POWUr NEWS

Saskatoon Chapter News

January 5, 2004

Happy New Year

Meeting Notice

Tuesday
January 13, 2004

@ Ramada Hotel, Manitoba Room

Speaker: Richard Rooley, ASHRAE President

Topic: Building Services and Refrigeration Vital to Buildings in International Communities

5:30 - 6:00	Cash Bar
6:00 - 6:45	Supper
7:00 - 7:30	Chapter Meeting
7:45 - 8:45	Dinner Speaker

Please attend and give Richard a warm Saskatoon Welcome!!

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS

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Vacant

Newsletter
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Funspiel

The local chapter "Funspiel" will be held Saturday, February 28, 2004 at the Granite Curling Club, starting at 3:00 P.M. Followed by dinner. Family, Partners and friends welcome. Jack will have a sign up sheet at the next meeting.

Speaker BIO

RICHARD H ROOLEY BA BAI FREng FICE FIMechE FCIBSE

Elected as President of ASHRAE in June 2003, he is the first person to hold the position from outside the United States and Canada.

He served on the Board of Directors and the Board Executive Committee as president-elect in 2002-03, treasurer in 2001-02, vice president in 1999-01 and 1997-98 and director-at-large in 1980-83.

Mr. Rooley's past service is extensive. He has chaired numerous councils and committees. Mr. Rooley is a recipient of the ASHRAE International Activities Award, the Distinguished Service Award and an Award of Merit.

After school in Scotland and University in Ireland. Richard Rooley trained initially in civil, mechanical and manufacturing industries and then with the consulting practice Donald Smith Seymour and Rooley where he was a partner from 1970 to 1991.

As Principal of Project Management Partnership and Rooley Consultants since 1991, he has been associated with the design and supervision of a large number of major building engineering services projects. He has extensive experience in the cross discipline integration of design, construction and operations and maintenance He acts as an arbitrator and as an expert witness in construction disputes. He is a consultant to AET, the provider of flexible space solutions in buildings.

In the UK,he was chairman of BSRIA 1985-87; in the Royal Academy of Engineering he was a Member of Council and Hon Sec for Civil Engineering 1993-95. H e has served on the council of CIBSE In the City of London, he has been master of both the Worshipful Companies of Engineers and Constructors. He is a Reader in the Church of England.

BUILDING SERVICES AND REFRIGERATION VITAL TO BUILDINGS IN INTERNATIONAL COMMUNITIES

Slide rules and ruling pens were used in design and drawing of buildings in 1975. In 2000 they had been replaced by computers and computerised draughting systems. In 2020 the change will be even more dramatic.

The majority of buildings in 2020 have already been built or will be refurbished before that time. Lessons in the technology of buildings and in the whole procurement process from around the world will be presented. Is the USA unique in the demands placed on the internal environment? Why are so many building owners and occupants dissatisfied? Is standardisation of systems and manufactured equipment a solution to the gap between design philosophy and operations and maintenance? What is the impact on international standards of American concerns on homeland security, green buildings and mould?

ASHRAE, with 55,000 members of whom 5,000 sit on committees which write guidance materials and standards, has resources to have an impact on the design of the technology, the shape, fabric and structure of buildings and the way food is stored and processed. It's members can rise to the challenge of excellance.

24th July 2003
RHR/5339

BUILDING SERVICES AND REFRIGERATION
VITAL TO BUILDINGS IN INTERNATIONAL COMMUNITIES

BUILDING SERVICES AND REFRIGERATION
VITAL TO BUILDINGS IN INTERNATIONAL COMMUNITIES

Richard H Rooley FREng
President ASHRAE

INTRODUCTION

This Paper is based on a personal research and observations of the construction process in North America the United Kingdom and other parts of the world. It is based on his construction experience, together with contributions and research to cross industry boards and committees in USA and the UK. A number of the hypotheses in the paper have been presented to audiences of experienced construction professionals worldwide who have each been challenged to correct statements made in those hypothesis. Many of the comments made are therefore personal opinion which has been exposed to critical assessment by his peers and verified by their agreements to the hypothesis.

The comments in this paper are directed to the entire construction industry. The best performers in major projects have little effect on the greater majority of small projects. This paper addresses best, normal and worst practice.

THE CHANGING WORLD

The world of owning, constructing and using buildings is constantly changing. The world of science, mathematics and engineering is also in a state of change. There have been occasions in history when there has been a dramatic change at a far greater rate than normal evolution. Two examples are the change to our cities by the introduction of The Clean Air Act in the 1930's and the mushrooming growth in air conditioning in London about 1970.

DRIVERS OF CHANGE

In 1975 engineers were changing from slide rules to simple calculators. In the year 2000 all calculations are carried out using computers. On the assumption of increasing rate of change, the developments between 2003 and 2015 should be greater than that between slide rules and computers. This change will impact the entire construction industry. There are already indications of changing methods of working. These changes however are developments of the present process. Perhaps the change will be a step change from a quite different perspective.

The change however from slide rule to computer around the year 2000 can be argued to be less significant than the change in 800AD when Al-Khwarizmi introduced the zero to calculations. The step change from using Roman numerals to Arabic with the introduction of zero and negative numbers enabled an extraordinary rapid development in science. A possible lesson from this however is the remarkable reversal of progress as Europe entered the Dark Ages some 500 years later.

There was a separation of theory and practice which occurred in building services about 1950. Pressures from servicemen returning from the Second World War and universities establishing a large number of new degree courses and the institutions drive towards higher academic levels in charter contrasted with the movement away from combined design and contracting toward installation alone. This change was not reflected in the food refrigeration industry to the same extent. Between 1950 and now the separation has remained. It is hypothesised that it will not come together until perhaps 2020.

Until 1980 it was strongly argued that the solution to this separation was better education of installation, commissioning and maintenance operatives. To a large extent this was abandoned at that time. Until 2003 I have argued that the solution to the division was training of designers to ensure that all systems could be commissioned and maintained. It has been comprehensively proved to me that no significant efforts on a large enough scale are being made to achieve this. It can therefore be assumed that the HVAC designer alone will not redress the problem.

BUILDING DEMOGRAPHICS

The ASHRAE report on Homeland Security issued in January 2003 shows that in 1999 there were 4.7million commercial buildings in the United States comprising 67.3 billion square feet of space. 95% of those buildings were smaller than 10,000 square feet and only 2% larger than 100,000 square feet. One third of all workers worked in the large buildings. There was a mean age of buildings of 30.5 years.

The ratio of large design and construction firms to those employing less than 10 people is in a similar ratio to large buildings to small. UK figures indicate similar ratios. The Construction Industry Board and other innovation driven bodies established in the late 1990's a triangle of innovation.

The upper or pointed part with a small number of practitioners are leaders in developing thought. The second group will also innovate and develop as soon as they see others with successful applications. The third and larger group follow the new trend when instructed by their client. The fourth level will continue to work as they always have. This group can be compared to those in about 1900 who continued to try to work in the horse transportation industry while all the others turned to motor transportation. The horse industry ended.

There have been many initiatives to improve efficiency of construction in the United Kingdom These have had a significant effect on the best performers, but have they helped the whole industry?

THE EDUCATION PROCESS

American students who spend part of their course in Britain have problems. The American student is given an assignment and works closely with teaching staff throughout that assignment. When they visit a UK university they are usually left to their own devices to establish their methodology for the project and their own deadline. Similarly the British student used to setting their own programme have difficulty in subjecting themselves to the discipline of the American. When visiting a British university, discussion with professors will quickly come round to research, but in America will stay on teaching.

Large parts of the American university staff are devoted exclusively to teaching. The British model requires funds to be raised through research to supplement teaching contrasting with higher fees in America. These are subjective findings and it is noted that there are exceptions to the model on both sides of the Atlantic. This has led to a "check box": approach to design in America. Design methodology is clearly set by the employer and followed rigorously by the workforce. This is further enforced by the use of the professional engineers stamp. There will be a relatively small number of registered engineers, but all design drawings must be stamped by one of those engineers.

There is no such legal requirement in the UK where quality assurance techniques have been introduced possibly as an alternative.

On both sides of the Atlantic the best engineers have great lateral thought based on deep technical knowledge. In the model developed by Monty de Philistone in the 1970's this upper 1% of engineers are comparable. In the Philistone model of the second and third tiers of 10 and 100 the engineering leaders have greater control of the design process in the American model.

STANDARDS

In the USA, ASHRAE writes Standards which are developed using a consensus process. Public comment is central to this. Each State then writes its own Building Codes often based on ASHRAE Standards. In the UK Building Regulations and British Standards are written by Government and by British Standards Office with input from individuals in industry. In Europe the technical representatives from each Nation make recommendations, but final decisions are taken at a political level.

In principle ASHRAE Standards are prescriptive using "check box" procedures. In the UK they are principally generic or performance based.

In energy conservation in Europe and the UK Standards have generally been for building fabric performance and structural safety. Building Service elements have been an adjunct to this principally based on safety considerations.

In America energy standards issued by ASHRAE are system based giving specific instructions on the efficiency of components, but are weak on overall building performance.

Comments on the education process above have led me to find that European countries with a similar education process to the British favour the European or British model. Other countries, including Germany, countries in the Eastern part of Europe and the majority of the developing world where ASHRAE has a number of Chapters and significant technical influence, favour the American model.

Both the British and the American systems are seriously flawed. Each method has advantages world-wide, but rationalisation, unless there is a step change in the construction process is unlikely. One of the principal constraints of Standards writing is the time commitment of the participants. Those who write Standards must be practitioners and are often those with a commercial interest in the balance of that Standard.

REHVA have reported on the differences in Standards throughout Europe. The difference in approach is significant. At a time when construction is an international industry faced with the constraints of global warming, the need for more efficient operation, health problems recognised in many buildings the absence of an international basis for Standards should be noted. ASHRAE is working closely with Green Building Council to address cross disciplinary Standards in the conservation area. The ASHRAE Standards required for indoor air quality, including mould, and energy Standards requires a development in the ASHRAE approach. This is built on the traditional prescriptive Standards, but is developing towards performance requirements. The industry worldwide must examine what Standards are appropriate in what countries, acknowledging, as in Europe, the independence of each sovereign state in writing Standards. Can this diversity continue?

HOMELAND SECURITY

The events of 911 has stimulated worldwide interest in security. In providing its first report in January 2003 ASHRAE has provided an excellent source of risk assessment methods. The report is available for download from the ASHRAE website. The centrepiece of protection against extraordinary incidence in buildings is a realistic risk assessment. There is a balance between cost and absolute safety.

The report shows that significant reductions in risk can be achieved by sensible housekeeping. Simple precautions in food safety, operation of filters, location of outside air inlets and security awareness for visitors are all effective. In high risk buildings further steps are required.

ASHRAE is conducting a review of all technical publications, Standards and activities to ensure that the principles of Homeland Security and Risk Assessment are correctly addresses.

INTERNATIONALISM

The telephone, air travel, Email and the Web have made the world smaller. Technologies, companies and people communicate across geographical, political and language barriers. As communication, including television develops, as the worlds resources are used to provide a better quality of life, the users of our buildings have raised expectations. What was an acceptable condition in buildings 20 years ago is no longer accepted. These qualities are being raised worldwide.

Heating, ventilating, air conditioning and refrigeration were recognised by the American National Academy of Engineering as one of the top 10 technologies of the 20th century. Food cannot be kept, a good quality of environment cannot be provided in many parts of the world, with ASHRAE activities. There is a constant change in leadership of finance and contracting strength. While America and Japan have been dominant with Europe becoming stronger and for a period Korea and other parts of the Pacific group China has now become a powerful influence.

In design ASHRAE members have reported a trend for design companies to sub-contract technical activity to India and elsewhere. This follows precedent in the computer industry. Those who state that this will lead to lower quality buildings should examine the changing roles of designer, contractor and manufacturer. Some have argued that much of the work carried out by designers, particularly following the American model can be carried out by different groupings within the construction team or indeed is largely computerised.

There is one manufacturer of air conditioning equipment in Italy who encourages his principle clients to specify their exact requirements on the computer Web page. Not only does the purchaser specify in full detail, but they can purchase production time in the manufacturing facility whether in Italy or subcontracted to China. There is very little intervention by the manufacturer beyond maintenance and quality control. Should this detailed specification and selection of equipment be carried out by consultant, by contractor or indeed by the end user?

In this working across international boundaries, can international Standards continue to be dominated by political pressure? ASHRAE meet the challenge by providing Standards which can then be adopted by any American State or country worldwide. In Pakistan the best engineers use the ASHRAE Standards on a voluntary basis. As stated earlier however, most ASHRAE Standards are directed at single technologies. The cross interest or multi-disciplinary Standards are the ones which absorb much time and effort to incorporate the many non HVC & R interests.

HOW DOES AN ENGINEER SPEND THEIR TIME?

In subjective discussions with firms of consultants, design contractors, architects and multi-disciplinary practices principally in America, but also in other parts of the world, it emerges that a design engineer will spend between 10 and 20% of their time on matters of strict technology as set out in the ASHRAE Handbooks, Standards and other publications. This equates to something under one day per week. The remaining four days are spent on the process of construction including negotiation and discussion with architects and other members of the design team, financial planning, special awareness, risk assessment, leadership, management and working within the team, the use and abuse of computers and the whole process of communication through the team. The subjective response is also that several years are spent in learning a degree in engineering, followed by several more to achieve Charter or Professional Engineer and then continuing technical education lifelong.

The remaining four days activities are generally picked up within the office from others around. ASHRAE addresses this in courses, lectures and publications on these "soft" side of their activities.

In the UK there has,, at least during the last 20 years, much cross construction industry discussion and decision making on the process of construction. Emphasis is on team work, on partnering to achieve reductions in cost. Most consultants are employed directly by the client. There has been a trend towards a form of managing contracting with many sub-contractors employed by a management firm.

In the USA the architect generally remains dominant in the design process. They provide leadership, they employ the consultants and sub-contractors and specify the works. The consultants are then paid by the architect out of the architect's fee. At tender stage the responsibility for the drawings which have professional engineers stamp passes to the contractor who then has the legal responsibility for performance of the completed building.

In both the UK and in America there are alternatives with America moving towards partnering and in the UK projects run by the general contractor on a design and build basis. The differences are based on the way in which the building industry has developed on each side of the Atlantic.

In both continents there are excellent buildings and a very large number where the air conditioning and other building services do not operate as intended.

It is generally accepted that structural engineers work with great integrity. Indeed it is driven for the need for buildings never to fail. Although the same will apply to refrigeration this integrity is not a driver in air conditioning. Most calculations are driven at the optimum performance against cost solution. Unfortunately this stretches beyond the simple matter of integrity.

In every building in which I have given a lecture during my Presidential Year I have used an example from either that building or the city in which I am speaking to give examples of failure either in performance or visually. There is a generally accepted relationship that engineering systems which are straightforward in commissioning and familiar to the commissioning engineer can be put to work within the specified short time. If there is complexity and the systems are prototypes, commissioning is not completed for several heating and cooling seasons. Normal practice however, is that the owner of the building will correct the problems themselves after two years and in a very small number of cases proceed to litigation or arbitration. Both these problems may be traced back to the separation of design from craft and the one day in four technology. While each skill within the construction industry is very well educated, and indeed trained in that narrow field, there are great problems in communication, a fuzzy edge disease.

THE FUTURE

Speed of communication, the coming together of client bodies, the changing relationships of designers, contractors and manufacturers cannot allow the separation of design and operation to continue. Although partnering should solve most of the problems, the application in the early days where operation is less importance than construction have predicated against a solution.

The rapid changes and developments in technology have pushed designers away from standardisation. Historically manufacturers will prefer to sell specials at a higher profit margin than standard components. The bidding process of all consultants and contractors usually on an incomplete specification and with harsh conditions of contract are normal practice. The combination of designing prototypes in all components and the pressure on costs has put construction in a precarious position where increased turnover is required with small profit to support future work.

Designers are uncomfortable with standardisation. My experience with the very small number of Standard systems on the market is that designers see it as a challenge to modify Standard products. As example, with an underfloor system, with standard fan tiles, central units in each 300 square metre zone and standard controls always gives good feedback to the supplier in every building I have visited. It will work very satisfactorily in a great variety of building shapes and sizes providing standard components within a sophisticated building.

In the aircraft, ship building and car industries these techniques of standard components in unique products is well developed. Why is it resisted in buildings?

It has often been stated by practitioners in buildings that the shortage of money prevents good quality. Is this an acceptable excuse for poor performance? As the slide rule has been replaced by a calculating computer there are already indications that the majority of the work of design, particularly if based on standardised products, will remove much of the design requirements as practised in our present design offices. Similar changes are occurring in the accountancy profession and throughout manufacturing.

We continue to concentrate in university selection, university courses and discussion of engineering practice on the one day per week activities. We avoid the four days per week or at best include those activities as a minor part of the curriculum.

As horses were replaced by the motor car, so will our present design processes and tools be replaced, but the rate of change is much faster. Young people currently at university are being prepared for the processes of the late 20th century. Fortunately they are adaptable and may have the wisdom to adapt and lead us forward.

RHR
December 2003

Energy Answers

Rob Dumont

What is an appropriate indoor relative humidity for Canadian dwellings?

In the Canadian "Exposure Guidelines for Residential Indoor Air Quality," Health Canada recommends an interior relative humidity between 30% and 55% in winter. Most dwellings in the prairie climate, however, cannot handle as high a value as 30% relative humidity through a good part of the winter.

What happens if the relative humidity is below 30%?

If the humidity is too low, long periods of low relative humidity are believed to cause dryness of the skin and mucous membranes, which may lead to chapping and irritation. Many people will complain about dry throats and nasal passages in low relative humidity conditions. Some species of bacteria and viruses also thrive at low rh values. The Health Canada Guidelines also state: "The evidence suggests that humidity levels should be maintained between 40% and 50% to reduce the incidence of upper respiratory infections and to minimize adverse effects on people suffering from asthma or allergies."

How low can the humidity go in Canadian residences?

The Canadian Exposure guidelines state that "Relative humidities in Canadian homes have been found to range from 21% to 68%."

We, however, have measured indoor relative humidity levels as low as 4% in winter time. Yes, 4%! This occurred in a multi-unit residential building here on the prairies that was ventilated with outside air at a rate of 39 L/s (83 cfm) per suite. Most of the suites had only one or two occupants, and the high ventilation rate brought in so much dry outside air that it desiccated the suites (and the occupants). It was so dry in the building that the occupants could almost spit grasshoppers.

In colder winter weather, high ventilation rates will readily lower the indoor relative humidity below 30% in most parts of Canada. Cold outside air cannot hold nearly as much water vapour as warm air. For instance, outside air at a temperature of 20 C can hold a maximum of about 15 grams of water vapour per kilogram of dry air; however, at 0 C, outside air can only hold about 4 grams of water vapour per kg of dry air; and at -20 C, the amount drops to 0.6 grams per kg of dry air. When this dry air is brought in, either intentionally via a ventilation system, or unintentionally through building envelope leaks, the house air will drop in humidity. Sources of moisture inside the house such as people, cooking, bathing, plants, pets, gas ranges, candles, hot tubes, etc., will humidify the house air somewhat.

Given that Health Canada guidelines recommend 30% minimum relative humidity in winter, are most houses able to maintain that humidity?

A footnote in the Health Canada guidelines is as follows:"30% relative humidity in winter–unless constrained by window condensation."

Here in Saskatoon, our average outdoor temperature is -18 C in January, and temperatures will fall on occasion to as low as -40 C. At those outside air temperatures, most older houses with standard double glazed windows will readily frost on the inside if the interior humidity is 30%. Thus, most houses in our climate will not be able to sustain a 30% relative humidity in the colder parts of winter. Relative humidity values in the low 20% range are thus often found in wintertime in conventional houses around here.

How can you safely raise the relative humidity in houses in cold winter climates?
Better windows with higher thermal resistance values are key. It also helps if the house has an R2000 quality air-vapour barrier that can prevent concealed moisture condensation in walls.

Humidifiers can be used, if necessary, to raise the humidity levels, but they should be used with extreme care. Here are three points to note about humidifiers.

1. Standing water in humidifiers can quickly become a source of bacteria and mold.
2. Many humidifiers will release the salts in the water into the air of the house, creating a white dust near the humidifier. Dust is generally not a healthy substance to breath.
3. It takes energy to humidify air.

Some air to air heat exchangers use desiccant wheels or paper cores that can recycle moisture from the outgoing air back into the fresh outside air entering the house. Such heat exchangers have not been popular in colder climates, however, as the air exchangers are prone to freezing. Elaborate pre-heaters are needed with that type of heat exchanger to make them work in very cold climates.

A humidifier that we have found to work in our home is a table top model that uses a rectangular shaped wick of small diameter wood fibers that draws water out of a reservoir. Air blowing through the top part of the wick draws water from the wick and into the house air. The advantage of the wick-style humidifier is that the normal salts in the water remain in the wick and do not contaminate the air. The downside of this humidifier is that it has to be manually refilled, and it needs about two or three wicks each winter, as the salts eventually clog the pores in the wood fiber wick. We normally let the humidifier go dry every day so that bacteria will not grow; cleaning the humidifier once a week or so also seems advisable.

Where can I buy a decent relative humidity indicator?

The best lower cost units that I have seen (and purchased) are battery driven digital units available at the bigger lumber yards and building hardware suppliers. I recently purchased a digital temperature and relative humidity sensor for about $30 including tax. I cross-checked the unit with our sling psychrometer, and it agreed quite well.

What problems are associated with too high a relative humidity in the summer time?

Again, to quote Health Canada, "Humidity levels above 50% have been found to increase the population size of moulds, fungi and mites (dust mites) that may cause allergies." And "High humidity at high temperatures leads to increased sweating and a loss of electrolytes from the blood; prolonged exposures may lead to heat exhaustion or heat stroke."

Relative humidity is one of those parameters like temperature that should be controlled within a relatively narrow band; neither too high nor too low, but just right. If only the story of Goldilocks had included a section on relative humidity!

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