

AHSCA Research Foundation Newsletter

May 2018



Largest roof drainage research project in the world is successfully completed.

After more than 3 years, the joint initiative between the University of Sunshine Coast (USC) and the AHSCA Research Foundation is complete, now it's time to bring the new technologies to the members...

The AHSCA Research Foundation roof drainage test facility started construction at the USC in 2015 incorporating a simple, flexible but ingenious design of lead researcher Dr Terry Lucke.

The test facility incorporates three working levels, adjustable gutter width, adjustable gutter depth, adjustable gutter gradient and the ability to adjust flow direction; either centrally or to a gutter end flow configuration.



The facility provides the researchers with the opportunity to observe both positive and negative pressures (siphonic) with all associated components (gutter, sumps, pops and downpipes) connected. This ability has enabled the researchers at USC to increase the flow rate in box gutters from a maximum of 16 l/s (AS/NZS 3500.3) to an incredible 100 l/s.

This world leading technology is now being delivered to Foundation members enabling them to offer significant cost savings to the broader construction industry. State Chapter members of the Foundation have already completed the Stage 1 training courses that have identified critical errors in the legislated Standard AS/NZS 3500.3. Graduates of the Stage 1 training course have qualified to use the recently developed online calculator (corrected from AS/NZS 3500.3) for flows up to 16 l/s and are encouraged to complete the Stage 2 course enabling them to be trained and certified by the Foundation as Advance Roof Drainage modellers.



RESEARCH FOUNDATION

A joint initiative of AHSCA States

The AHSCA Research Foundation is a joint initiative between the Qld, WA, SA & Vic Chapters of the Association of Hydraulic Services Consultants Australia providing advanced training courses, relevant CPD and world leading technical solutions to its members.

The Foundation also provides independent performance testing for a number of products to assist the industry where a recognised performance Standard is not available.

www.ahsca-research.com.au

Note: AHSCA NSW is not affiliated with the AHSCA Research Foundation.



Sometimes, seeing is believing.....

During the past three years, many AHSCA members from around Australia have travelled to the University of the Sunshine Coast to witness the operation of the world's largest roof drainage test rig.

The support of [Stoddart](#) in assisting with the travel of State Chapter representatives is greatly appreciated.

Many members were amazed that some of the hydraulic principals that they had been taught over the years appeared to be irrelevant at certain flow or configuration combinations. High volume discharges through gutters, sump outlets or pops can fluctuate between positive and negative pressure transients, each resulting in varying gutter depths and flow characteristics.

Demonstrations at the rig made it obvious to members that the current sizing data incorporated in AS/NZS 3500.3 could not be safely extrapolated above 16 l/s in many cases and other demonstrations established significant over design in the regulated standard.

Many pressurised Water Authority distribution mains peak at flows of around 70 l/s, so members were amazed that flows in excess of this could be generated in a roof drainage system by harnessing only self-generated system pressure. Future research projects will focus in more detail on the development of Hybrid roof drainage systems, where conventional systems transition to siphonic conditions enabling dramatic flow increases.

Members and guests that toured the research facility were also shown a number of different overflow combinations. Simple demonstrations were presented where upstands around an outlet were shown to provide a significant increase in flow. Many of the trials of the outlets focused around simplicity, items that can be installed on site or with the minimum of

pre-manufacture.

Flow increases of up to 50% were achieved by simple outlet shape variables and the targeted location of outlets in relation to the gutter and or sump.

The main observation made by members and guests that toured the facility was the relationship that one component of the roof drainage system has on another part of the system. A gutter, with only an outlet opening has one flow, a gutter with an outlet and a pop has another and a gutter with a pop and a downpipe has another again. Naturally, each of these discharge variables also has a corresponding dimensional gutter variable. It was also demonstrated that significant flows could be achieved without the pressure generated by the installation of traditional sumps as mandated in AS/NZS 3500.3.

Previous national and international research studies related to roof gutter drainage systems have generally tested each component in isolation and therefore were unable to observe the considerable hydraulic advantage that can be generated when all components are operating together.

Many design guides (such as AS/NZS 3500.3) assume that gutter depth is reduced with increased gutter gradient however; full scale testing has revealed that this is quite often not the case.

Detailed testing has identified hydraulic jumps in the gutter flow that negate any theoretical hydraulic advantage of gradient. This significant discovery was published in the Journal of Building Engineering (*Luke Verstraten, Terry Lucke & Geoffrey O'Loughlin*). This is just one of the reasons that maximum flows in box gutters designed in accordance with AS/NZS 3500.3 should not be extrapolated beyond the nominated limit of 16 l/s.

If you build it they will come.

Over the past three years, the Foundation has hosted numerous industry representatives from all around Australia to its testing facility at the USC. These organisations include:

- Australian Building Codes Committee
- Australian Plumbing Codes Committee
- Victorian Building Authority
- Queensland Building & Construction Commission
- Engineers Australia
- Housing Industry Association
- Australian Institute of Refrigeration, Air conditioning and Heating (AIRAH)
- Air Conditioning & Mechanical Contractor's Association
- Master Builders Australia
- Plumbing Products Industry Group
- Australasian Fire Authorities Group
- Standards Australia
- NSW Office of Fair Trading
- WA Building Commission
- Reece
- Geberit
- Davey Water Products
- Architects & Project Managers

The initiatives of the research project have been highlighted on television via

[Channel 7 News](#) and [WIN News](#) as well as being well supported by Plumbing Connection magazine, thanks to Jeff Patchell.

The Foundation's PhD Scholarship recipient, Mr Luke Verstraten presented an overview of the research project at the International Novatech Conference in Lyon, France in 2016, creating significant international interest.

The Foundation's testing facility has also been used to undertake independent performance testing for a number of different organisations including:

- [SPS Drains](#)
- [Galvin Engineering](#)
- [Dam Busters](#)

The testing facility now also incorporates a full sized residential eaves gutter rig that can test the overflow characteristics of slotted gutters and the performance of auxiliary overflow measures such as those detailed in AS/NZS 3500.3 and the NCC. The preliminary testing has been quite surprising!

The Foundation has also been in discussions with a number of other industry bodies exploring the opportunity to undertake some joint research initiatives to assist the broader industry.

Desktop Study: Typical Bunnings Warehouse located in Melbourne ARI:187mm/hr.

Recently one of the Foundation's members undertook a preliminary desktop study related to a roof drainage system for a typical Bunning Warehouse store located in Melbourne.

The system was first designed in accordance with the regulated Standard AS/NZS 3500.3 and then redesigned using the technology developed by the AHSCA Research Foundation.

Both designs were estimated with the assistance of a plumbing contractor and revealed that Foundation initiatives could save in the order of \$50,000.00 to \$60,000.00. These savings comprised of reduced sumps, downpipes, overflow, stormwater drainage (in ground) and a reduction in junction pits. Imagine what the saving would be in Queensland! What can the Foundation's initiatives save your next client?



Plumbing Industry Climate Action Centre (PICAC) 1 in 500 ARI @ 100 l/s - 1 Outlet!
The proposed PICAC plumbing trade school to be constructed at Narre Warren Victoria will use the Foundation's roof drainage technology for a 1 in 500 ARI. This roof drainage system will be used to demonstrate research outcomes.

What is the importance of independent testing of grated roof and balcony outlets? Hydraulic Consultants beware!

According to the Bureau of Statistics, the 2016 Census showed that 10% of the Australian population spent Census night in an apartment. Over the past 25 years, the number of occupied apartments (including flats and units, excluding townhouses) in Australia has increased by 78% to 1,214,374.

The 2016 Census also identified that 18% of Australia's occupied apartments were part of a development of four or more storeys.

Given that single level residential houses do not often use the services of a hydraulic services consultant, the current trend to multi level apartment living is generally encompassing a far greater component of annual revenue for hydraulic services design companies and also major plumbing contractors.

When considering the obligations of all professionals involved in a project, such as residential implied warranties and guarantees, the requirement for all components to be fit for purpose is paramount.

Unfortunately for the industry and design professionals, there is not an Australian Standard that appropriately deals with the measurement and certification of flow rates through grated roof and balcony outlets. This leaves the specifier and installer at considerable risk of being tangled up in protracted litigation disputes when failure or inadequate performance is alleged.

While there are a number of responsible manufacturers and suppliers of these products within the industry, there are a number that have not undertaken any testing of their outlets or have simply relied upon generic mathematical equations that fail to reasonably estimate realistic flow rates.

The identification of required head (pressure) over the grate for a given flow is also critical where a secondary grate is used as an independent overflow.

To assist the industry with this problem, the Foundation developed the *“Flow Capacity and Water Level Test Protocol for Grate Roof and Balcony Drainage Outlets”*. Among other things, the protocol sets out flow and measurement techniques and the calibrated equipment that must be used in testing regime such as:

- Electronic Flow Meters
- FM Transmitters
- Ultrasonic Level Sensors
- Data Loggers

Importantly, the protocol also requires the outlets to

be tested with a number of different outlet piping configurations. This requirement avoids the hydraulic advantage that may be inadvertently created in some piping configurations. This type of environment can lead to unrealistically favourable test results.

During physical testing of grated outlets, it is noticed that the water level above the grate fluctuates dramatically between 30mm head and 60 mm head (depending on grate size and shape). This zone of water depth is critical to hydraulic consultants because it represents the majority of design thresholds (such as gradient and balcony entrance upstand) that safeguards the property from flooding.

The transitional flow region repeatedly cycles between weir and orifice flow conditions during this phase resulting in unstable flow patterns, dramatically raising and lowering outlet flows and causing surges in the level of the water above the outlet.

The AHSCA Research Foundation's grated roof and balcony outlet testing procedures captures and documents these fluctuations enabling the identification of a minimum flow rate at any given head, hence protecting the specifier, installer and the occupant.

The Foundation's Test Certificates issued for certified grates are available on our website and clearly detail the stable and transitional flow conditions which allow design professionals to specify products with confidence.

To safeguard your clients, make sure that the roof and balcony grates are tested to the AHSCA Research Foundation protocol.

“When considering the obligations of all professionals involved in a project, such as residential implied warranties and guarantees, the requirement for all components to be fit for purpose is paramount”



AHSCA Codes and Standards Reps.

The Foundation is seeking suitably qualified members from all member States to be our voice on Codes and Standards.

The restructure now encourages enthusiastic individuals to work as part of the national Codes and Standards team to help shape the future of our industry.

Our team members will be at the forefront of regulatory change, keeping members informed of proposed changes and assisting the Foundation with formal submissions to State and National regulators.

Each team member will consult with other interstate team members and keep their State Chapters up to date with proposed and pending changes.

An ability to provide both written and oral presentations with the view of keeping your industry peers informed is desired.

Please contact your State President to register your interest in being part of this exciting team.

A nationally inclusive approach to Codes and Standards for all AHSCA Foundation member representatives.

In 2015, the Association of Hydraulic Services Consultants Australia (Limited), the former national body, was de-registered. As an interim measure, the AHSCA State Chapters agreed to an informal discussion group (not a legal entity) called the National Technical Council (NTC).

During the formation of the AHSCA Research Foundation Limited in 2016, all AHSCA State Chapters agreed and committed to a Constitution that requires the Foundation to “*make representations and applications to government bodies and or regulators (National and State based) that represent the interests of its members*”.

Accordingly, late last year, the State Chapters of AHSCA voted that the informal NTC group should be disbanded and that all representations and associated activities related to the former NTC should be managed by the Foundation. These activities include all matters related to Standards and Codes.

The decision to disband the NTC was primarily due to the fundamental governance issues related to any informal body. The inability to secure insurance for its representatives, inability to obtain a bank account and lack of formalised operation rules and objectives are just a few of the issues associated with these types of structures.

Subsequent to this decision, AHSCA NSW resigned its membership of the Foundation therefore excluding its members from enjoying the opportunity of advanced training and ongoing access to the Foundation’s ever-increasing innovative design solutions. This is a disappointing outcome for the NSW members however; such circumstances can now only be resolved at State level by the NSW membership via consultation with its Executive.

Historically, the NSW Chapter’s David Wood has represented the AHSCA State Chapters on Standards and Codes. David’s contribution over the past 20 years has been significant and all State Chapters are appreciative of his efforts. The Foundation wishes David and the NSW Chapter all the best in its future endeavours.

The restructured management of Standards and Codes under the Foundation umbrella now allows for a broader cross section of opinion and expertise to make contributions by drawing on a much larger and diverse knowledge base. The new arrangements will also ensure that all members are kept up to date with proposed changes and have the opportunity to discuss and debate any proposal at their State Chapter meetings.

Each of the member States is seeking applications from prospective Codes and Standards coordinators to review, disseminate and comment on upcoming changes and amendments. To get involved in this important process, please contact your State President for local nomination requirements.

The Foundation is also seeking a National Codes and Standards representative who will be responsible for coordinating the State based representative responses and making formal position recommendations directly to the Foundation.

Any full voting member of any affiliated State Chapter is encouraged to make enquiries for this exciting position via their State President.

Member Training (Module 1)

The Foundation's national training program presented training courses in all member States in the later part of 2017. The Module 1 Course was presented by lead researcher Dr Terry Lucke and focused on the calculation of rainfall catchments and the deemed to satisfy requirements of AS/NZS 3500.3.

The Module 1 course was a full day training course and included a competency exam at the end of the day to ensure participants could demonstrate proficiency. Course participants were also advised of errors and omissions contained in the regulated



Standard, many were surprised of their existence and the potential impact they can have on preparing compliant designs.

The common consensus of the participants was the complexity of the Standard and the multiple steps and variables that need to be calculated or considered to complete even the simplest of designs are confusing.

To solve this problem, the Foundation has developed an on-line calculator that will dramatically reduce design time for the members whilst also reducing the chances of designer error caused by the convoluted manual process. All graduates of Module 1 will have access to the Module 1 Online calculator free of charge.

To register for the next Module 1 Training Course in your State, contact your State Representative.



Module 2: Advanced Training

Graduates of Module 1 (full members) are eligible to enrol in the Advanced Performance Based techniques (Module 2) developed from our three-year research project.

This course is currently under development in conjunction with the Stage 2 calculator and will enable our members to design box gutter flows of up to 100 l/s to a single outlet as well as providing our members with another six primary outlet and overflow configurations.

The course and Stage 2 calculator will be rolled out to the States during 2018 enabling graduates to offer



dramatic performance enhancements and design simplicity to their clients.

Members must be aware that registration, participation and accreditation for the performance based design methods developed by the Research Foundation are predicated on each member successfully completing Module 1.

As all courses are subject to minimum student numbers (15) and maximum class sizes (25), it is important that you register your interest with your State Chapter representative as soon as possible to allow those courses to be booked by the Foundation.

THE NEW WORLD OF ROOF DRAINAGE DESIGN IS HERE!

New Foundation Appointments

The Foundation is pleased to announce the appointment of Joseph (Jos) Steele as Director.

Jos is a Director of one of Australia's leading multi-discipline engineering firms, Norman Disney & Young and is their Melbourne Office Manager.



Joseph Steele - AHSCA Research Foundation Director

"As the Foundation continues to grow and deliver more and more products and services to its members and the broader industry, the Foundation felt it important to seek out talented and experienced professionals for appointment to the Board. Jos' experience and knowledge of both industry and business further compliments and strengthens the Board's resources. We are all really pleased to have him on the team."

Mark Alexander (AHSCA Research Foundation -Chairman)

Next Research Projects?

The Foundation is committed to continuing world-class research in all aspects of hydraulic services design. With our current infrastructure already in place, it is proposed to utilise our test facility at USC in the immediate future. There is also opportunity that we may run concurrent research projects with joint venture partners on non-roof or stormwater related matters.

The test facility already has considerable bookings for 2018 (to be announced soon) related to product testing and certification; these commitments will run simultaneously with new research opportunities where possible.

Some exciting research possibilities may be:

- Corners in box gutters
- More overflow options for box and eaves gutters
- Siphonic vs. traditional outlet blockage comparison
- Gutter sizing for Siphonic systems
- Extended gutter lengths (on grade expansion joints) to take advantage of new maximum flows

Do you have any suggestions? Talk to your State Chapter representative and let them know. You never know, we might just do it!

Contact Info:

The Foundation is managed wholly by part-time volunteer representatives who receive no remuneration for the many hours involved in developing and managing research projects, private testing, publication development, training courses, software development and the like. Many of the difficult and enormously time-consuming tasks undertaken by the Foundation members are back of house, mundane activities that are normally undertaken after a long day at work or on the weekend. Feel free to let the team know you appreciate their efforts, I certainly do!

Mark Alexander - Chairman

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