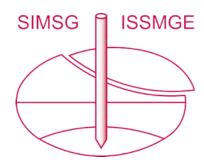
INTERNATIONAL SOCIETY FOR SOIL MECHANICS AND GEOTECHNICAL ENGINEERING



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with an oncoming wet period and use a Δus of 1.6pF. This would increase the ys value by about 13% and possibly a whole classification higher. Using figure 15 and an average Ips of 4.7% this y_s would be ≈ 95 mm and $y_m \approx 57$ mm.

In all climate conditions the models can also be modified to allow for varying Hs, Ueq and Δus values. It should also be noted that, due to the effect of the curvilinear relationship, the *I*ps values are higher at <4pF and lower at >4pF, therefore Ips values should be calculated from two tangents as in figure 6.

CONCLUSIONS. 6

The investigations for this paper have been carried during a fortuitous period which included the Millennium drought that lasted 20 years but interrupted by two one year long 'transitional' periods. From mid-2010 there were two consecutive flooding years followed by 3 short droughts which were interrupted by short 'transitional' periods culminating in the Black Summer bush fires in 2019-2020 and a wet La Nina event from late 2020 to the present.

The aim was to gather data about surface suction variation, house concrete slab performance and, soil moisture to determine whether new and extended models in AS2870 could be designed for the characterization of ground foundation movement in an increasingly chaotic climate.

The results from 5 investigations were compared and new models presented for 'normal' and 'abnormal' foundation moisture conditions by extending the AS2870 methodology.

The results of this research indicated the following:

- a) The Millennium drought and the very wet period that followed, caused considerable damage to many thousand houses in the reactive clay areas in Australia.
- b) The AS2870 classification model designed in the 1980's was not adequate for recent climatic conditions and controlling authorities have not made the necessary changes to AS2870.
- c) The site preparations practices have never been adequate since the expansion of subdivisions into highly reactive clay areas and reduction in allotment size.
- d) AS2870-2011 has not been reviewed since it was completed in 2009 and the building industry has missed all the warnings given by many practitioners in the late drought and the information learned from the flood of 2011 and since.
- e) This paper proposes a few solutions worth considering especially for problems on sites with 'abnormal' moisture condition and reactive clays in Australian conditions.
- The authors recommend further research into the relationship of TMI, and H_s depth, damage contribution by inflexible pipes and the effect of chemicals of water home discharges in highly expansive or soft soils is warranted.

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REFERENCES

Australian Standard 1996 kAS2870-

Bureau of Meteorology 1993, "Climate of Victoria, Bureau of Meteorology, Commonwealth Government, of Australia.

Buxton M. Osman-Schlegal N. & Lopes D. 2016, "Soil Moisture and rural Land Use in Victoria, Australia - ASEAN Australia Engineering Congress, Kuching, Malaysia.

Cameron D.A. & Yttrup P.J. (1992), "Footings for light structures in the Reactive Soils of Melbourne". Proc. Seminar Engineering Geology of the Melbourne District pp345-354.

Fityus S.G. Walsh P. F. & Kleeman P. W. 1998, "The influence of climate by the Thornthwaite moisture index on the design depth of moisture

- change of clay soils in the Hunter Valley" Conference on geotechnical engineering and engineering geology in the Hunter Valley, Springwood, Australia.
- Fityus S. G., Allman M.A. & Smith D. W., 1999. "Mound Shapes beneath Covered Areas". Australian Geomechanics.
- Fityus S. G. & Buzzi O., 2008 "On the use of Thornthwaite Moisture Index to Infer Depths of Seasonal Moisture Change" Australian Geomechanics Publication, Vol. 43-4.
- Fredlund D. G. Cheng D. & Zhao J. 2011, "Estimation of Soil Suction from the Soil -Water Characteristic Curve" Published by NRC
- Fredlund D. G.& Houston S L. "Interpretation of Soil-Water Characteristic Curves when volume change occurs as Soil Suction is changed".
- Fredlund D. G. & Xing A. "Equations for soil-water characteristic curve". Karunarathne A. 2016, "Investigation of Expansive Soil for Design of Light Residential Footings in Melbourne". PhD thesis, Swinburne University of Technology, Melbourne, Australia.

 Li J. & Cameron D. 2002, "Case study of courtyard house damaged by
- Expansive Soils" Journal of Performance of Constructed Facilities.
- Li J. 2002, "Two Dimension Simulation of a Stiffened Slab on Expansive Soil subject to a Leaking Underground Water Pipe. Journal of Performance of Constructed Facilities.
- Lopes D. & Karunarathne A. "A new approach for Characteristic Expansive Clay Sites" Faculty of Engineering and Industrial Sciences, Swinburne University of Technology, Melbourne, Australia.
- Lopes D. & Karunarathne A "Moisture and suction changes pre and postconstruction in expansive clays during a recent extreme climate". Faculty of Engineering and Industrial Sciences, Swinburne University of Technology, Melbourne, Australia.
- McManus K.J, Lopes D. & Osman N., 2004 "The Effect of Thornthwaite Moisture Index Changes on Ground Movement Prediction in Expansive Soils in Australia". 9th Australia-New Zealand Conference on Geomechanics. Auckland.
- McManus K.J., Mann A. "What is Soil Suction" Swinburne University Mitchell P W., 1984 "The Field performance of Taft Footings for building on expansive soil". 5th S.S. Conference on Expansive Soils, Adelaide, Australia. Australian Geomechanics Society (S.A. Group) & Institution of Engineers, National Conference. 84-3.
- Mitchell P W. 2008., "Footing Design for Residential Type Structures in Arid Climates". Australian Geomechanics Journal., 43-4, p.51-68.
- Nelson J. Chao K. C. & Overton D. D. & Nelson E. J. "Foundation Engineering for Expansive Soils".
- Omar M. A. & Bulut R., 2020, "Non-linear Determination of Suction Compression Index in Expansive Soils for Heave Prediction". ASCE Geotech Geo-environ, England.
- Osman N. & Lopes D., 2010, "Changes of the Thornthwaite moisture indices in Victoria from 1948-2007 and effect on seasonal foundation movements". Australian Geomechanics Journal., 45, p.37-48
- Pham & Fredlund D. G., 2008, "Equations for the entire soil-water characteristic curve of volume change in soil", Published on the web 17 April 2008. Canadian Geotechnical Journal, 45, p.443-453.
- Walsh P. F., Fityus S. & Kleeman P., 1998, "A Note on the Depth of Design Suction Change for Clays in Southwestern Australia Southeast Queensland". The Australian.