



The Australasian Wind Engineer

www.awes.org

Welcome Wind Engineers to the first AWES Newsletter of the year, and whilst it is somewhat later, it's a bumper edition!

We lead with all the details of this year's AWES Workshop held in Wellington in February. We also have details of the AWES Spring Lecture held in Melbourne, and a report on ICWE 14, held in San Paulo, Brazil this year.

The AWES would also like to congratulate Joachim Paetzold (from The University of Sydney) for winning the AWES Postgraduate Wind Engineering Prize, and having the opportunity to present his work at ICWE 14.

David Henderson and Matthew Mason provide a number of fascinating insights into three tropical cyclones (Nathan, Marcia and Olwyn) from earlier this year.

A new wind tunnel facility is now in operation at The University of Auckland, and Richard Flay has all the details on this.

Nominations are due soon for the 2015 Undergraduate Wind Engineering Prize, and all the details of the award are inside.

We also have news from the AWES for upcoming membership dues, events and elections for the 2016-2018 committee.

Finally, we also report on the recent passing of Charles Bubb, and George Walker, Kevin McCue and Bill Melbourne have provided a tribute to Charles.

Editor: Leighton Aurelius

BMT Fluid Mechanics

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A strong contingent of AWES Members at ICWE 14 (whoever can come up with the best collective noun for a group of wind engineers will win a prize!)



2015 AWES Workshop, Wellington, New Zealand

Contributors: Matthew Mason, Richard Turner

The 2015 AWES Workshop was held at the Capthorne Hotel in Wellington, New Zealand during February this year, with the theme of, wind extremes, vulnerability and resilience: putting research into practice.

As is now customary, the AWES also held its Wind Loading Day series of lectures for practicing engineers detailing some of the theory behind AS/NZS1170.2. The two events were well attended with 70 registrants across the three days.

The Society was pleased to have two excellent keynote speakers in Dr John Holmes (JDH Consulting), and Bill Coulbourne from the Applied Technology Council (ATC). John spoke in detail about the history of the joint Australia-New Zealand wind loading standard, AS/NZS1170.2, and gave his thoughts on where it is headed into the future. Also, with extensive experience in the world of translational research, Bill Coulbourne spoke on how to move wind engineering research from the lab to design and construction practice. Both talks were well received and raised important issues and subsequent discussion during the workshop. In all more than 30 papers were presented during the workshop across a wide range of research and practical wind engineering topics.

As part of the workshop the AWES Postgraduate Wind Engineering Prize was again on offer for the best presentation given by a postgraduate student at the workshop. As always competition was stiff, but the judging committee awarded Joachim Paetzold from The University of Sydney the prize for his presentation on Wind effects on parabolic trough collectors at different positions in the solar field. The AWES congratulates Joachim on his achievement and as part of his prize supported his travel and registration for the International Conference on Wind Engineering in Brazil earlier this year (see ICWE article). Joachim's winning paper can be found at the end of this newsletter.

In closing, the AWES and the Workshop Organising Committee would like to acknowledge and thank the support of Geoscience Australia and the ATC who contributed financially to the success of the Workshop.



Jerome Rowcroft presents a paper at the 2015 AWES Workshop

AWES Spring Lecture

Contributor: Matthew Mason

The AWES Spring Lecture was held at the Victorian branch of Engineers Australia in Melbourne during late September.

We were fortunate to have Dr John Holmes speak about the past, present and future of AS/NZS1170.2 to an audience of engineers, architects and students. This was the first of such lectures to be held in Melbourne and it was great to see attendees from academia as well as industry in attendance.

The lecture was followed by some social 'drinks and nibbles' and many of the students and young engineers/architects in attendance got to spend some one-on-one time discussing their respective wind engineering research with Dr Holmes.

As with previous lectures the Spring Lecture was recorded and will soon be uploaded to the AWES website. At the time of writing it was undergoing editing, but if you would like to listen to John's talk please check the Archives page on our website.



John Holmes presenting the 2015 AWES Spring Lecture.

AWES at ICWE 14, Porto Alegre, Brazil

Contributor: Matthew Mason

The 14th International Conference on Wind Engineering (ICWE) was held in Porto Alegre, Brazil in June this year. A strong contingent of AWES members, Australia/New Zealand based and expatriates, made the journey to South America for the conference and by all accounts had a great time at the conference proper, as well as extended travels throughout the country!

AWES members were not only well represented as attendees at the conference, but two of our Life Members, John Holmes and Chris Letchford were keynote speakers at the event. John spoke about what he sees for the future of wind engineering and Chris distilled many years of work on non-synoptic winds, their link into The Davenport Chain and the possibility of codifying this type of wind event. Feedback on both presentations was excellent, and all were impressed with Chris’s ability to weave a story about Darwin’s voyage on the Beagle into his talk!

The AWES was also proud to support the attendance of Joachim Paetzold (University of Sydney), the winner of the 2015 Postgraduate Wind Engineering Prize, at the ICWE. Joachim presented his dissertation research on wind effects on parabolic trough collectors in solar fields to the conference and exemplified the high-quality research being done in our region.

On a more formal note, during the ICWE the International Association for Wind Engineering (IAWE) held its General Assembly. This meeting is held every four years in conjunction with the ICWE and enables all the national and regional wind engineering society’s to meet, discuss and vote on matters that pertain to the international society. After two terms as President of the IAWE, Professor Yukio Tamura stood down from his position and Professor Ahsan Kareem was elected to serve for the coming four year term. The AWES congratulates Professor Kareem on his new role. In addition, the location for the next ICWE was voted on and Beijing, China was decided upon as the city to host the 2019 event.

With the completion of ICWE it signals the time to start gearing up for the regional rounds of conferences. The AWES will play host to the 2017 Asia-Pacific Conference on Wind Engineering, with Richard Flay and his team at The University of Auckland already putting in the hard yards to plan this event. We look forward to again hosting an international wind engineering conference in our region and wish Richard and his team all the best for the event.

Surface level wind observations during Tropical Cyclone Nathan (2015)

Daniel J. Smith¹, David Henderson¹, Korah Parackal¹, and Matthew Mason²

¹Cyclone Testing Station, James Cook University, Townsville, Australia

²University of Queensland, Brisbane, Australia

Tropical Cyclone Nathan made landfall as a Category 3 system (BOM) on March 20th 2015 north of Cape Flattery, QLD. Prior to landfall, the CTS deployed six weather towers in the Cooktown region via the SWIRLnet (Surface Weather Information Relay and Logging network) program. Each tower records data locally at 10 Hz and transmits 10 minute summary files (in real time) via modem. Figure 1 shows the location of each tower and the BOM anemometer in the Cooktown region. Table 1 summarizes the data and Figure 2 compares the gust wind speed and direction traces for the Cooktown AWS (10 m) and the adjacent SWIRLnet Tower 1 (3 m).

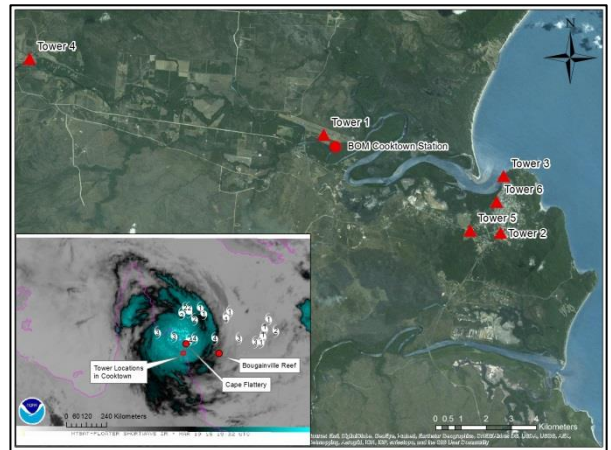


Figure 1. SWIRLnet and BoM weather station locations in Cooktown and North of Cooktown relative to satellite imagery of TC Nathan as of March 20 6:30 AM (Courtesy NOAA).

Site	Max V3,600 [m/s]	Direction (°)	Time [20/3]	Tower height [m]	Approx. upwind terrain category @ max gust	P [hPa]
Tower 1	21.5	128	3:46	3	2	1004
Tower 2	26.8	318	2:44	3	2.5-3	1002
Tower 3	21.1	158	1:43	3	2-2.5	1005
Tower 4	18.4	114	2:17	3	2-2.5	1001
Tower 5	20.3	153	2:11	3	2	1004
Cooktown (BoM)	23.6	112	3:30	10	2	1005

Table 1. Wind, pressure, and measurement site information for SWIRLnet and BOM weather stations during TC Nathan

In comparing Cooktown AWS data with that recorded at SWIRLnet Tower 1, similar wind direction is shown at the time of maximum wind speed.

Predominantly the 10 m V3,600 is larger than V3 recorded at 3 m, as would be expected, with a ratio of V3(3m)/V3,600(10m) of 0.91. Incidentally, the $M_{z,cat}$ (terrain category/height multiplier per AS/NZS 1170.2) for Terrain Category 2 at 3 m is also 0.91, but note that AS/NZS 1170.2 uses a 0.2 second gust, not 3 second as shown here.

Analysis is proceeding on both the comparisons between 10 m and 3 m data and utilising the other 5 SWIRLnet tower data for investigating topography and terrain influences at single storey house height. The SWIRLnet data from the previous deployment in Cooktown with Cyclone Ita is also being incorporated into this study.

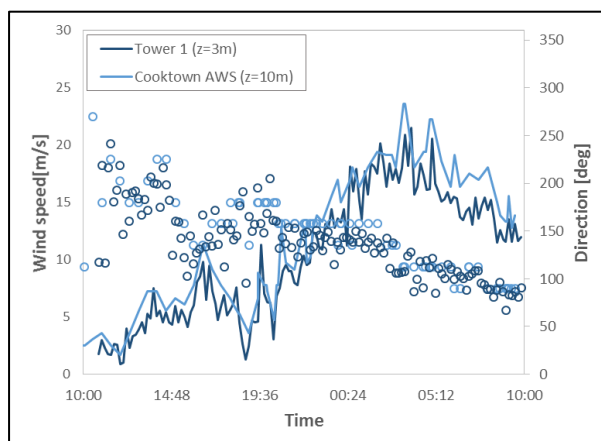


Figure 2. SWIRLnet anemometer Tower 1 (3 m height) and Cooktown Bureau of Meteorology (10 m height) automatic weather station maximum 3-second gust (V3,600) wind speed (solid line) and direction (open dots) from 10 AM (AEST) Thursday March 19, 2015 to 10 AM Friday March 19 2015 during TC Nathan. (Note: these weather stations were located within ~20 m of each other at the Cooktown Airport)



Figure 3. SWIRLnet anemometer Tower 1 (3 m height) and Cooktown Bureau of Meteorology (10 m height) automatic weather station (left hand side of figure) at the Cooktown Airport during TC Nathan.

Damage from Cyclone Marcia – February 2015

Contributor: David Henderson

Survey team: David Henderson¹, Daniel Smith¹, Matt Mason² and Ryan Crompton³

- 1 Cyclone Testing Station, JCU;
- 2 University of Queensland;
- 3 Risk Frontiers.

Tropical Cyclone Marcia crossed the Queensland coast at the sparsely populated Shoalwater Bay on 20 February 2015. At this time Tropical Cyclone Marcia was forecast as an extremely destructive category 5 system (estimated peak winds in excess of 250 km/h). The forecast track map is shown in Figure 1.

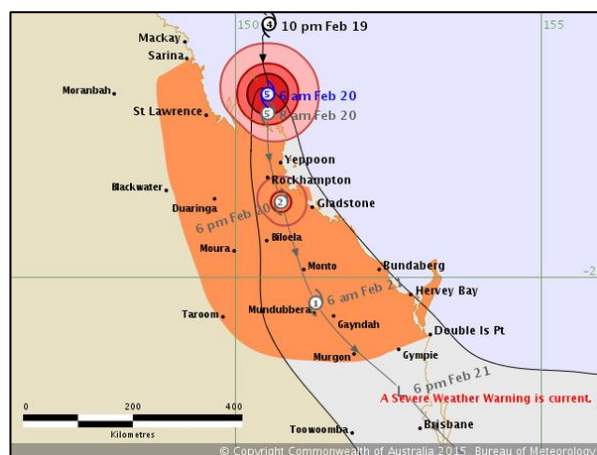


Figure 1. BOM Forecast track map for Cyclone Marcia

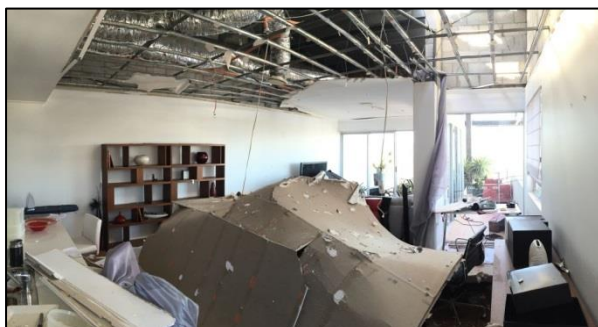
As the system moved south over land, it lost intensity. On reaching Yeppoon, the maximum gust recorded by the Bureau of Meteorology at their 10m high automatic weather station (AWS) was 156 km/h, suggesting a Category 2 system. The Bureau's AWS in Rockhampton recorded a maximum gust of 113 km/h, consistent with a Category 1 system. It should be noted that the measured wind speeds were considerably less than the design wind speed for importance level 2 buildings (e.g. houses) of approximately 250 km/h.

However, the system caused significant damage to residential and commercial buildings in Yeppoon and Rockhampton. Flash flooding in and around Rockhampton, severely damaged several properties and infrastructure.

From the damage survey, not surprisingly, the majority of structural damage from wind loads occurred in older (pre-1980) housing whose construction predated Appendix 4 of the Queensland Home Building Code (1981). Damage to these buildings generally related to roof failures where inadequate roof tie down was unable to withstand the wind loads. In many cases the house had previously been re-roofed with new cladding and roofing screws, but the connections from the

battens to the rafters was still the original 75 mm nail(s). To avoid this mode of failure, when re-roofing houses of this age strapping of battens to rafters and rafters to top plates of external and interior walls is recommended. Details for upgrading of older housing can be found in the Standards Australia Handbook HB 132.2 and in Timber Queensland builder notes published by QBCC. It should be noted that topographic speed up of winds was also a factor in the damage to housing. The re-roofing of older structures in exposed locations needs to incorporate the required tie down details for the site wind classification, as per AS4055.

More surprisingly was the amount of damage to elements of modern multi-storey residential and commercial low rise buildings in Yeppoon and Rockhampton. There were several observed cases of multi-storey buildings with wind damage to the upper storey roofs, fascia, soffits and flashings as well as their roof top mounted equipment (air-conditioning units, vents, HVAC, and antennas).



led to; exacerbated water ingress damage to multiple units. The failure of windward fascia resulted in ceiling collapses from the pressurized roof space. Of additional concern, these failures generated wind driven debris. These failures were all at wind speeds well below the design levels for the region. To learn more, go read the article in the Engineers Australia magazine on the observed issues of poor design detailing and construction practice from this event:

<https://cyclonetestingstation.com.au/publications/content/cyclone-marcia-article-in-engineers-australia>

Damage from Cyclone Olwyn – March 2015

Contributor: David Henderson

Survey team: Geoff Boughton^{1,2}, Debbie Falck^{1,2}

- 1 TimberED;**
- 2 Cyclone Testing Station, JCU**

Tropical Cyclone Olwyn (TC Olwyn) made landfall near Exmouth, Western Australia in the early hours of Friday 13 March, 2015. The measured wind speeds at Learmonth (32 km south of Exmouth) showed peak 3 second gusts of 180 km/h. The estimated peak gusts in Exmouth were around 185 km/h, which was less than 70% of the Region D ultimate limit state design wind speed for housing (allowing for the conversion of 3 second gusts to design wind speeds).

Houses that were repaired and retrofitted after TC Vance (1999) experienced little structural damage. This is expected, as the wind speeds in TC Olwyn were significantly lower than both the design wind speed and those recorded in TC Vance.

Although the wind speeds were around the level at which buildings should remain serviceable, there was significant damage to many houses and buildings from wind-driven rain entering through flashings, windows and doors. Water damaged plasterboard ceiling and wall linings, carpets, and timber floors as shown in the photos below.



These failures and breaches of the building envelope



Report of the damage investigation along with recommendations published on CTS website:

<https://cyclonetestingstation.com.au/publications/content/technical-reports/tech-report-61/view>

New Boundary Layer Wind Tunnel at the University of Auckland

Contributor: Richard G. J. Flay

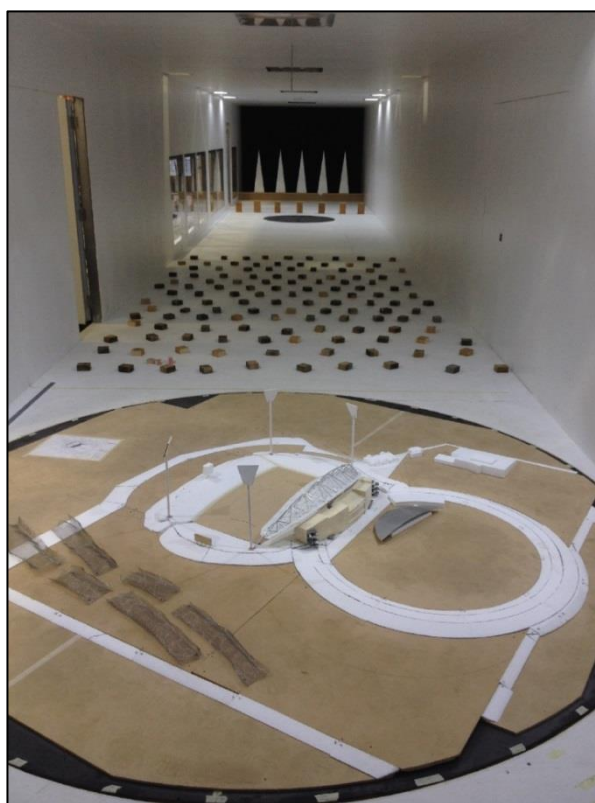
In 2013 the University of Auckland purchased 5.2 hectares of land at Newmarket in Auckland for a new campus. Large research laboratories from the Faculty of Engineering have been the first to move to Newmarket. Some have come from the Tamaki Campus which is further away from Engineering's City Campus, and some have come from the City Campus. In the case of Mechanical Engineering's Aerodynamics Laboratory, it has been established at Newmarket, replacing laboratories at both the City and Tamaki Campuses.

The Twisted Flow Wind Tunnel was moved to Newmarket and upgraded, and the opportunity that this move gave was used to replace the small 50-year old BLWT tunnel with a larger general purpose closed-circuit wind tunnel incorporating two 1.8 m diameter 90 kW fans that the laboratory had acquired from a former consulting job. The new BLWT has a test section 20 m long, 3.6 m wide and 2.5 m high, and the top speed is 20 m/s. The wind tunnel was designed to be a general purpose facility. It has a cycle test rig near the upstream end of the test section. Aerodynamic drag and cyclists' power output can be measured in real time and displayed on the floor using a data projector. A moving belt ground plane that was developed by FSAE students for testing vehicle models in ground effect has been located under the test section about midway along it, and a 3.5 m diameter turntable for wind engineering investigations is located at the downstream end of the facility, as shown in the photograph, which is a view looking upstream.

The wind tunnel shell was built using steel framing made from sheet metal (used for building construction) with MDF or plywood fixed to it. It was a very economical and convenient solution, enabling a large amount of the building work to be done in-house. The wind tunnel was run for the first time in June 2015, and has been used a lot since then for a variety of wind engineering and cycle studies.

I express my thanks to Mr David Le Pelley, Wind Tunnel Manager, who managed and carried out the construction, and also to JC Gillen and Ben Goodwin for their significant contributions to detailed design and construction.

For further information, please contact Richard Flay, r.flay@auckland.ac.nz



New Wind Tunnel Facility at Auckland University

Awards

The 2015 Undergraduate Wind Engineering Prize is again on offer to recognise the best undergraduate thesis or project undertaken at an Australian or New Zealand university during 2015. A significant amount of high quality wind-related research is undertaken by undergraduates throughout the region and this award aims to recognise this contribution to our field and help boost a young researcher and their career.

Similar to previous years student/s are required to submit a 5-page summary of their work with a short description of how it contributes to the field. Submissions will be accepted from students studying at

any university within Australia or New Zealand and will be judged by a committee of AWES Life Members. The winning student/s will be awarded a cash prize of \$300 (AUD) and be invited to present their work at the AWES Workshop in 2016. As such they will gain a great opportunity to mix with some of the region's top wind engineers and provide good exposure to their School/Department and university.

To ensure we get another good crop of submissions, could we please ask all members who are involved with undergraduate supervision to encourage their students to get involved. Submissions need to be received by 6 November 2015, with the winners announced before the end of November. For further information on the award as well as submission templates please direct your students to <http://www.awes.org/prizes/>.

Membership dues

Biennial membership fees are due by 31st March 2016 for all AWES members. Rates (for two years) are \$95 for full membership, \$40 for postgraduate student membership and free for undergraduate students. We have kept rates low to encourage as many people as possible to be involved with the Society, so we encourage you to let your friends and colleagues, know about the Society and its activities and encourage them to get involved.

Of course we also want all our current members to continue with the Society and make sure it remains a valued resource for wind engineering researchers and practitioners.

To pay your membership, please goes to the AWES website. For the convenience of everyone, a new online payment system will be trialled this year, so please let us know how you find the experience so we can ensure the membership payment process is as smooth as possible (this should be up and running by December).

Elections: Call for nominations

The AWES Constitution requires that every two years elections be held to fill the six seats on the National Committee for the coming two year period.

Of those elected a Chairperson, Secretary and Treasurer will be appointed from and by the elected members. On the current National Committee we also have a Newsletter Editor, Website Manager and NZ Representative. We also have two co-opted Committee Members (non-elected), one, as has traditionally been the case, is the Chairperson of the forthcoming AWES Workshop (Mr Leo Noicos) and very recently we added a Social Media Manager, Dr Daniel Smith. Further information about the Committee's current members can be found on the AWES website.

We now call for nominations for those wishing to be

appointed to the National Committee for the period 2016-2017. If you would like to nominate yourself or someone else for election to the Committee, please forward your nomination to secretary@awes.org before 20 November 2015.

Elections will be run through an online voting system from 1 December, 2015 to 15 December, 2015.

Voting details, along with profiles of all candidates, will be forwarded to all registered members in late November. We strongly encourage all members to cast a ballot and have your say in the future of our Society.

Upcoming events: AWES Summer Lecture

The AWES Summer Lecture, will be held at the University of Queensland (Brisbane) on **December 8** and will be held as a side event to the 2nd International Conference on Performance-based and Life-cycle Structural Engineering.

The immediate past-President of the International Association for Wind Engineering, Professor Yukio Tamura, will present this lecture and shall outline his research on method to modify wind induced response of super tall buildings through shape modification.

More information about location, timing and registration for this event will be made available through the AWES website as the date approaches.

In Memoriam: Charles Bubb

Contributors: George Walker, Kevin McCue and Bill Melbourne

On 17th May 2015 one of Australia's most eminent civil engineers during the latter half of the 20th century passed away. Charles Thomas James Bubb was born and educated in Perth, Western Australia. He graduated with a civil engineering degree from the University of Western Australia in 1950 following which he joined the construction side of the then Commonwealth Department of Works and Housing. In its various guises he worked with this Department until his retirement in 1987 as the Director of Engineering, the top engineering position in the Commonwealth public service at that time, and the last to hold this position.

Charles Bubb began his career working with the Victoria-Tasmania branch of the Commonwealth Department of Works and Housing which in 1952 became the Department of Works. During this period he got his first experience with major projects when he was seconded to the Tasmanian Hydro Electric Commission for a time. During 1964-65 he was seconded to the US Navy to work on the design and construction of a group of six communication towers as part of their North West Cape Project near Exmouth, which were then the tallest structures in Australia – the



tallest three being 364 m and now the second tallest. This experience was to prove useful 10 years later when he became responsible for the design and construction of the Omega Tower near Woodside in Victoria which until it was demolished in April 2015 was the tallest structure in Australia at 427m. During the 1970's he led the design of a new telecommunication tower for the then Telecom (now Telstra) to be located on Black Mountain in Canberra. The resulting 195m tower was one of his pride and joys. So outstanding was it aesthetically that the National Capital Development Commission, which at that time controlled developments in Canberra, protested – unsuccessfully - in the High Court against its construction on the grounds that it would dominate other aesthetic structures in Canberra as well as the nature park in which it was located.

The most challenging project on which he was engaged was probably the design of the Australian National Animal Health Laboratory during the 1970's because of the strict requirements imposed on the design to ensure the risk of escape of dangerous viruses and pathogens to be studied in it would be essentially zero, even if hit by a plane or a tornado. While engaged in the above projects and others of national significance two significant events occurred which were to have a seminal influence on his major contributions to professional engineering in Australia. The first of these was the Meckering earthquake in October 1968 and the second was Cyclone Tracy in December 1974.

In the early 1960's Charles Bubb spent some time with the then Territory of Papua New Guinea office of the Department where he first learned about earthquakes and in 1961 wrote his first Departmental technical note on aseismic design. At that time earthquakes were not thought to be a significant problem in Australia and the technical note was for the construction of Commonwealth facilities in Papua New Guinea. The 1968 M6.8 Meckering earthquake which destroyed the town of Meckering and caused damage as far away as Perth, changed that view for a number of structural engineers, and particularly for Charles Bubb. In 1969 with the support of the Department he undertook earthquake engineering studies at Imperial College, London, under Professor Ambraseys, graduating with their post-graduate Diploma. On his return he became a very active member of the Australian National Committee for Earthquake Engineering which was formed in 1971 and was responsible for the first national series of professional earthquake engineering seminars in 1974. It also underpinned the development of the Australia's first earthquake code ASS2121 published in 1979 which was led by Charles Bubb. He remained actively involved with earthquake engineering for most of his life, in his retirement playing a leading role in the establishment of the Australian Earthquake Engineering Society, of which he was the inaugural President, from 1990 to 1995.

Charles Bubb was well aware of the risk from tropical cyclones to northern Australia and within the

Department had been a strong advocate for giving attention to them following his involvement in the North West Cape project. He quickly recognised that Cyclone Tracy had produced an opportunity to change thinking in relation to wind design and made the most of it. His strong support of the investigation of the damage from Darwin and the recommendations that came out for changing the approach to the determination of design wind speeds in northern Australia, and to the design of housing by requiring them to be structurally designed for wind, was probably the main reason these changes occurred. In the case of wind speed design it meant adopting a radically different approach by using Monte Carlo simulation of possible events based on historical events using a technique being researched at the University of Sydney but untested in practice anywhere in the world. Today such simulations are common place in the determination of hazard risk, but its use following Cyclone Tracy was a world first and but for the strong support of Charles Bubb it would probably not have happened.

It was the same with housing design. The recommendations were strongly opposed by the building industry, but despite the strong political lobbying from the industry he ensured their adoption for the reconstruction of Darwin which provided the precedent for their eventual adoption Australia wide. Included in this was adoption of a radical proposal that the metal roof fastenings be designed for fatigue, an idea suggested by a young engineer in the Department, Vaughan Beck, with strong support from Bill Melbourne at Monash University. He quickly latched on to it and immediately commissioned studies within the Department to investigate its significance before adopting the results in the reconstruction of Darwin despite the additional costs involved. It was another world wide first. These things are all taken for granted now but a lesser person in his position may well have caved into the political pressure to avoid radical solutions, and if the situation had been like now when there is no one like him in such a position in the Commonwealth public service it is difficult to see it happening at all.

His involvement with the earthquake and wind engineering design resulted in him playing a leading role in the initial development of the structural design loading codes which are used today. He early recognised the superiority of limit state design over working stress design, which underpinned almost all structural design at the time. It was an idea strongly promoted by Professor Len Stevens from Melbourne University. Australia led the way internationally in changing its design codes to this approach but again without the strong support of Charles Bubb, and consequently the Commonwealth Department he represented, it is highly likely it would not have happened at that time.

He was appointed Chief Structural Engineer of the then Department of Construction in 1977 and made Director



of Engineering of what was by then the Department of Housing and Construction in 1979, succeeding Norm Sneath, another brilliant public service engineer with whom he had worked much of his life. The annual award of the Charles Bubb Medal by the Australian Earthquake Engineering Society will be a continuing reminder of his contribution to Australia in the earthquake field.

Len Stevens commented:

He had a major influence on the character of structural engineering in Australia. One particular action on his part illustrates just one of his contributions. He assisted me greatly when I was trying to convince the profession that it was time to introduce Limit States Design as a replacement for Allowable Stress methods. There was considerable reluctance by many senior engineers who could not be convinced that this was necessary. Charles was then responsible for the design of the Black Mountain Tower and realised that design by Allowable Stress methods could lead to possibly unsafe conditions under the combination of wind and dead load as had been graphically demonstrated by the then recent collapse of the Ferry Bridge cooling towers. Charles, backed by Norm Sneath, successfully adopted a Limit States approach using the ultimate design wind with a minimum dead load and required all designs for the Commonwealth Department of Works to follow this approach. His appreciation of the damage from Cyclone Tracy also reinforced his decisions. This quickly convinced the profession that they needed to get behind the adoption of Limits State Design. Without this input the adoption would have been greatly delayed. He was a great Australian engineer and his contributions deserve to be appropriately recognised.

John Nutt, a former head of Ove Arup in Australia who worked closely with him on structural design standards commented:

He deserves the respect of the profession for his contribution to the knowledge base of engineering in this country. I saw the significant impact he had in the fields of earthquake engineering and wind in particular, and as a structural engineer designer of major projects throughout the region, I gained significant benefit.

Now a retired eminent professor, Vaughan Beck commented:

After Tracy I formulated a hypothesis that the failure of sheeting in Darwin may have been caused by repeated loading. To their credit (and perhaps boldness?) both Charles and Norm were very receptive to this hypothesis that was being proposed by a very recent graduate engineer that had effectively no history with the Department. They had no hesitation in supporting a very quick experimental program at the Experimental Building Station - which investigated the effects of repeated loading under uplift. Following the results obtained at EBS, Charles and Norm obviously saw the potential implications and arranged for me to travel to Darwin to

undertake on-site inspections.

Joe Minor, an eminent wind engineering professor from the US whom Charles Bubb engaged to assist in the investigation of Cyclone Tracy commented:

He was one of a very few who made my career.

Bob Leicester, a retired eminent researcher from the former CSIRO Division of Building Construction and Engineering commented:

Round about 1972, Greg Reardon and I had initiated the idea of using conventional structural engineering methods for analysing the strength of houses. This had an output in the form of a CSIRO travelling circus titled "Keep Your Roof On", which we took to any group around Australia that was prepared to invite us. Since this involved recommendations related to changing building construction, reception to our talks was often negative and in fact sometimes even hostile (we had a reject from Darwin about 6 months before Tracy hit). The first 'respectable' group to invite us was the team of design engineers led by Charles Bubb. At least Charles was enthusiastic, even though some of his engineers were sceptical. So in this sense Charles was a pioneer.

George Walker, whom he engaged to lead the investigation of Cyclone Tracy commented:

The passing of Charles Bubb reminds us of what Australia has lost by abolishing an in-house engineering based Department at Commonwealth government level responsible for the planning, design and supervision of construction of major national infrastructure and other projects of national significance. He was the last of a line of great engineers he had the distinction of being the most senior engineer in the Government public service responsible for these activities. In my opinion the 'ceiling insulation' and 'school building project' fiascos would never have occurred if such a Department had been in place, and nor would there be the current concern over national infrastructure which appears to be largely the result the vacuum created at national level by the abolition of the Department.

Well, that's it for this edition of the AWES Newsletter. Many thanks must go to our contributors. As always, a newsletter cannot exist without news, so any stories, photos or information on upcoming events will always be appreciated.

Cheers,

Leighton Aurelius
AWES Newsletter Editor.

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