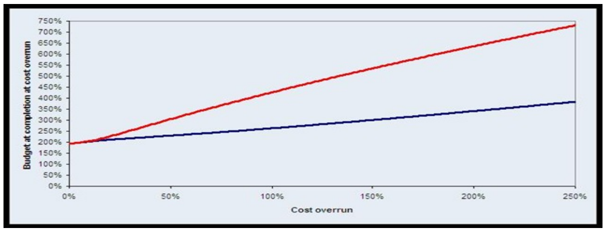
Innovation in Shell and Tube Heat Exchangers

Murray Rundle, P Eng, Canada Manager, EMbaffle Inc.

Wednesday, June 8, 2011.

Engineering Management - A Profession in Crisis

Dr. Max Wang



The presentation will go over the criticality of Engineering Management and challenges in today's world. A significant part of our project struggles are due to poor Engineering Management. Boeing and Airbus etc suffer from the similar challenges.

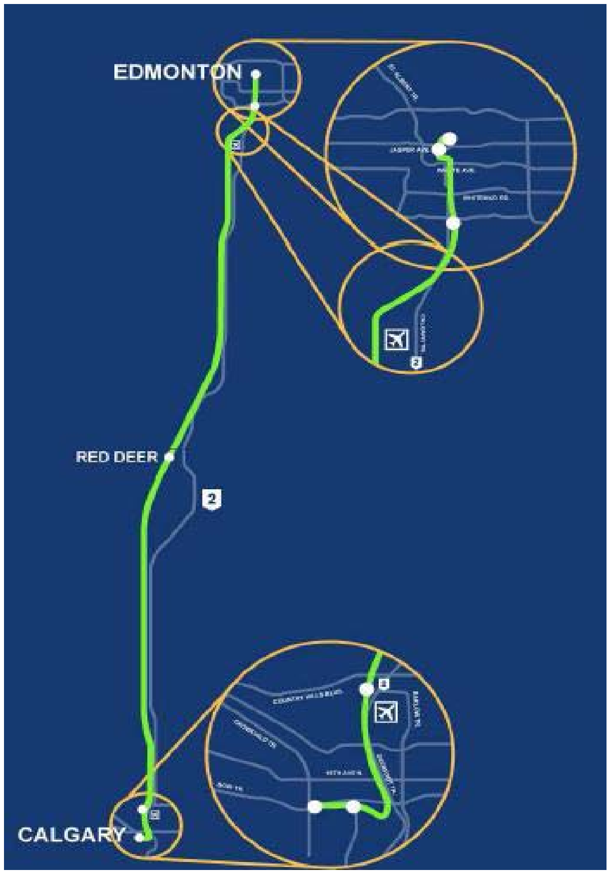
If you have suggestions for the Technical Programme please contact the Technical Meeting Coordinators identified on the back page.

Wednesday, September 8, 2010.

A Vision of High Speed Rail for Alberta

Ralph L. Garrett, P Eng FEC VP Infra-structure, Alberta High Speed Rail Inc.

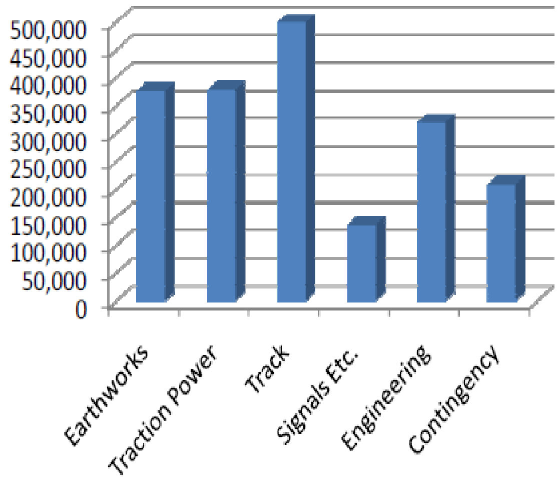
Ralph Garret presented his company AHSR's (Alberta High Speed Rail Inc) vision of the proposed high speed rail link between Calgary and Edmonton. The audience of over forty was receptive to the concept but have yet to be convinced that the province will move ahead with the proposal.



MAP OF PROPOSED HIGH SPEED RAIL ROUTE

The plan is for the Province of Alberta to build a twin high speed rail track between Edmonton and Calgary with five stations two in Calgary, one west of Red Deer and two in Edmonton. The rail link would require a land corridor 35 metres wide, and is envisaged to use 19% of Canadian Pacific's right of way into Calgary and Edmonton. The twin track would be dedicated to passenger traffic only, fenced along its entirety, have no 'at grade' road crossings and would avoid small communities.

The estimated cost for the rail line infrastructure is $2.3billion. AHSR's proposes the rail track infrastructure be constructed by the province and leased to a private enterprise operating company.



Their operating plan would have trains leaving Calgary and Edmonton on an hourly basis from 6 am to 9 pm. The duration of the journey would be 84 minutes and the average price ticket would b $80. The maximum capacity of the rail link is estimated at 16,000 passengers per hour versus 10,500 for the existing four lane highway. AHSR estimated that eight train sets would initially be required to operate the system. Both Calgary and Edmonton have transport plans that make provision for the potential high speed rail link between the cities.

ICE GERMAN HSR TRAIN

In 2006 there were 47.5 million trips on the QE2 between Edmonton and Calgary. This is forecast to double by 2031 and treble by 2051. AHSR's target for viability is to move 3 million passengers a year on the high speed rail link within five years of start-up.

The high speed link once constructed has a lower carbon footprint than most other modes of transport. The high speed train is claimed to generate 13.7 grams of CO2 per seat kilometre, 7% of that generated by the automobile and 12.5% generated by an aircraft. Safety records for high speed rail links are also extremely good. Ralph Garrett quoted Japan as having no fatalities in forty years on their high speed rail link having transported 8 billion passengers in that time. The presentation included photographs of rolling stock and infrastructure from Europe and Japan. The photograph is of a German Intercity Express (ICE) and a German railway station. Experience has shown in Europe and Japan the high speed rail terminals like airports develop their own synergies to become centres of business development.

GERMAN HSR STATION

Ralph Garrett emphasized that time is of the essence as the most of the proposed locations for the high speed rail infrastructure in Edmonton and Calgary are still undeveloped. The province needs to acquire the land before it is lost to other development projects.

Wednesday, October 13, 2010.

Alberta's Future Electricity Grid: Opportunities and Challenges

R. V. (Randy) Stubbings, P.Eng.

Randy Stubbings proposed that forces on several fronts are influencing the growth and development of Alberta's electricity system. On a local scale, landowners are concerned about the impact of transmission lines and other energy developments on their land. On a provincial scale, residential, commercial, industrial, and institutional customers are concerned about the delivered cost of electricity. On a global scale, whether you believe the push for greener forms of electricity generation is based on science or politics, it is happening. How should Alberta respond to the challenges, and what will its future electricity system look like?

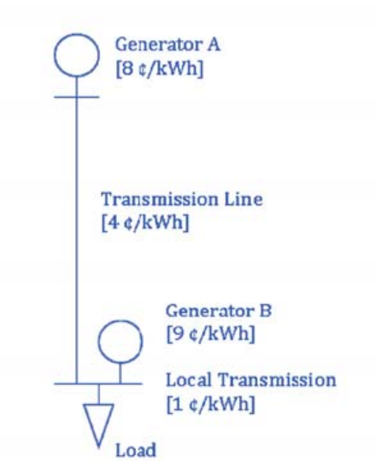


Figure 1: Remote and local generators.

One of the biggest hurdles to implementing a secure and reliable power system at a reasonable cost is Alberta's transmission policy. This requires the Alberta Electric System Operator ("AESO") to implement a "congestion-free" transmission grid and to send the bill for it directly to consumers. Under this policy, AESO must build transmission to serve Generator A because its energy price—i.e., its price excluding transmission—is less than that of Generator B (see Figure 1). As a result, instead of paying a total of 10 ¢/kWh for electricity from Generator B, consumers will be forced to pay at least 12¢/kWh.

In support of the government's transmission policy, the AESO introduced a ten-year plan that calls for up to $16 billion to be spent on new wires. To get an idea of the magnitude of that expenditure note that, based on the AESO's own data, Alberta could replace its entire fleet of coal fired generators with appropriately located gas fired generators, reduce its CO_2 emissions by roughly 25 million tonnes per year, and have roughly $6 billion left over. Several independent studies, including one by the University of Calgary's School of Public Policy, strongly suggest that implementing the AESO's plan will result in an over built transmission system and significantly higher than-necessary electricity costs for Alberta consumers. (The report is available at http://policyschool.ucalgary.ca/files publicpolicy/TransmissionPolicyONLINE.pdf.)

The importance of gas fired generation in Alberta's future has only increased with the recent advent of technology that allows economic access to the huge quantities of shale gas present in North America. Adequate supplies and low prices are expected to persist for at least the next few decades. That, and the fact that gas is cheaper to transport than electricity (one 36" gas pipeline carries as much energy as five 500 kV direct current transmission lines and requires vastly less right of way), will make gas fired generation the generation of choice for many years. It can be built near to load so as to minimize the need for transmission lines.

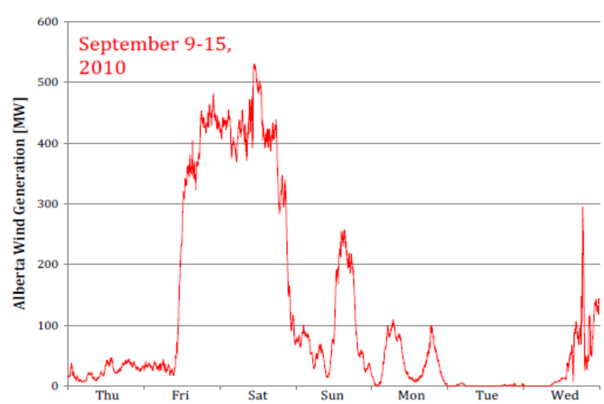


Figure 2: The large variability of wind generation over a one-week period.

Not only can gas fired generation defer or eliminate the need to build massive quantities of transmission, its flexibility can also help integrate more wind generation. While wind is desirable from the perspective of CO_2

emissions, its variability and lack of correlation with the highest load periods, as illustrated in Figures 2 and 3 above offer significant challenges. The wind plus gas scenario can go a long way toward reducing Alberta's dependence on coal-fired generation which, as shown in Figure 4, accounts for a significant fraction of the province's generation capacity and an even larger fraction of its total electricity production.

Another important factor in the development of Alberta's future electricity system will be the province's approach to the "smart grid." The smart grid concept, ENMAX's version of which is illustrated in Figure 5, is currently "all the rage" in the electricity world, but for at least three reasons it would be a mistake to mandate the installation of "smart meters" for every customer in the province. First, virtually all large electricity consumers in Alberta already have the sophisticated metering systems needed to optimize their electricity

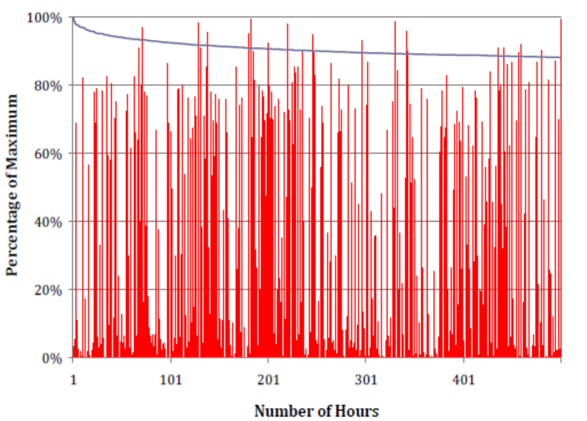


FIGURE 3: THE POOR CORRELATION OF WIND OUTPUT WITH SYSTEM LOAD IS ILLUSTRATED BY THIS CHART, WHICH SHOWS FRACTIONAL WIND OUTPUT (RED LINE) IN THE 500 HIGHEST-LOAD HOURS OF 2009 (BLUE LINE).

consumption and to contribute to demand response initiatives, and of the small customers who remain, only a small fraction will ever use the real time feedback of smart meters to alter their consumption patterns. (Competitive retailers will gladly provide smart meters to those customers that will actually make use of them.) Second, utilities have been implementing the "smartest" grids that could be justified based on their reliability and economic benefits since the first power systems were constructed, and there is no

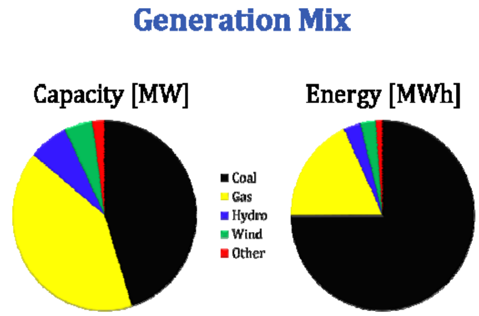


FIGURE 4: ALBERTA'S GENERATION MIX (CAPACITY AND ENERGY) FOR 2009.

reason why that would change with the next generation of grid technologies. And third, the costs and benefits of smart grids vary widely depending on the circumstances (e.g., remote versus urban settings); consequently, the various elements of smart grids should be implemented based on sound business cases and the wishes of customers. In the end, no government mandated roll out of smart grid technology is needed.

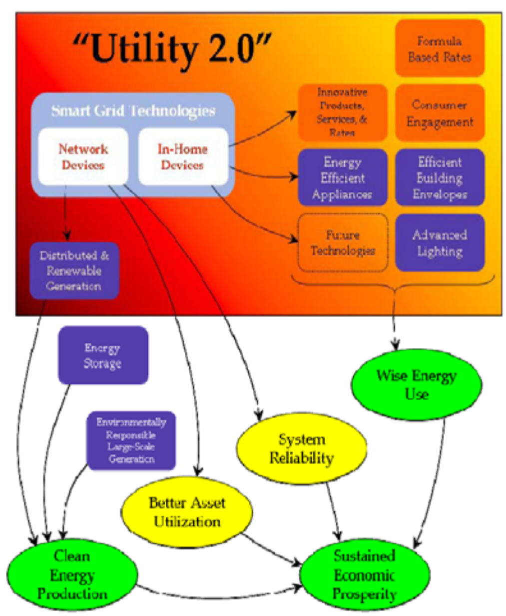


FIGURE 5: ENMAX'S CONCEPT OF A "SMART GRID

The comprehensive and intelligent evaluation of all options is absolutely essential for providing Albertans with a safe, reliable, and economic supply of electricity in the future. It is extremely important that government policies and regulations support such evaluations.

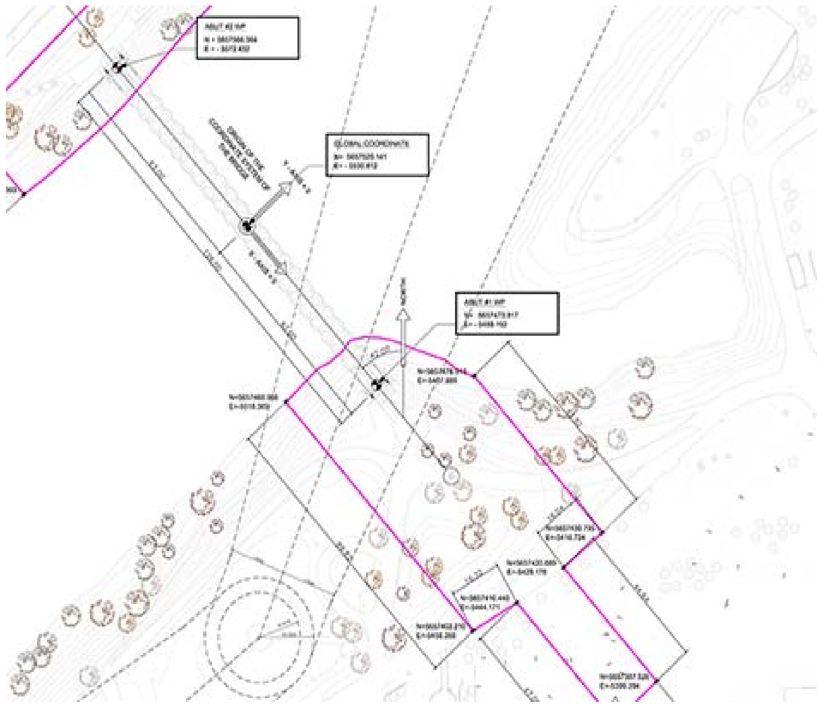
November 10, 2010

Design and Construction aspects of the Bow River Peace Bridge, Calgary

Jadwiga Kroman, P.Eng. Manager of the Bridges and Structures Division of the City and Gerd Birkle, Ph.D., P.Eng., Senior Associate, Stantec Consulting.

An attendance of approximately 70 reflected the considerable interest in Calgary's newest pedestrian bridge. The bridge, presently under construction, is located just west of Prince's Island near the helipad on the south bank of the Bow River. The bridge is also three blocks east of the existing LRT river crossing. The bridge is one of the more expensive structures for Calgary and by far the most expensive of the many pedestrian bridges constructed in recent time. The fact that it was sole sourced to a foreign design firm without prior consultation with City residents meant that it was announced into controversy. Justification for the new Bow River crossing is that the estimated City population is expected to double by 2035 while the number of jobs in the downtown core will increase 50% to 180,000 by 2025. Currently peak traffic on the two existing bridges is 700/hr for the LRT pedestrian bridge and 1200/hr for the Prince's Island Bridge.

Ms. Kroman explained that the structure is a "Gateway" project for The City and thus required a designer of international standing with a record of similar projects in many countries. The firm, Santiago Calatrava LLC, produced an unusual and exciting concept. Briefed to produce a single span crossing of the river under a relatively low flight path for the adjacent helipad and offered the generous amount of approximately $21 million for the design and construction costs, they were to produce a design worthy of our City. A life of at least 75 years was required for the bridge which would have to withstand the 100 year flood condition. It would also have to provide barrier free access to people of all mobility types. Money was from the Provincial Government Municipal Sustainability Infrastructure Fund. $25 million was available for design, administration, special consultants and construction. Stantec were to be the 'Engineer of Record' responsible for ensuring that the design and construction met all Alberta requirements. Local consultants were retained

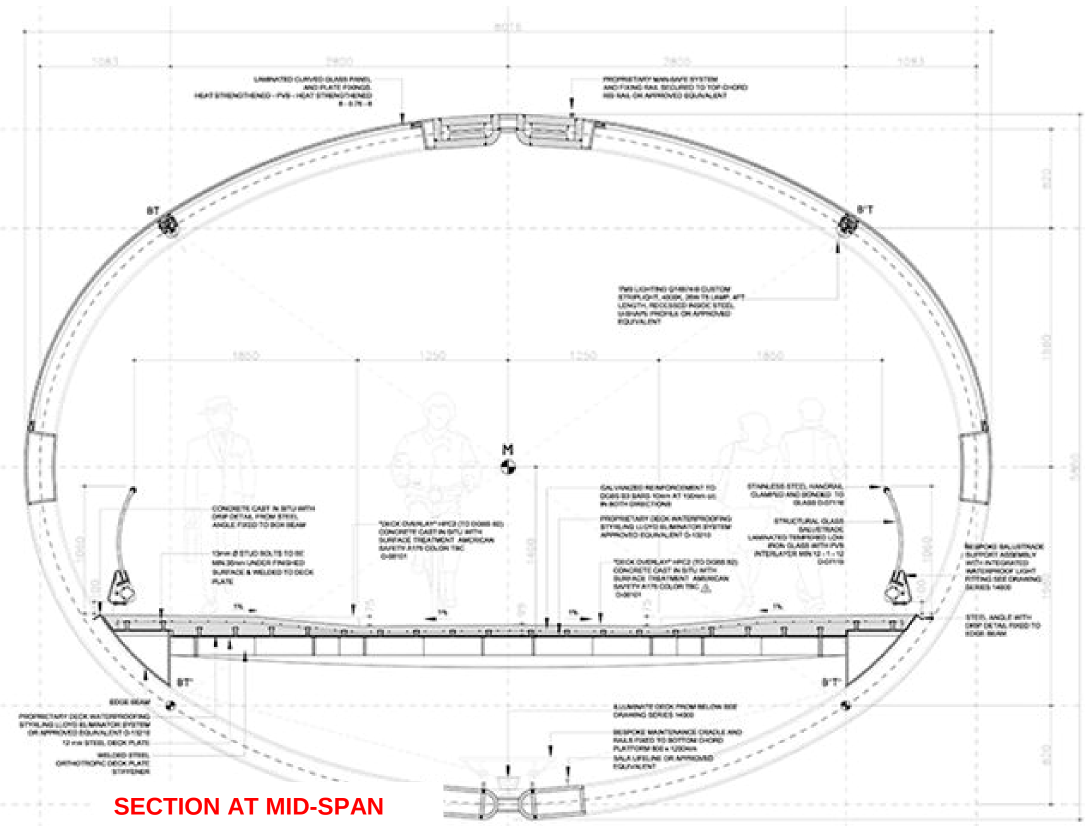


LOCATION OF BRIDGE – Helipad to SE and west end of Prince's Island to E.
(This and all pictures in this paper are reproduced with th permission of The City of Calgary and of Santiago Calatrav LLC

for Geotechnical, Hydrological and Wind studies. The total of all design fees is approximately $3.9 million and a Project Administration and contingency sum a further $2.6 million.

The appearance of the bridge is likely to be quite stunning. It takes the form of an elliptical tube cambered upwards over the river. The tube walls are created from steel box sections curved in helical threads from one end of the bridge to the other. With a number of helixes criss-crossing in both directions the view from the side is one of a series of diamond shaped panels.

The structure cam be described as made up from two truss like frames each bent around their longitudinal axes to form a ‘C’. The two ‘C’s are then fastened toe to toe at the top and bottom of the bridge centreline to form an oval cross section.

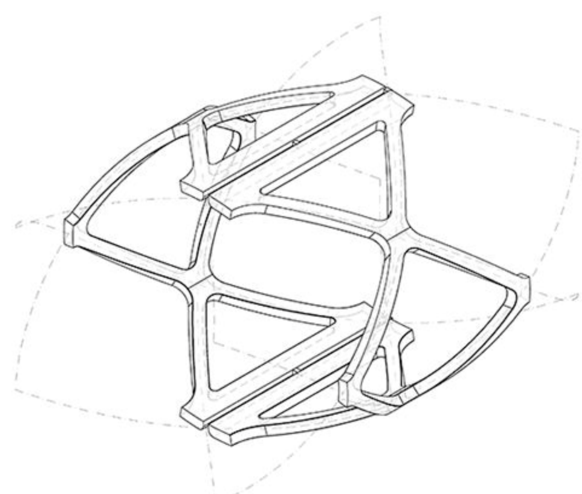


SECTION AT MID-SPAN

The oval is formed from four circle segments with large radii top and bottom and smaller radii for the sides. The overall height is 5.85 meters and the width 8.016 meters. With a span between bearings of 126 meters the span/depth ratio is 21.5 which creates a deep stiff beam unlikely to be bothered by significant deflection, vibration or wind problems. The steel design was to Euro Code 3, DIN 18800 and checked by Stantec against CSA S6. Some difference was found in the analysis of the compression chord. European codes permit the full plastic capacity of the section ($\varphi F_y A_s$) while Canadian codes only permit the use of the flexural buckling capacity (S6 Clause 10.9.3.1). Both codes assume geometrical irregularities in the built members. These steel sections have thus been increased in thickness to satisfy the requirements of the Canadian code.

The sizes of the box sections forming the framework of the structure was determined primarily by the forces that the curved members carry. The curved shape introduces large bending and torsional stresses in the web members which require large section sizes. Plate thicknesses vary from 10 mm to 50 mm with outer dimensions of the box sections similar along the length of the bridge.

From the archi-tectural point of view the flowing smooth curves of the red coloured framework and the expansive use of curved glass suggest a visually



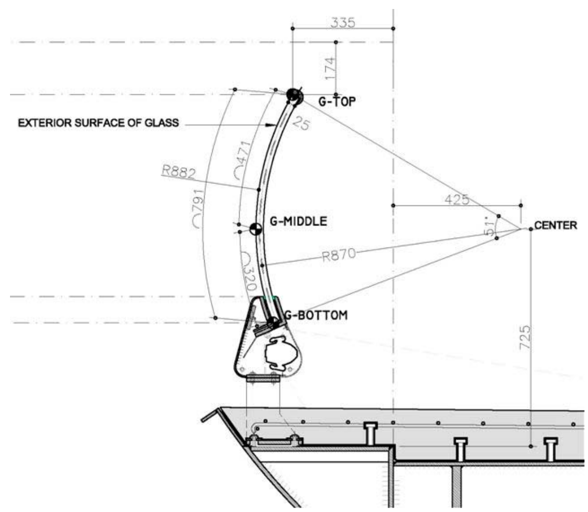
4.

TWO HALF SEGMENTS SHOWING CHORDS AND SHAPES OF THE WEB MEMBERS tantalizing form particularly under night time lighting effects. There is little doubt that the finished structure will be greatly admired.

For the steel fabricator the challenges are enormous. With no possibility of using standard steel shapes, each member is built up from plate curved and welded around prebuilt forms. Because of the vertical curve of the bridge each segment is built with a slight variation from that preceding it. Groups of three half segments are welded to form modules in the fabrication shop in Spain which are then shipped out to site where they are assembled and welded together south of the river where fabrication of the steel will be completed. Some 15,000 meters of weld in the fabrication process are followed by a further 7,000 meters in the field. The connections at the top and bottom truss chords (toes of the 'C's) are intermittent and relatively simple. Steel was fabricated and coated by Augescon of Spain. Erection is by Graham Infrastructure of Calgary.

The cast-in-place concrete composite deck provides 1.85 meter wide pathways either side for pedestrians and a central bike path of 2.5 meters at a 75 mm lower elevation. Small ramps spaced along the pathways enable wheel chairs to pass from one side to the other across the bicycle pathway.

The roof and upper side panels have laminated glass panels curved to match the steel. This provides a partially protected enclosure and reduces the amount of snow clearing required. The reflection from these panels will also add to the appearance and provide some background contrast for approaching helicopters.

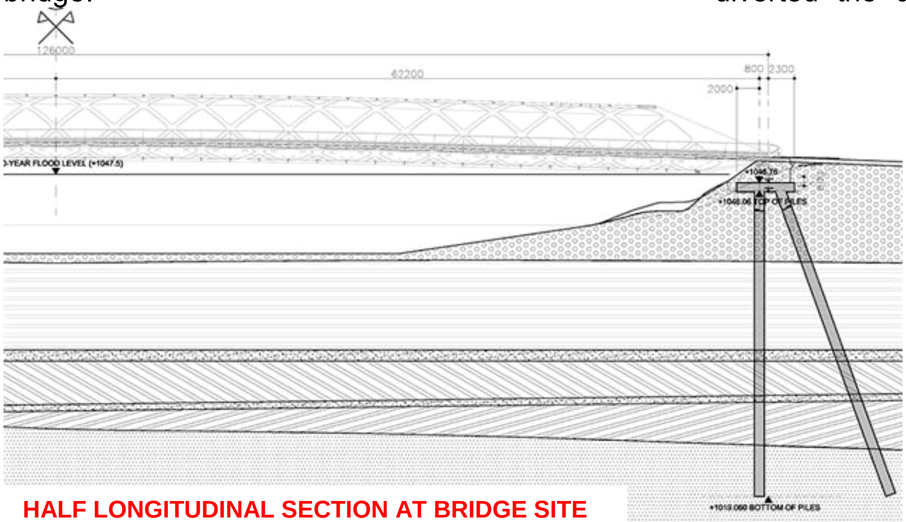


SECTION THROUGH THE BALUSTRADE

The balustrades are of curved laminated structural glass with stainless steel rails along the top edges. All glass will be provided and installed by GIG Fassaden of Austria.

The foundations for the bridge are six number 900 diameter bored and poured in place concrete piles at each abutment bearing on solid rock at depths of 27 meters (south) and 21 meters (north). The front rows contain two vertical piles and two raked away and sideways from the bridge. The back row contains two raked away along the longitudinal centre line. The angle of rake required was 20 degrees. In Calgary conditions and experience the maximum rake is usually about 10 degrees. The steep slope consequently caused problems and delays to the piling

SINGLE HALF MODULE AS SHIPPED TO THE SITE contractor; however, the European designers were inflexible on this requirement! The abutments, hidden in the earth embankments are concrete box structures used also for electrical and bearing maintenance rooms. Extensive pathway and landscape work is also being undertaken at the entrances to the bridge.



HALF LONGITUDINAL SECTION AT BRIDGE SITE

The construction of the bridge is being accomplished by the installation of a temporary multispan bridge in the river but offset from the position of the permanent structure. Once the steel modules are assembled in their permanent shape and welded together they will be jacked across the temporary bridge on steel rails and Teflon slides. Once across the river the structure will be moved laterally onto the permanent bearings. Thereafter the temporary bridge and its pilings will be completely removed from the river. With the steel structure in place the deck and glass will be installed.

Questions after the presentation kept our speakers busy till late in the evening. Many people were interested in whether or not the Calgary public were getting good value for their money. Considering about half of the $25 million was being spent in Europe it seemed an odd way to spend our infrastructure money in these times of financial and economic constraint. Our speakers were naturally reluctant to broach any controversial topic and diverted the discussion to the positive facts that a “Gateway” structure was needed in Calgary and that we did not have the experience here to design or fabricate similar architectural works. Canadian companies had equal opportunity to bid for the construction parcels, if not the design. Also, the bar has now been lifted and might inspire us to improve our own capabilities.

We are grateful to our speakers who presented us with a most interesting and inspiring vision of what an architect can design when free from the usual engineering disciplines of economy and efficiency.


THE FIRST SIX HALF MODULES ASSEMBLED IN THE WELDING SHELTER

Additional Data on the Peace Bridge

The total weight of structural steel in the bridge is 700 tonnes. The cost of the steel including erection is about $17,500 per tonne. The total area of glass is about 800 square meters weighing approximately 2,000 kg. The cost of the surface glass including installation is about $2.5 million. The bearing loads (ULS) are 3,500 kN/bearing. The deck cost is approximately $300,000, the substructure also $300,000, the balustrade approximately $1.0 million and painting about $300,000.

The effect of thermal variations in the structure will cause a movement of approximately +-70 mm at one end. Vertical deflections are up to 10 mm. The maximum wind deflection is approximately 35 mm.

Construction time will be about 7 months for fabrication and about 8 months for erection. The bridge was planned to be completed by the end of October, 2010 but will not be before next Spring. The main delay was fabrication time in Spain. The City does not anticipate any major change in cost but the difficulties with the raked piles has used up some of the contingency amount built into the contract.

Some further information is available on the City of Calgary web site under Transportation Infrastructure – Peace Bridge

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The CPGCE Executive as of Dec 2010

Nigel	SHRIVE	403	239 9104 220 6630	ngshrive@ucalgary.ca	C	Chairman Scholarships
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Robert	ENEVER	403	271 1953	eneverr@shaw.ca	E	Hon. Treasurer Newsletters
Tom	MARTIN	403	246 1542	tmconsultants@shaw.ca	Ci	Deputy Treasurer
Adrian	DUMBRAVA	403	245 1838 537 8169	adrian.dumbrava@snclavalin.com	Ch	Scholarships
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Vacant						Membership