COMMERCIAL-IN-CONFIDENCE
Report prepared on behalf of Unisearch Expert Opinion Services
A business of the University of New South Wales

CERTIFICATION OF STRUCTURAL SYSTEM

for

Dincel Construction System
Your reference: Berkay Dincel

by

Emeritus Professor Mark Bradford
Emeritus Scientia Professor
Founding Director, Centre for Infrastructure Engineering & Safety

Date of Issue: 25 January 2024
Our Reference: UN207742

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SCOPE AND SUMMARY

1 This report outlines a structural appraisal, for the purposes of certification, of the patented concrete formwork system of Dincel Construction System Pty Limited. It was undertaken by Scientia Professor Mark A. Bradford of the Centre for Infrastructure Engineering and Safety at the University of New South Wales on behalf of Unisearch Expert Opinion Services.

2 It presents firstly a letter of certification of the product, and then addresses in more detail the Engineering Manual of the Dincel formwork product.

3 This Revision 6 is required for the following reasons:
The introduction of AS3600 – 2018.
The introduction of 155 mm thick and 275 mm thick Dincel Walls.

4 The report concludes that, on the basis of the methodology used in the assessment, the Dincel formwork system performs satisfactorily when used in conjunction with the Dincel Construction System Manuals, and that the Structural Engineering Design Manual are consistent with design clauses and practice in relevant international structural engineering codes of practice, in particular the widely-used Eurocode EC2 and American ACI 318 Building Code Requirement, and the AS3600-2018 Concrete Structures Code.

LETTER OF CERTIFICATION

15th January 2024

Our Ref: UN207742

UNSW SYDNEY

Scientia Professor Mark A. Bradford
RESEARCH DIRECTOR
Centre for Infrastructure Engineering and Safety

Dincel Construction System Pty Limited
PO Box 104
St Clair, NSW 2759

Dear Sirs

Dincel Construction System
Structural Engineering Certification

I have conducted an expert review of the Dincel Construction System's Structural Engineering Design Manual (3S Structural Engineering Manual) and its Construction Manual.

Specifically, the *Structural Engineering Design Manual* addresses material properties as well as the structural design of axially loaded walls subjected to vertical loading in sway prevented structures, flexural members that are subjected to bending and shear effects and shear walls. The *Construction Manual* deals with the Dincel Wall components, architectural planning layouts, installation and detailing recommendations.

I am satisfied that the design principles and methodologies in these manuals are appropriate and consistent with the design clauses in the relevant and frequently used international structural engineering codes of practice, such as the ACI 318 and Eurocode EC2 mentioned in the Dincel Construction System's Engineering Manual, and in particular with AS3600 - 2018 Concrete Structures.

I am satisfied that the walls and columns of the Dincel Construction System, when designed in accordance with the *Structural Engineering Design Manual*, will comply with AS3600 - 2018 Concrete Structures. Dincel Walls and Columns will comply with the Deemed-to-Satisfy Provisions B1D4 and Specification 1 (S1C2) from Volume 1, Specification 1 (S1C2) from Volume 2, and Part 2.2.4 from the Housing Provisions of the Building Code of Australia.

Based on the aforementioned evaluation and review, I certify that the use of the Structural Engineering Design Manual complies for the purposes of structural engineering design.

Yours faithfully

Mark Bradford.

MARK A BRADFORD
BSc BE PhD DSc FTSE FIStructE FIEAust Dist.MASCE

REVIEW OF DINCEL CONSTRUCTION SYSTEM – STRUCTURAL ENGINEERING DESIGN MANUAL

5 The *Dincel Construction System Manual* has been reviewed by the consultant and conforms with current design practice for concrete walls and columns.

UNREINFORCED CONCRETE WALL/BLADE COLUMN DESIGN

3S-3.2.2 Structural Engineering Design Manual

6 AS3600-2018 requires a minimum reinforcement ratio for concrete walls in structural design, as stated in Section 11.7. When the point of application of a load in a rectangular cross-section of depth d is such that its eccentricity *e* (relative to the geometric centroid defined by the depth *d*/2) is such that

$$-\tfrac{1}{3}\left(d/2\right) \le e \le \tfrac{1}{3}\left(d/2\right),$$

the combined effects of pure compression and bending do not result in tensile forces, and most design codes (such as the Eurocode EC2 and American ACI 318) do not require reinforcement in this case. When the loading lies outside this 'middle third', AS3600 - 2018 requires the wall design to include bending effects and the consequent need for reinforcement, as in Section 11.2.

7 The minimum reinforcement requirement in AS3600 - 2018 relates to shrinkage effects, and to the cracking that may occur because of shrinkage deformations. It is also based on thermal requirements in concrete walls where the concrete is exposed directly to fire. These shrinkage deformations are more profound in situations which result in rapid moisture egress during curing, such as hot dry conditions which may be present at the time of removal of conventional formwork. The presence of the impervious membrane in the Dincel system retains moisture during curing, and produces a benign environment for concrete curing, and thereby eliminates the inherent difficulties that such shrinkage cracks which are present in conventional concrete walls.

8 The comparison between Section 11 of AS3600 - 2018, Section 14.5 of ACI 218 and Section 12.6.5 of Eurocode EC2 for wall design that is given in the *Dincel Structural Engineering Design Manual* demonstrates very close agreement between these Standards. The formulation of ACI 318 shown in the *Dincel Structural Engineering Design Manual* is the empirical formula given in Section 14.5 of ACI for unreinforced plain concrete walls. These formulations provide conservative results for the load carrying capacity of walls, because no reinforcement is provided in the formulations, even for the purposes of crack control. The design engineer may therefore choose Section 11.5 of ACI 318 if minimum reinforcement is provided for crack control, which will provide a higher load carrying capacity than the provisions of Section 14.5 of ACI 318 or Section 11 of AS3600 - 2018. Eurocode EC2 offers a similar approach by adopting a capacity reduction factor of 0.8 or 1.0 for unreinforced and reinforced cross-sections.

9 The difference between Sections 14.5 and 11.5 of ACI 318, although being identical formulae, is the load carrying capacity factor of (0.55 × 0.65) / (0.45 × 0.60) = 1.32, so that Section 11.5 with minimum reinforcement provides 32% additional capacity (0.60 and 0.65 are the respective capacity reduction factors of the ACI).

10 The approach adopted in Section 11 of AS3600 - 2018 for wall design, although being the same as that of ACI 318, requires minimum reinforcement for crack control. Therefore, it is clear that the approach of AS3600 - 2018 is more conservative than that of Section 14.5 of ACI 318 since it requires minimum reinforcement, so that the provisions of AS3600 - 2018 should be compared with Section 11.5 of ACI 318 and not with Section 14.5 of the ACI.

11 The crack inducers and the permanent polymer enclosure in the Dincel Wall ensure that the crack control mechanism is established, and **so there is no need for additional minimum vertical and horizontal reinforcing steel requirements for crack control** for a cross-section in compression for a design based on Section 11 of AS3600 - 2018. Because the crack control

mechanism in the Dincel Wall eliminates the need for minimum reinforcing steel, Australian design engineers could use Section 11.5 of ACI 318 with the Dincel Wall product for higher load carrying capacity directly, even without the use of minimum reinforcement since crack control is provided. However, the Dincel Wall capacity conservatively adopts Section 14.5 of ACI 318 and Section 11 of AS3600-2018 without the use of reinforcement.

12 The commentary to Section 14 of ACI 318 recommends the use of Section 11.5 rather than Section 14.5 if the walls of multi-storey buildings or major structures subject to differential settlement, wind, earthquake or other unforeseen loading conditions are required to possess the same ductility and ability to maintain their integrity when cracked. It must be borne in mind by the design engineer that the Dincel Wall recommends the use of unreinforced wall design under the following conditions:

(i) The sway is prevented by the presence of shear walls which are reinforced, both vertical and horizontally, by steel reinforcement.

(ii) The remainder of the concrete walls can be designed as being unreinforced if Dincel Walls are part of the sway-prevented structure, i.e. when shear walls are provided. However, this is subject to the following additional conditions and considerations:

a. Dincel crack inducers provide crack control and hence uncontrolled cracking is not an issue with the structural behaviour.

b. The wall that is already cracked by the presence of the crack initiators must be connected to the floor slab above it with ‘ L ‘ bars, and with dowel bars at the bottom of the wall. These reinforcement provisions establish the joint ductility of a wall which has a pin connection at its bottom and a translational lateral restraint at the top, as shown in the *Dincel Construction System Manual*.

c. Dincel Wall that is used as a non-shear wall without horizontal reinforcement and that is cracked can be designed without vertical reinforcement subject to the following further provisions:

   - The loading eccentricity $e < t/6$, i.e. the load acts within the middle-third of the cross-section of thickness t.

- The cross-section in question is in compression (the Dincel Wall therefore does not rely on the tensile capacity of concrete or of the polymer skin); <u>and</u>
- There are no sustained loads present that will develop long-term creep effects (for example, Dincel Wall requires vertical reinforcement usage for lateral soil pressure), and if it is the axial compression that causes creep, the stress level within the cross-section of the wall is relatively low; and
- The wall in question is not subjected to wind or earthquake loading that creates tensile stress on the cross-section, or to earth or liquid retaining loads. As specified clearly in the *Dincel Construction System Manual*, these walls require vertical reinforcement, but do not require horizontal reinforcement for crack control unless horizontal reinforcement is specified by the design engineer for flexural purposes.

13 The designer should also note that the Dincel Wall's polymer encapsulating concrete enhances the ductility of plain concrete, because the benign curing environment that it creates produces a higher tensile capacity and reduced brittleness. The provisions of the Dincel Wall address the concerns of the commentary to Section 14.5 of ACI 318.

14 Clause 11.7.2 of AS3600 - 2018 clearly defines that the specified minimum horizontal reinforcement is for crack control due to shrinkage and temperature effects. However, the same clarification for minimum vertical reinforcement usage in Clause 11.7.1 of AS3600 - 2018 is not defined, and this appears to cause some confusion amongst AS3600 code users. Australian practice does not restrict the use of other well-accepted codes, such as the Eurocode EC2 and American ACI 318, and the provisions for unreinforced plain concrete wall design given in these codes can be adopted by Australian practitioners. In fact, it is widely-known that many provisions in AS3600 were adopted from the Eurocode and American codes.

15 It should be noted that Dincel Construction Systems crack inducers and permanent polymer formwork as designed under the previously described conditions will not require the use of both vertical and horizontal reinforcement. Based on the clarification above provided by ACI 318, it is acceptable for design engineers to ignore the minimum reinforcement requirement as defined in AS3600 - 2018 Clauses 11.7.1 and 11.7.2 when designing a Dincel Construction Systems walling system.

16 ***The Consultant agrees with the engineering methodology presented in Section 3.2.2 – Unreinforced Concrete Wall Design of the Dincel Construction Systems Manual as being technically sound and appropriate.***

NON-DUCTILE STRUCTURAL WALL REINFORCEMENT REQUIREMENTS TO AS3600 - 2018

17 AS3600 – Clause 14.2.10 states that structural walls may be considered as Non-Ductile, Limited Ductile or Moderately Ductile. Clause 14.4.4.1 communicates that non-shear walls subjected to vertical compression forces, buckling in a one-way direction, can be designed as non-ductile walls of a sway prevented structure in accordance with Section 11.

18 Clause 11.5.2 lists certain limitations on the use of Clause 11.5.3. For example, Clause 11.5.2(a) states that structural walls designed using Clause 11.5.3 shall "be limited to a maximum design axial stress of 3 MPa unless vertical and horizontal reinforcement is provided on both wall faces……" However, the formula within Clause 11.5.3 does not refer to any reinforcement usage (i.e. there is no area of steel within this formula). Therefore, the design engineer must look to Clause 11.7 in order to seek the minimum reinforcement required.

19 Section 3.2.2 of the Dincel Construction System Structural Engineering Design Manual explains shrinkage and thermal reinforcement requirements and the function of the Dincel crack inducers/controllers. **Therefore, the**

horizontal reinforcement requirements of AS3600 – Clause 11.7.2 for crack control do not apply when designing a Dincel Wall.

20 Clause 11.7.1(b) states that for a wall designed for one-way buckling, and where there is no restraint against horizontal shrinkage or thermal movements, the use of horizontal reinforcement may be reduced to zero if the wall is less than 2.5 m wide. This represents the case for all Dincel Walls as the crack inducers/controllers are at spacings far less than the 2.5 m width referred to in this clause. **Therefore, the horizontal reinforcement requirements of AS3600 – Clause 11.7.1(b) do not apply when designing a Dincel Wall for one-way buckling.**

21 Clause 11.7.1(a), contrary to what EuroCode and ACI 318 allow, requires minimum vertical reinforcement. The minimum required vertical reinforcement ratio is allowed to be reduced from 0.0025 to 0.0015 when the design axial compressive force does not exceed the lesser of 0.03 f'c and 2 MPa. In accordance to the commentary for AS3600 – 2018, the minimum vertical reinforcement is required for robustness purposes for a lateral force resisting system.

22 **Therefore, even when the design axial stress is greater than 3 MPa, Dincel Wall in a sway prevented structure can be designed as a non-ductile wall with zero horizontal reinforcement and minimum vertical reinforcement to satisfy AS3600 Clauses 11.5.3, 11.7.1(a), 11.7.1(b), and 11.7.2.**

SHEAR WALL THICKNESS

23 The earthquake tests conducted by the University of Technology Sydney, available on the Dincel website, clearly demonstrate that significant lengths of shear walls are required to resist major earthquakes. The length of shear walls commonly available in building lift shafts is very much less than the shear wall length that is normally required for significant earthquake design loads. For this reason, engineers often introduce additional lengths of shear walls.

24 Experienced earthquake design engineers would know that the stiffness of a shear wall is achieved by increasing the length of the wall and not necessarily by increasing its width. The increase of wall thickness from 200 mm to 250 mm or even 350 mm produces an insignificant stiffness increase in comparison to that achieved with an increase in length.

25 There is therefore no need to exceed a 275 mm Dincel Wall thickness for a shear wall, provided that the compressive stresses are resisted by providing an adequate length of Dincel Wall.

WATER/CEMENT RATIO IN CONCRETE MIX DESIGN

26 Fire engineering and fire fighting systems are in a constant state of upgrading, and hence the fire requirements of engineering codes are also being upgraded. The upgrade of the fire section in AS3600 – 2009 was an example of this. The fire section of AS3600 now adopts the principles of Eurocode EC2. The Eurocode EC2 BS EN 1992 – 1 – 2 : 2004 – Clause 4.5.1 recommends 3% moisture content by weight to control the spalling of concrete under cellulosic fire conditions. This correlates approximately to a water/cementitious (water/binder) ratio of 0.4 ~ 0.45 (by weight); however considering the time of construction prior to occupancy of the structure, this ratio should not exceed 0.5 when fire in a structural design is considered. It is known in concrete materials science that when a concrete mix with water/binder ratio exceeding 0.7 (by weight) is used, the moisture content of the concrete will exceed 3% (by weight), even after very long periods of time.

In addition, designers should be aware that a relative humidity greater than 90% alone will provide 3% (by weight) moisture content. As a result, a concrete mix having water/cement ratio greater than 0.5 (by weight) will exceed the limit given by Eurocode EC2, unless the concrete is covered by an impervious membrane for ambient moisture conditions of the surrounding environment not to be absorbed by the porous concrete. It is therefore recommended that design engineers should specify the water/cement ratio in addition to 28 days concrete compressive strength normally specified to comply with AS3600 or Eurocode EC2.

27 One way to ensure the quality of supplied concrete for critical members such as walls is to specify Self Compacting Concrete (SCC), which will guarantee that the concrete use will have water/binder ratio ≤ 0.5 (by weight).

USE OF EUROCODE EC2

28 The major revision for AS3600 – 2009 was for Section 5, Fire engineering design and definition of column in Clause 5.6.2. The previous codes only considered wall thickness for structural fire adequacy purposes.
AS3600 – 2018, Clause 5.7.2 for structural adequacy under fire conditions is based on the lower tier method of Eurocode EC2 which currently requires an engineer to consider the applied loads and slenderness in addition to wall thickness. This very approximate method of Table 5.7.2 of AS3600 may not be considered appropriate; in fact, not applicable for, particularly lightly loaded members with high slenderness and increased load eccentricities.
AS3600 – 2018, Clause 5.3 offers Eurocode’s EC2 more refined solutions for higher tier design methodology.

29 A higher tier design offered in Eurocode EC2 consists of the Zone Method which is adopted by the Dincel Design Tool (refer Dincel Structural Engineering Design Manual, Clauses 3S-3.2.1.3 and 3S-3.2.5). For structural adequacy purposes this higher tier method requires consideration of applied loads, slenderness ratio, applied load eccentricity for first order and allowance for geometrical imperfections and concrete’s compressive strength.

30 Any structure under fire loads shall be more critical than when subjected to axial gravity loads only. It is therefore acceptable for an Australian engineer to adopt the use of Eurocode EC2 in lieu of AS3600 – 2018, Section 11 strength design without fire as well. I have reviewed the Dincel Structural Engineering Manual which includes the Dincel Design Tool incorporating the use of Eurocode EC2 for walls and blade columns.

DINCEL WALL COMPLIANCE WITH THE "DEEMED TO SATISFY" DEFINITION OF THE BCA

31 The structural engineering certification issued at the beginning of this report states that Dincel Wall can be designed to AS3600 and complies with the BCA.

32 For the benefit of non-technical or less experienced engineers, Dincel Construction System has requested a further explanation of whether the Dincel Wall complies with the "deemed to satisfy" definition of the Building Code of Australia (BCA).

33 This explanation is required so that the design engineer understands that Dincel Wall is no different from conventional concrete walls defined in structural engineering codes.

34 The Building Code of Australia's (BCA) approval methods for concrete walls are as follows:

(i) Compliance with the "deemed to satisfy" definition of the BCA by designing to AS 3600, or

(ii) A performance solution being carried out. For the purposes of structural engineering, the performance solution must demonstrate that it is at least the equivalent of the "deemed to satisfy" provisions. This therefore requires a performance solution to demonstrate by the method of testing as shown in AS3600 – 2018, Appendix B, i.e. the test load shall simulate 100% of the design loads.

35 The only difference between a Dincel Wall/blade column and a conventional wall is the presence of a permanent polymer membrane. The following comments would therefore be relevant:

- Dincel's polymer formwork has been tested, with a CodeMark Certificate of Conformity being issued for fire compliance with the relevant BCA provisions.
- The Dincel Structural Engineering Design Manual, Clause 3S-3.2.3, Polymer Reinforced Design clearly states that the permanent polymer formwork is not included in any strength design or for fire design purposes. If the Dincel polymer is stripped, the remaining component is concrete with or without reinforcement. Therefore, the designer can ignore the presence of the Dincel permanent polymer for axial, flexural or shear strength purposes; however the waterproofing quality verified by the CSIRO and AS3735 tests can be utilised to assist the durability Section 4 of AS3600 – 2018.
- The prototypes tested throughout the evolution of structural concrete to develop the reinforced or unreinforced concrete science of today consisted only of either plain concrete, or reinforced concrete consisting of steel bars. If steel reinforcement bars are used, they must have adequate concrete cover to suit the exposure conditions for durability. AS3600, Clause 4.10.3 requires prescribed concrete cover to any steel reinforcement or metallic embedded component built into the concrete for durability purposes, since AS3600 does not consider membrane systems or even galvanising to avoid its concrete cover requirement. The steel bars or metallic components will always have a minimum of 20 mm of concrete cover, even though the Dincel polymer and joints offer a waterproof membrane at each face of the wall. Polymers, unlike metals, do not require any concrete cover for corrosion protection. Therefore, there is no issue as to why Dincel Wall cannot be treated the same as the prototype forms on the basis of conventional concrete walls.
- During a fire event, the additional concrete spalling because of the expansion of steel bars/embedded metallic components without adequate concrete cover in a concrete wall/blade column, particularly under

compression, can lead to premature structural slenderness failure depending on the applied load level. As a result, AS3600, Section 5 requires a minimum concrete cover to control concrete spalling under fire conditions. Therefore, the designer should ensure that the concrete cover to the steel bars/metallic components is in accordance with AS3600 – 2018, Section 5.

36 As a result and as confirmed in this report, Dincel Wall can be engineered to comply with AS3600, ACI and Eurocode EC2. The prototypes which formed the basis of engineering codes such as ACI and Eurocode EC2 are identical with Dincel Wall with the exception of the permanent polymer formwork. Design engineers can therefore consider the presence of the waterproof Dincel polymer as permanent formwork which improves the curing of the concrete and eliminates the durability concern of plain or reinforced concrete, offering longer life sustainable structures.

37 A design that is compliant with AS3600 means that it is in compliance with the “deemed to satisfy” definition of the BCA. It is therefore clear that Dincel Wall with or without reinforcement can be engineered to comply with ACI or Eurocode or AS3600, and hence complies with the “deemed to satisfy” definition of the BCA.

CONCLUSION

38 I agree with the engineering methodology presented in the Dincel Structural Engineering Manual as being technically sound and appropriate for use by Australian engineers.

Mark Bradford.

Emeritus Professor Mark A Bradford
BSc BE PhD DSc FTSE FIStructE FIEAust Dist.MASCE

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Gate 14, Barker Street
UNSW SYDNEY NSW 2052

APPENDIX A

Curriculum Vitae

Unisearch Expert Opinion Services

CURRICULUM VITAE	Professor Mark BRADFORD

Qualifications

- Bachelor of Science (BSc), University of Sydney, 1977
- Bachelor of Engineering (BE) (Hons 1), University of Sydney, 1979
- Doctor of Philosophy (PhD), University of Sydney, 1984
- Doctor of Science (DSc), University of New South Wales, 1988

Present Position

Scientia Professor and Professor of Civil Engineering
Centre for Infrastructure Engineering and Safety (CIES)
School of Civil and Environmental Engineering,
University of New South Wales

Principal
Advanced Structural Consulting Pty Limited, Sydney

Areas of Expertise/ Special Interests

- Structural Engineering
- Steel
- Concrete and Composite Structures
- Engineering Mechanics
- Numerical Modelling

Affiliations

- Fellow, Australian Academy of Technological Sciences and Engineering (FTSE)
- Distinguished Member, American Society of Civil Engineers
- Fellow, Institution of Engineers, Australia
- Fellow, Institution of Structural Engineers (UK)
- Chartered Professional Engineer (CPEng), Australia
- Chartered Engineer (CE), UK
- Professional Engineer (PE), USA

Employment Experience

2016 - Current	**Expert Assessor** European Research Council, Brussels
2000 - Current	**Principal** Advanced Structural Consulting Pty limited, Sydney
2018 - 2020	**Distinguished Professor** Guangzhou University, China
2010 - 2015	**Australian Laureate Fellow** The University of New South Wales
2010 - 2012	**College of Experts** Australian Research Council
2010	**Dean, Faculty of Engineering and Information Technology** University of Technology, Sydney
2009	**Visiting Professor** The University of Hong Kong
2009	**Visiting Professor** City University of Hong Kong
2008	**Visiting Professor** Yonsei University Korea
2006	**Visiting Professor** The University of Toronto, Canada
2006 - 2010	**Foundation Director** CIES, The University of New South Wales
2004 - 2009	**Federation Fellow** The University of New South Wales
2002 - 2004	**Australian Professorial Fellow** The University of New South Wales
2001 - 2003	**Expert Advisory Committee** Australian Research Council

1999 - 2010	**Professor of Civil Engineering** The University of New South Wales
1996	**Visiting Professor** The University of Strathclyde, UK
1994	**Visiting Professor** The University of Edinburgh, UK
1992 - 1998	**Associate Professor in Civil Engineering** The University of New South Wales
1990	**Visiting Associate Professor** University of Minnesota, USA
1986 - 1992	**Lecturer / Senior Lecturer in Civil Engineering** The University of New South Wales
1985	**Postdoctoral Fellow** University of Warwick, UK
1984	**Postdoctoral Fellow** University of Sydney
1983	**Engineer** Wholohan Grill and Partners, Sydney

Editorial & Advisory Boards

- International Journal for Numerical Methods in Engineering
- Structures (Associate Editor)
- Engineering Structures
- Computers and Structures
- Thin-Walled Structures
- Progress in Structural Engineering and Mechanics
- International Journal of Structural Stability and Dynamics
- Advances in Structural Engineering
- Interaction and Multiscale Mechanics
- Steel and Composite Structures
- Advanced Steel Construction
- Electronic Journal of Structural Engineering

Standards Australia Committees

- BD/1 Steel Structures
- BD/23 Structural Steel (immediate past Chair)
- BD/32 Composite Construction
- BD/92 Evaluation of Structures

Awards and Fellowships

- NSW Premier's Award for Excellence in Engineering and Information and
- Communications Technologies (2015)
- Distinguished Member, American Society of Civil Engineers (2013)
- Engineers Australia's Structural College Eminent Speaker (2012-2013)
- Connell Gold Medal of Engineers Australia (2012)
- Shortridge Hardesty Award of the ASCE (2011)
- Australian Research Council's College of Experts (2010-2012)
- Australian Laureate Fellowship (2010-2014)
- Scientia Professorship (renewed) (2011-2016)
- Australia/Korea Visiting Fellowship (2008)
- Fellowship of the Australian Academy of Technological Sciences and Engineering (2007)
- Faculty of Engineering Research Excellence Award (2006)
- Australian Academy of Science Visiting Fellowship to North America (2006)
- Federation Fellowship (2004-2009)
- Scientia Professorship (2004-2010)
- Australian Professorial Fellowship (2002-2006)
- Australian Research Council's Expert Advisory Committee (2001-2003)
- Doctor of Science (1998)
- Royal Society Visiting Fellowship (1996)
- British Council Visiting Fellowship (1985)

University Committees (UTS)

- Vice-Chancellor's Committee (2010)
- Academic Board (2010)
- Faculty Board (Chair) (2010)
- FEIT Executive Committee (Chair) (2010)
- Industry Advisory Network (2010)

University Committees (UNSW)

- Council of The University of New South Wales (2006-2008)
- Vice-Chancellor's Postdoctoral Committee (1995-1999; 2004-2006)
- Qualifications Committee for Promotion to Professor, UNSW (2001-2003)
- Scientia Professorial Selection Committee (2002)
- Academic Board of The University of New South Wales (1992-1996)

Faculty and School Committees (UNSW)

- School of Civil and Environmental Engineering Research Management
- Committee (1996-2019)
- School of Civil and Environmental Engineering Senior Management Committee (1998-2010)
- Faculty of Engineering Research Committee (2001)
- Faculty Promotions Committee to Associate Professor (1995-1997)
- Faculty of Engineering Executive Committee (1992-1999)
- School Curriculum Review Committee (1991)
- Faculty of Engineering Higher Degree Committee (1988-1992)
- School Postgraduate Committee (1989-1992)
- Third Year Management Committee (1987-1990)
- Fourth Year Management Committee (1992-1995)

Professional Committees

- Australian Academy of Technological Sciences and Engineering, Membership Committee (2017-2019)
- Immediate Past President, ASCE Australia Section (2017-2018)
- Australian Academy of Science, Chairman, National Committee for Mechanical and Engineering Sciences (2016-date)
- President, ASCE Australia Section (2015-2016)
- Australian Academy of Science, Deputy Chairman, National Committee for Mechanical and Engineering Sciences (2016-date)
- Universities Australia-Elsevier Scopus Young Researcher Panel (2010-2014)
- Chairman, Composite Construction in Steel and Concrete VII (2013)
- Co-Chairman, International Conf. on Structures: Steel, Concrete, Composite and Aluminium, Sydney (2003)
- Vice-President, Association for Int. Cooperation and Research in Steel-Concrete Composite Structures (2000-2003)
- Chairman, 18th Australasian Conf. on Mechanics of Structures and Materials, Sydney (1999)
- Secretary, Int. Conf. on Structural Stability and Design, Sydney (1995)
- Board of Directors, The Univ. of New South Wales Club Ltd. (1993-1995)
- Chair of TAFE Migrant Education in Eng. Accreditation Committee (1992)

Publications

Books (Authored and Edited): 19

Chapters in Books: 21

Refereed Journals: ~ 460

Conferences: ~ 290

Recent Non-Confidential Consultancies

- Conzpec Civil Pty Ltd v Taylor Constructions Group Pty Ltd (2022)
  McCabe Curwood
- Museum of Contemporary Art ats Marilee Callister (2021)
  Barry Nilsson Lawyers
- Resolution Rigging Services Pty Ltd & anor ats Hamish Lawson (2021)
  McCabe Curwood
- Warren Sydney King v Insurance Australia Ltd (2021)
  McMahon Lawyers
- AddBuild Master Builders Pty Ltd ats Lucy Walker (2015)
  Curwood Lawyers
- Mohammed Ali Mourad e/b Wollongong GPT (2015)
  Kells
- Dispute between Dematic Pty Ltd and Nedcon Magazijninrichting PV (2014)
  TressCox – before the Hon. G.E. Fitzgerald AC QC
- R&D PanelForm Pty Ltd & ors -ats- Gillespies Crane Nominees Pty Ltd (2014)
  Yates Beaggi Lawyers
- Sweetie Developments Pty Ltd v RHB Stage 6 Lessor Pty Ltd and ors (2014)
  Holman Webb
- CSR Building Products – AFS LogicWall® System. Corrosion Durability Review (April 2014)
- Dincel & Associates Pty Limited. Certification of a Structural System (2014)
- John Bowman v Dana Steel Pty Ltd and ors (2012)
  RMB Compensation
- The Owners SP 61288 v Brookfield Australia Investments Ltd and ors (2012)
  Grange Lawyers