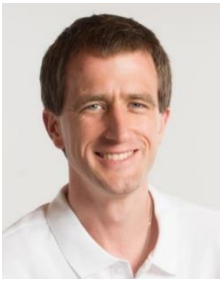
CURRICULUM VITAE – Prof Richard Walls [redacted]



Nationality	South African
Current Occupation	Full Professor – Stellenbosch University
E-mail address	rwalls@sun.ac.za
Languages	English (Excellent). Afrikaans (Conversational). Basic Biblical Greek.
Religion	Christian
YouTube Channel	https://www.youtube.com/channel/UCUZH8qYZwKToJa6n2T9FhyA
FireSUN Channel	https://www.youtube.com/channel/UCv1bBnE4i6eiuYFBEDO3K1Q

QUALIFICATIONS

PhD (Civil Engineering)	Stellenbosch University. 2013-2016.
MSc (Structural) (with distinction):	University of the Witwatersrand. 2009-2010.
G.D.E. (with distinction):	University of the Witwatersrand. 2009-2010.
BSc.Eng (Civil) (with distinction):	University of the Witwatersrand. 2005-2008
Pr. Eng.:	Registered as a professional engineer with ECSA. 2014.
BTh (with distinction):	SA Theological Seminary – Part-time studies. 2006-2013.

RESEARCH, PUBLICATIONS & UNIVERSITY

Research Interests and Experience

Prof Richard Walls is the head of the Fire Engineering Research Unit at Stellenbosch University, Africa's first research team with a focus on fire engineering and structural fire design. Various fire related topics are currently being investigated, such as the design of steel structures in fire, analysis of structures in fire, forensic fire investigations, 3D printed concrete in fire, materials behaviour, multi-storey timber fires and informal settlement fire behaviour. Full-scale fire tests on shacks have been conducted on around seventy homes to understand fire behaviour, spread and how to reduce the impact of such fires. The behaviour of different smoke and fire alarms in informal settlements has been carried out. Consulting work has been done for companies developing rational structural fire design systems, ascertaining the fire resistance of products, repairing fire-damaged structures (including high-profile national key points), forensic investigations and technical guidance on fire safety specifications. He was part of the team analysing the Knysna fire disaster, sponsored by Santam, and specifically considered why almost 1000 homes were lost in South Africa's largest wildland fire disaster. His research has been covered by multiple newspapers, radio stations and websites. Masters and PhD programmes in fire safety engineering have been developed. He runs postgraduate courses on structural fire engineering, fire dynamics and fire safety. His team has published the first technical guideline in the world for fire safety in informal settlements. He has contributed to publications by the World Bank, United Nations and various other organisations. He led the writing of South Africa's first infrastructure report card on fire safety infrastructure.

AWARDS & AFFILIATIONS

- “TW Kambule-NSTF Award: Emerging Researcher” of the year in South Africa in 2020. The national NSTF-South32 Awards are the largest Science, Engineering & Technology & Innovation (SETI) awards in South Africa, known as the 'Science Oscars'.
- Honorary Fellow of the SA Institute of Civil Engineering (SAICE) – 2021
- Excellence in Structural Engineering Education Award – Institution of Structural Engineering, UK – 2021.
- Academic of the year award – Faculty of Engineering, Stellenbosch University – 2019
- Emerging researcher of the year award – Faculty of Engineering, Stellenbosch University – 2017
- Best post-graduate thesis award – Department of Civil Engineering, Stellenbosch University – 2016
- Committee member – National Fire Protection Association (NFPA, USA) Foundation – Research advisory board
- Committee member – SAICE Fire Engineering Division
- Committee members – SABS technical committees for fire standards
- Member of the International Association of Fire Safety Scientists (IAFSS), Society for Fire Protection Engineers (SFPE), SA Institute of Civil Engineering (SAICE), Fire Protection Association of SA (FPASA).

UNIVERSITY RELATED INDUSTRY CONSULTING AND RESEARCH

Various specialist services have been rendered to industry, including examples as below:

- Arbitrations: Expert witness services (R1bn in projects)
- Cape Town Parliament fire investigation and analysis (> R2bn damages)
- Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) fire investigation and structural repair development (> R1bn damages).
- Fire testing of train materials under the PRASA Chair, based on R1bn arson damages to SA trains.
- Guidance to train manufacturer regarding product specifications and code compliance.
- Silo fire and structural repair recommendations for a severe agricultural fire.
- Development of fire design guidelines for industry products, e.g. Voidcon decks.
- Review of industry designs on structural and fire systems.
- Knysna fire investigation and analysis of homes lost (SA’s largest wildland fire incident).
- Development of fire guidelines for shipping container structures.
- Testing of suppression and other products for industry.
- Fire modelling for specialist products, e.g. large train manufacturing facility.
- Passive protection for timber structures.
- Development of fire safety material for informal settlements.
- Development of 3D concrete printing system incorporating recycled plastic.

PUBLICATIONS & RESEARCH

PhD Thesis – "A beam finite element for the analysis of structures in fire"

An analysis methodology and beam finite element has been developed which allows for the simplified design of structures in fire. This thesis was completed under the supervision of Dr Hennie de Clercq and Prof Celeste Viljoen. Refer to the end of this document for the abstract of this thesis, or to http://scholar.sun.ac.za/handle/10019.1/100331.

Journal Papers (peer-reviewed academic):

[1] A. Elvin, R. Walls, D. Cromberge, Optimising structures using the principle of virtual work, J. South African Inst. Civ. Eng. 51 (2009).

[2] R. Walls, A. Elvin, An algorithm for grouping members in a structure, Eng. Struct. 32 (2010) 1760–1768. https://doi.org/10.1016/j.engstruct.2010.02.027.

[3] R. Walls, A. Elvin, Automated structural design and optimisation, Struct. Eng. 88 (2010) 30–34.

[4] R. Walls, A. Elvin, Mass and stiffness distributions in optimized ungrouped unbraced frames, Int. J. Steel Struct. 10 (2010). https://doi.org/10.1007/BF03215833.

[5] R. Walls, A. Elvin, Optimizing Structures Subject to Multiple Deflection Constraints and Load Cases Using the Principle of Virtual Work, J. Struct. Eng. 136 (2010) 1444–1452. https://doi.org/10.1061/(ASCE)ST.1943-541X.0000246.

[6] R.S. Walls, C. Viljoen, A comparison of technical and practical aspects of eurocode 3-1-1 and SANS 10162-1 hot-rolled steelwork design codes, J. South African Inst. Civ. Eng. 58 (2016) 16–25. https://doi.org/10.17159/2309-8775/2016/v58n1a2.

[7] R. Walls, C. Viljoen, H. de Clercq, C. Clifton, Reliability analysis of the slab panel method (SPM) for the design of composite steel floors in severe fires, J. Struct. Fire Eng. 8 (2017). https://doi.org/10.1108/JSFE-01-2017-0008.

[8] R. Walls, G. Olivier, R. Eksteen, Informal settlement fires in South Africa: Fire engineering overview and full-scale tests on "shacks," Fire Saf. J. 91 (2017). https://doi.org/10.1016/j.firesaf.2017.03.061.

[9] W.J. van Jaarsveldt, R.S. Walls, E. van der Klashorst, Experimental Testing and Finite Element Modelling of Steel Columns Weakened to Facilitate Building Demolition, Int. J. Steel Struct. 18 (2018) 1483–1496. https://doi.org/10.1007/s13296-018-0049-3.

[10] R.S. Walls, C. Viljoen, H. de Clercq, Analysis of Structures in Fire as Simplified Skeletal Frames Using a Customised Beam Finite Element, Fire Technol. 54 (2018) 1655–1682. https://doi.org/10.1007/s10694-018-0762-7.

[11] A. Cicione, R.S. Walls, C. Kahanji, Experimental study of fire spread between multiple full scale informal settlement dwellings, Fire Saf. J. 105 (2019) 19–27. https://doi.org/10.1016/j.firesaf.2019.02.001.

[12] H. Marx, R. Walls, Thermal behaviour of a novel non-composite cellular beam floor system in fire, J. Struct. Fire Eng. 10 (2019). https://doi.org/10.1108/JSFE-10-2018-0032.

[13] M. Kloos, R.S. Walls, Finite Element Modelling of the Structural Behaviour of a Novel Cellular Beam Non-composite Steel Structure in Fire, Int. J. Steel Struct. 19 (2019) 1367–1380. https://doi.org/10.1007/s13296-019-00215-5.

[14] R.S. Walls, R. Eksteen, C. Kahanji, A. Cicione, Appraisal of fire safety interventions and strategies for informal settlements in South Africa, Disaster Prev. Manag. An Int. J. 28 (2019) 343–358. https://doi.org/10.1108/DPM-10-2018-0350.

[15] R. Walls, C. Viljoen, H. de Clercq, A nonlinear, beam finite element with variable, eccentric neutral axis, Eng. Struct. 187 (2019) 341–351. https://doi.org/10.1016/j.engstruct.2019.02.056.

[16] C. Kahanji, R.S. Walls, A. Cicione, Fire spread analysis for the 2017 Imizamo Yethu informal settlement conflagration in South Africa, Int. J. Disaster Risk Reduct. 39 (2019). https://doi.org/10.1016/j.ijdrr.2019.101146.

[17] R. Walls, C. Viljoen, H. De Clercq, Parametric investigation into the cross-sectional stress-strain behaviour, stiffness and thermal forces of steel, concrete and composite beams exposed to fire, J. Struct. Fire Eng. 11 (2019) 100–117. https://doi.org/10.1108/JSFE-10-2018-0031.

[18] A. Cicione, M. Beshir, R.S. Walls, D. Rush, Full-Scale Informal Settlement Dwelling Fire Experiments and Development of Numerical Models, Fire Technol. (2019). https://doi.org/10.1007/s10694-019-00894-w.

[19] Y. Wang, C. Bertrand, M. Beshir, C. Kahanji, R. Walls, D. Rush, Developing an experimental database of burning characteristics of combustible informal dwelling materials based on South African informal settlement investigation, Fire Saf. J. 111 (2020) 102938. https://doi.org/10.1016/j.firesaf.2019.102938.

[20] N. de Koker, R.S. Walls, A. Cicione, Z.R. Sander, S. Löffel, J.J. Claasen, S.J. Fourie, L. Croukamp, D. Rush, 20 Dwelling Large-Scale Experiment of Fire Spread in Informal Settlements, Fire Technol. 56 (2020) 1599–1620. https://doi.org/10.1007/s10694-019-00945-2.

[21] S. Löffel, R. Walls, Development of a full-scale testing methodology for benchmarking fire suppression systems for use in

informal settlement dwellings, Int. J. Disaster Risk Reduct. 45 (2020). https://doi.org/10.1016/j.ijdrr.2019.101451.
[22] S.A. Löffel, R.S. Walls, Determination of water application rates required for communities to suppress post-flashover informal settlement fires based on numerical modelling and experimental tests, Fire Mater. (2020). https://doi.org/10.1002/fam.2825.
[23] S. van der Westhuyzen, R. Walls, N. de Koker, Fire tests of South African cross-laminated timber wall panels: fire ratings, charring rates, and delamination, J. South African Inst. Civ. Eng. 62 (2020) 33–41. https://doi.org/10.17159/2309-8775/2020/v62n1a4.
[24] J.F. Volkmann, R.S. Walls, N. de Koker, Implementation of the fire beam element method into OpenSees for the analysis of structures in fire, Adv. Struct. Eng. (2020) 1–12. https://doi.org/10.1177/1369433220933451.
[25] D. Rush, L. Gibson, G. Bankoff, R. Walls, G. Spinardi, S. Cooper-Knock, J. Twigg, L. Hirst, S. Jordan, Fire risk reduction in an urbanizing world, United Nations Office for Disaster Risk Reduction, Geneva, 2019. https://www.unisdr.org/files/66548_f421finaldavidrushfireriskreduction.pdf.
[26] A. Cicione, L. Gibson, C. Wade, M. Spearpoint, R. Walls, D. Rush, Towards the Development of a Probabilistic Approach to Informal Settlement Fire Spread Using Ignition Modelling and Spatial Metrics, Fire. 3 (2020) 67. https://doi.org/10.3390/fire3040067.
[27] A. Cicione, R.S. Walls, Towards a simplified fire dynamic simulator model to analyse fire spread between multiple informal settlement dwellings based on full-scale experiments, Fire Mater. 45 (2021) 720–736. https://doi.org/10.1002/fam.2814.
[28] R.S. Walls, A. Cicione, B. Messerschmidt, K. Almand, Africa: Taking fire safety forwards, Fire Mater. 45 (2021) 999–1007. https://doi.org/10.1002/fam.2894.
[29] A. Cicione, J. Kruger, R.S. Walls, G. Van Zijl, An experimental study of the behavior of 3D printed concrete at elevated temperatures, Fire Saf. J. 120 (2021) 103075. https://doi.org/10.1016/j.firesaf.2020.103075.
[30] N. Flores Quiroz, R. Walls, A. Cicione, Developing a framework for fire investigations in informal settlements, Fire Saf. J. 120 (2021) 103046. https://doi.org/10.1016/j.firesaf.2020.103046.
[31] A. Cicione, C. Wade, M. Spearpoint, L. Gibson, R. Walls, D. Rush, A preliminary investigation to develop a semi-probabilistic model of informal settlement fire spread using B-RISK, Fire Saf. J. 120 (2021) 103115. https://doi.org/10.1016/j.firesaf.2020.103115.
[32] A. Cicione, R. Walls, Z. Sander, N. Flores, V. Narayanan, S. Stevens, D. Rush, The Effect of Separation Distance Between Informal Dwellings on Fire Spread Rates Based on Experimental Data and Analytical Equations, Fire Technol. 57 (2021) 873–909. https://doi.org/10.1007/s10694-020-01023-8.
[33] N. Flores Quiroz, R. Walls, A. Cicione, M. Smith, Fire incident analysis of a large-scale informal settlement fire based on video imagery, Int. J. Disaster Risk Reduct. 55 (2021). https://doi.org/10.1016/j.ijdrr.2021.102107.
[34] N. Flores Quiroz, R. Walls, A. Cicione, Towards Understanding Fire Causes in Informal Settlements Based on Inhabitant Risk Perception, Fire. 4 (2021) 39. https://doi.org/10.3390/fire4030039.
[35] N. Flores Quiroz, R. Walls, A. Cicione, M. Smith, Application of the Framework for Fire Investigations in Informal Settlements to large-scale real fire events – Consideration of fire formation patterns, fire spread rates and home survivability, Fire Saf. J. 125 (2021). https://doi.org/10.1016/j.firesaf.2021.103435.
[36] S.M. Shuttleworth, N. De Koker, R.S. Walls, Insulation Resistance Time Reference Curves for Specifying Passive Fire Protection for Modular Structures from Shipping Containers, Fire Technol. 58 (2022) 133–147. https://doi.org/10.1007/s10694-021-01143-9.
[37] A. Cicione, R. Walls, S. Stevens, Z. Sander, N. Flores, V. Narayanan, D. Rush, An Experimental and Numerical Study on the Effects of Leakages and Ventilation Conditions on Informal Settlement Fire Dynamics, Fire Technol. 58 (2022) 217–250. https://doi.org/10.1007/s10694-021-01136-8.
[38] V. Narayanan, R.S. Walls, Reduced-scale experiments and numerical simulations of informal settlement dwelling fires, Prog. Scale Model. an Int. J. 3 (2022) 1–16. https://doi.org/10.13023/psmij.2022.03-01-01.
[39] V. Narayanan, A. Oguaka, R.S. Walls, Reduced Scale Experiments on Fire Spread Involving Multiple Informal Settlement Dwellings, Fire. 5 (2022) 199. https://doi.org/10.3390/fire5060199.
[40] J. Claasen, R. Walls, A. Cicione, D. Streicher, Structural behaviour of a novel modular cellular steel beam system at elevated temperatures based on large-scale experimental testing and numerical modelling, J. Constr. Steel Res. 197 (2022) 107512. https://doi.org/10.1016/j.jcsr.2022.107512.
[41] A. Cicione, R. Walls, The effect of shear connectors on the strength, serviceability and dynamic response of composite floors using cold-formed steel beams and concrete in decking, Eng. Struct. 269 (2022) 114806. https://doi.org/10.1016/j.engstruct.2022.114806.
[42] T. Kiran, N. Anand, M.E. Mathews, A.D. Andrushia, R. Walls, B. Kanagaraj, E. lubloy, Post-fire behaviour and improving the performance of hot rolled open sections subjected to standard fire exposure, Case Stud. Constr. Mater. 16 (2022) e01021. https://doi.org/10.1016/j.cscm.2022.e01021.
[43] L. Strauss, R. Walls, Modeling of Composite Structures in Fire Using a Coupled Skeletal Frame and Floor System Analysis: Slab Panel Method, J. Struct. Eng. 149 (2023) 1–13. https://doi.org/10.1061/JSENDH.STENG-11807.

Conference Papers (items under review in italics):

[1] R. S. Walls and A. A. Elvin, “A search algorithm for optimizing the grouping of members,” in *Advances and Trends in Structural Engineering, Mechanics and Computation - Proceedings of the 4th International Conference on Structural Engineering, Mechanics and Computation, SEMC 2010*, 2010, pp. 1121–1124.

[2] R. S. Walls and A. A. Elvin, “The virtual work optimization method applied to structures: An investigation into cellular beams versus trusses,” in *Advances and Trends in Structural Engineering, Mechanics and Computation - Proceedings of the 4th International Conference on Structural Engineering, Mechanics and Computation, SEMC 2010*, 2010, pp. 1113–1116.

[3] R. S. Walls and S. E. Ekolu, “An investigation into failures and problems of industrial floors on the ground - With an emphasis on case studies,” 2012.

[4] R. Walls, C. Viljoen, H. de Clercq, and J. Retief, “A critical review on current and proposed structural fire engineering codes for steelwork in South Africa,” in *Construction Materials & Structures*, 2014, pp. 1134–1140.

[5] R. S. Walls and M. Botha, “Towards a Structural Fire Loading Code for Buildings in South Africa,” in *Insights and Innovations in Structural Engineering, Mechanics and Computation*, 2016, pp. 1761–5.

[6] R. S. Walls, “Teaching structural analysis and design: Evaluation and student feedback on various techniques and interventions,” in *Insights and Innovations in Structural Engineering, Mechanics and Computation*, 2016, pp. 2169–74.

[7] W. J. Van Jaarsveldt and R. S. Walls, “Predicting the failure load of steel columns weakened to facilitate demolition of a structure,” in *Insights and Innovations in Structural Engineering, Mechanics and Computation - Proceedings of the 6th International Conference on Structural Engineering, Mechanics and Computation, SEMC 2016*, 2016, pp. 1190–1195.

[8] R. S. Walls, “Demolition of steel structures: structural engineering solutions for a more sustainable construction industry,” in *Advanced Technologies for Sustainable Systems*, 2017, pp. 3–8. doi: 10.1007/978-3-319-48725-0_1.

[9] R. S. Walls and P. Zweig, “Towards sustainable slums: understanding fire engineering in informal settlements,” in *Advanced Technologies for Sustainable Systems*, 2017, pp. 93–98. doi: 10.1007/978-3-319-48725-0.

[10] L. L. Gibson, D. Rush, O. Wheeler, R. Cairns, and R. Walls, “Fire detection in informal settlements,” in *Remote Sensing Technologies and Applications in Urban Environments III*, Oct. 2018, p. 31. doi: 10.1117/12.2501885.

[11] R. S. Walls, A. Cicione, B. Messerschmidt, and K. Almand, “Africa: The Next Frontier for Fire Safety Engineering?,” in *15th International Conference and Exhibition on Fire Science and Engineering*, 2019, pp. 819–829.

[12] A. Cicione and R. S. Walls, “Towards a Simplified Fire Dynamic Simulator Model to Analyse Fire Spread Between Multiple Informal Settlement Dwellings Based on Full-Scale Experiments,” 2019.

[13] A. Cicione and R. Walls, “Estimating time to structural collapse of informal settlement dwellings based on structural fire engineering principles,” in *Advances in Engineering Materials, Structures and Systems: Innovations, Mechanics and Applications*, Sep. 2019, pp. 1909–1914. doi: 10.1201/9780429426506.

[14] T. Dunn and R. Walls, “Demolition engineering: Determination of the axial load capacity of steel columns weakened by horizontal and diagonal cuts,” in *Advances in Engineering Materials, Structures and Systems: Innovations, Mechanics and Applications*, Sep. 2019, pp. 2209–2214. doi: 10.1201/9780429426506.

[15] D. Mitchell and R. Walls, “Demolition engineering: Lateral load carrying capacity of weakened steel beams,” in *Advances in Engineering Materials, Structures and Systems: Innovations, Mechanics and Applications*, Sep. 2019, pp. 2215–2220. doi: 10.1201/9780429426506.

[16] J. Kruger *et al.*, “Facilitating Ductile Failure of 3D Printed Concrete Elements in Fire,” in *Second RILEM International Conference on Concrete and Digital Fabrication. DC 2020. Rilem Bookseries 28*, 2020, pp. 449–458. doi: 10.1007/978-3-030-49916-7_46.

[17] R. Walls, C. Kahanji, A. Cicione, and M. J. van Vuuren, “Fire Dynamics in Informal Settlement ‘Shacks’: Lessons Learnt and Appraisal of Fire Behavior Based on Full-Scale Testing,” in *The Proceedings of 11th Asia-Oceania Symposium on Fire Science and Technology*, Singapore: Springer Singapore, 2020, pp. 15–27. doi: 10.1007/978-981-32-9139-3_2.

[18] A. Cicione, K. Mazolwana, J. Kruger, R. Walls, Z. Sander, and G. van Zijl, “Effect of transverse and longitudinal confinement on the interlayer bond in 3D printed concrete at elevated temperatures: An experimental study,” in *Proceedings of the 11th International Conference on Structures in Fire (SiF2020)*, Nov. 2020, pp. 184–195. doi: 10.14264/cf93893.

[19] A. Cicione, C. Wade, M. Spearpoint, L. Gibson, and R. Walls, “Towards the development of a semi-probabilistic model of informal settlement fire spread using B-RISK,” in *16th International Fire & Materials Conference*, 2021, p. UnderReview.

[20] R. Walls *et al.*, “Large-scale informal settlement experiment considering fire spread under opposed wind flow conditions,” in *AOSFST 2021 – 12th Asia-Oceania Symposium on Fire Science and Technology*, 2021, no. December, pp. 7–9.

[21] A. Cicione, P. J. Kruger, J. P. Mostert, R. Walls, and G. Van Zijl, “The effect of wind on 3D printed concrete interlayer bond strength based on machine learning algorithms,” in *Current Perspectives and New Directions in Mechanics, Modelling and Design of Structural Systems*, 2022, pp. 405–409. doi: 10.1201/9781003348443-66.
[22] J. Claasen, R. Walls, and A. Cicione, “Large-scale fire testing of an innovative cellular beam and composite flooring structural system,” in *Current Perspectives and New Directions in Mechanics, Modelling and Design of Structural Systems*, 2022, pp. 1049–1054. doi: 10.1201/9781003348443-171.

Books editted:

[1] R. Walls, A. Cicione, R. Pharoah, P. Zweig, M. Smith, and D. Antonellis, *Fire safety engineering guideline for informal settlements: Towards practical solutions for a complex problem in South Africa*. Stellenbosch: FireSUN Publications, 2020.

Book chapters:

[1] R. Walls, “1. Introduction,” in *Fire safety engineering guideline for informal settlements: Towards practical solutions for a complex problem in South Africa*, R. Walls, Ed. Stellenbosch: FireSUN Publications, 2020, pp. 1–8. [Online]. Available: http://hdl.handle.net/10019.1/108926
[2] A. Cicione, R. Walls, and D. Antonellis, “3. Understanding fire safety engineering,” in *Fire safety engineering guideline for informal settlements: Towards practical solutions for a complex problem in South Africa*, R. Walls, Ed. Stellenbosch: FireSUN Publications, 2020, pp. 23–52. [Online]. Available: http://hdl.handle.net/10019.1/108926
[3] R. Walls and M. Smith, “4. Informal settlement fire incident timeline,” in *Fire safety engineering guideline for informal settlements: Towards practical solutions for a complex problem in South Africa*, R. Walls, Ed. Stellenbosch: FireSUN Publications, 2020, pp. 53–62. [Online]. Available: http://hdl.handle.net/10019.1/108926
[4] R. Walls, “5. Case study: The 2017 Imizamo Yethu Disaster,” in *Fire safety engineering guideline for informal settlements: Towards practical solutions for a complex problem in South Africa*, R. Walls, Ed. Stellenbosch: FireSUN Publications, 2020, pp. 63–70. [Online]. Available: http://hdl.handle.net/10019.1/108926
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[7] R. Walls, “8. Conclusions and the way forward,” in *Fire safety engineering guideline for informal settlements: Towards practical solutions for a complex problem in South Africa*, R. Walls, Ed. Stellenbosch: FireSUN Publications, 2020, pp. 121–128. [Online]. Available: http://hdl.handle.net/10019.1/108926
[8] T. Kiran *et al.*, “Post-fire behaviour and improving the performance of hot rolled open sections subjected to standard fire exposure,” *Case Stud. Constr. Mater.*, vol. 16, no. March, p. e01021, 2022, doi: 10.1016/j.cscm.2022.e01021.

Reports, articles and technical documents:

[1] R. Walls and A. Elvin, “Automating Structural Design: Getting Computers to Design,” *Steel Constr.*, vol. 33, no. 3, pp. 32–34, 2009.
[2] R. Walls, “Consol Nigel: A state-of-the-art glass factory takes shape,” *Civ. Eng.*, vol. July, pp. 51–53, 11AD.
[3] C. Geldenhuys and R. Walls, “Saving Money on Passive Fire Protection - Designing Composite Floors in Fire: the Slab Panel Method,” *Steel Constr.*, vol. 39, no. 2, pp. 30–32, 2015.
[4] H. de Clercq and R. Walls, “Student to engineer - easing the transition by wau of the final-year design project,” *Civ. Eng.*, no. May, pp. 43–48, 2015.
[5] P. Zweig, R. Pharoah, R. Eksteen, and R. S. Walls, “Installation of Smoke Alarms in an Informal Settlement Community in Cape Town, South Africa – Final Report,” 2018.
[6] R. Walls, A. Moran, A. van Straten, and Z. Sander, *Knysna Fires Project – Analysis and lessons learnt from the homes and structures which were damaged or destroyed in the incident*. Cape Town: Santam, 2019.
[7] G. Forsyth, D. C. Le Maitre, R. Van Den Dool, R. Walls, R. Pharoah, and G. Fortune, “The Knysna Fires of 2017:

Learning from the disaster," 2019.
[8] J. McGlade *et al.*, *GAR: Global Assessment Report on Disaster Risk Reduction 2019*. Geneva, Switzerland: United Nations Office for Disaster Risk Reduction, 2019.
[9] D. Rush *et al.*, "Fire risk reduction in an urbanizing world," United Nations Office for Disaster Risk Reduction, Geneva, 2019.
[10] R. Walls, "Appendix F: Fire Safety Environment and Regulatory Systems in Developing Countries: A Case Study on South Africa," in *Urban Fire Regulatory Assessment and Mitigation Evaluation Diagnostic*, T. Moullier, K. Sakoda, B. Meacham, T. Abrassart, A. McAllister, and F. Krimgold, Eds. Washington DC: World Bank, 2020.

Examples of radio and television interviews conducted:

[1] AlgoaFM, The risk of mega-fires..., AlgoaFM. (2019). https://www.algoafm.co.za/article/local/100679/high-risk-of-mega-fires-in-sa-knysna-fire-report (accessed June 6, 2019).
[2] CapeTalk, Stellies to offer postgrad degree in fire safety and engineering, (2018). http://www.capetalk.co.za/articles/318173/stellies-to-offer-postgrad-degree-in-fire-safety-and-engineering (accessed August 6, 2018).
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Researcher & Student Supervision:

Postdoc: Dr Charles Kahanji 2017-2018

Dr Nico de Koker – 2018-2019

Dr Antonio Cicione – 2020-2021

Dr Mohamad Pourbehi – 2020-2021

Dr Natalia Flores-Quiroz – 2021-present

PhD: Cicione, A – "Fire dynamics in informal settlements" – 2017-2019 [MEng upgrade]

Narayanan, V – “Test methods for evaluating construction materials in informal settlements” – 2019-2022

Flores Quiroz, N – “Forensic investigations in informal settlements” – 2019-2021

Claassen, J – “Full-scale testing of the SAISC cellular beam structure” – 2018-2021

Wiid, F – The effect of additives for foam-water based automatic fire suppression systems in high pile tyre storage – 2020- . Co-supervisor.

Oguaka, AB – Fire behaviour modelling and analysis (to be confirmed) – 2021-

Adams, V – Petrochemical tank fire safety (to be confirmed) – 2021-

Devine, C – Fire safety for plastic recycling facilities – 2021-

Sulon, D – Behaviour of timber connections in fire – 2019- . Co-supervisor.

Shewalul, Y – Behaviour of construction systems incorporating waste plastic in fire – 2022- .

Du Plessis, M – Behaviour of passive protection products in timber joints – 2021- .

Kakoma, E – Fire safety for developing world trains – 2023-

Rakgate, S – Structural fire design of composite timber-concrete systems

MEng: Van Jaarsveldt, WJ – “Predicting the failure load of columns weakened to facilitate demolition of steel structures” – 2015-2016. Co-supervisor.

Kloos, M – “Structural behaviour of a new cellular steel beam structural system in fire” – 2016-2017

Marx, H – “Thermal behaviour of a new cellular steel beam structural system in fire” – 2016-2017

Volkmann, J – “Modelling of structures in fire using beam elements” – 2017-2018

Loffel, S – “Suppression of fires in informal settlements” – 2018-2019

Fourie, S – “Behaviour of the Voidcon flooring system in fire” – 2018-2019

Gous, M – “Behaviour of South African passenger trains in fire”- 2019-2021

Sander, Z – “Behaviour of recycled bottle EcoBricks structures in fire”- 2019-2021

Strauss, L – “Analysis of 3D structural frames in fire using the fire beam element (FBE)”- 2019-2020

Mnanzana, P – “Fire behaviour of a novel decking system in fire” – 2019- . Co-supervisor.

Botha, A – “Behaviour of recycled construction materials in fire” – 2020-2021 . Co-supervisor.

Oosthuysen, C – “Design of modified steel shipping containers for ambient and elevated temperatures”. 2020-2021. Co-supervisor.

Van Biljoen, M – “Modelling and analysis of standard fire testing furnaces”. 2020-2021. Co-supervisor.

Whitehead, M – “Comparative analysis of fire test standards applicable to building materials”. 2020-2021

Oosthuizen, J – Behaviour of 3D printed concrete incorporating Resin8 – 2021-2022. Co-supervisor.

Pillay, S – Modelling of 3D printed concrete in fire – 2022-2022.

Van Wyk, R – Development of an electronic HTRIS – 2022-

Zulu, S – Modelling of composite timber-concrete slabs in fire –

Shewalul, Y – Fire safety for developing world hospitals – 2023-

Vermeulen, Z – Development of a biomass intumescent paint – 2023-

Liebenbert, A – Fire safety for hospitals – 2023-

Approximately 4-5 final year (honours) research projects are also supervised each year. The table below summarises details.

	Current	Graduated	Total
Masters	5	15	20
PhD	9	4	13

Lecturing

- GO446 – Under-graduate course: Advanced Design Project
- SD424 – Design of structural steelwork
- Post-graduate course: Advanced Concrete Design
- Post-graduate course: Structural Fire Engineering
- Post-graduate course: Fire behaviour
- Post-graduate course: Fire safety engineering
- Various lectures on advanced geotechnical engineering, steel design and construction management.
- Refer to the YouTube channels listed above for various video lectures produced.

Research Grants and Funding Received From:

1. New Generation of Academic Personnel – Department of Higher Education & Training
2. NRF-DAAD
3. NRF Thuthuka Grant
4. The Ove Arup Foundation
5. Global Challenges Research Fund from the UK in conjunction with the University of Edinburgh.
6. SU Institute of Structural Engineering – Start-up funding
7. Various Stellenbosch University travel and research grants.
8. SA Institute of Steel Construction
9. Lloyd's Register Foundation – "Fire Engineering Education For Africa"
10. THRIP funding under the Department of Trade and Industry
11. Western Cape Government Department of Human Settlements
12. Voidcon Research and Development project under the Department of Trade & Industry
13. Royal Academy of Engineering / Lloyd's Register Foundation – Engineering skills where they are needed most
14. Structural fire engineering & Fire behaviour course – Run as research funding generating CPD courses.

Total funding generated: ±R15 million

University accolades – BScEng(Civil)

Wits University Awards: Cement and Concrete Institute Prize, Jere Jennings Prize for Civil Engineering, Jere Jennings Prize in Geotechnical Engineering, Desmond Midgeley Knight-Piesold Prize for Hydrology, Murray and Roberts Prize in Civil Engineering, R Kirkpatrick and Son Award, JSD Structural Engineering Prize, Dean's List, Best Academic Student in the class every year of BSc studies, best research presentation in engineering at the Wits Post-graduate Research Symposium.

CONSULTING EXPERIENCE PRIOR TO ACADEMIA

Employer:	BSM Baker – Civil and structural engineers
Director and mentor:	Geoff Baker (Pr. Eng.)
Period employed:	January 2010 – December 2013: Full-time employment.
	January 2014 – December 2015: Part-time consulting.
Position held:	Structural engineer

During employment at BSM Baker extensive experience has been gained in the design, management, supervision and financial control of industrial, petrochemical and commercial structures. Key areas involved with include: steelwork design; concrete design; composite design; draughting; computer modelling of structures; foundation design; design of liquid retaining structures; design of glass bottle factories, batch houses and associated works; project management; budgeting; tendering; managing staff; financial control and invoicing on projects; site supervision; petrochemical facilities and fire-fighting design. Much time has been spent on construction sites and in existing or new buildings during projects. Recognition as a professional engineer (Pr. Eng.) was obtained in 2014, based on the experience and technical work undertaken.

Selected Consulting Projects

Important projects involved with while at BSM Baker include:

- Consol Nigel Factory – a R1.2bn greenfields glass factory. The batch plant, offloading pit, ancillary services, transfer gantries etc. were designed for this project. A great deal of time was also spent on tendering and then doing site supervision during construction.
- An R80m batch house for Nampak's new glass furnace line. All budgeting and design were personally completed.
- Numerous upgrades at the Consol Clayville, Pretoria, and Wadeville factories
- A R30m rebuild to the Consol Bellville factory
- A R2.5bn crude oil storage facility to be constructed in the Western Cape. All preliminary design, budgeting and management of the project were completed.
- Preliminary design work on a R1.8bn coal handling terminal to be constructed in Richard's Bay
- A R12.5m extension to a factory for Pferd South Africa, with complicated details of tying into 3 existing structures.
- Design of a tower for wind turbines
- Design of a numerous warehouses
- Various other industrial structures including substations, chemical containment vessels, gantries, bunkers etc.

Consol Nigel site during construction

Consol Nigel Batch Plant

Consol Nigel Furnace Building & Warehouse

Consol Nigel Batch Plant on completion

Batch Plant, Johannesburg

Batch Plant, Johannesburg

Storage building, Johannesburg

Pharmaceuticals warehouse, Johannesburg

Pharmaceuticals warehouse, Johannesburg

Manufacturing facility, Johannesburg

Manufacturing facility, Johannesburg

Church - Soweto

Mining processing structures – South America

SCHOOLING AND INTERESTS

School accolades:	Head Boy, Top 50 Matric Student in South Africa for IEB, Top Academic Scholar at De La Salle, prefect, debating captain, representative on the Johannesburg Junior City Council.
Awards:	Exceptional leadership, Outstanding Loyalty, All-Round Proficiency, Top tennis player, Public speaking, Geography, Additional Mathematics and Mathematics.
Sports in school:	Cricket (1st team), tennis (1st Team), athletics, rugby, soccer and cross-country.
Cultural in school:	Debating (captain), public speaking (best speaker), chess and drama.
Cultural outside of school:	Represented South Gauteng for the Inter-provincial Maths Olympiad 2003.
	Finalist of South African Harmony Gold Maths Olympiad.
Current interests:	Teaching Sunday school, running a church home group, reading, mountain biking, running, hiking, theology and the outdoors.

SUMMARY OF EXPERIENCE, WORK & SCHOOLING

July 2020 – Present	Full professor in structural and fire engineering – Stellenbosch University
Jan 2020 – July 2020	Associate professor in structural and fire engineering – Stellenbosch University
July 2017 – Dec 2019	Senior lecturer in structural engineering – Stellenbosch University
Aug 2014 – Jun 2017	Lecturer in structural engineering – Stellenbosch University
Jan 2014 – Dec 2016	PhD (Civil Engineering)

Jan 2010 – Dec 2013	Structural engineer with BSM Baker
Jan 2009 – Dec 2009	Full-time work on a full research MSc and separate GDE (Graduate Diploma in Engineering). Both degrees were completed and awarded in 2010 at Wits University.
Oct 2006 – Aug 2013	BTh (Bachelor in theology). SA Theological Seminary. Part-time, correspondence studies.
Jan 2005 – Dec 2008	BSc.Eng (Civil) (with distinction).
Jan 2004 – Dec 2004	Outdoors activity instructor at Frontier Centre (UK). Travelled through Europe.
Apr 1994 – Dec 2003	De La Salle Holy Cross College Junior / Senior Schools (Johannesburg)
Jan 1991 – Apr 1994	Bergvliet Primary School (Cape Town)

PhD ABSTRACT

All building structures require a specified fire resistance rating and numerous procedures have been produced for ensuring this. In engineering practice designers can generally not perform detailed structural fire designs on buildings due to the high computational modelling requirements of most modern structures, and so they typically resort to conservative prescriptive methods instead. Hence, design engineer orientated methods are required to improve fire safety while providing more economical buildings. The goal of this dissertation is to provide a simple, but technically accurate, model for the analysis of structures in fire, including composite structures, which considers buildings as skeletal frames.

To achieve this end a beam finite element has been developed that has a moving, eccentric neutral axis that accounts for material properties that change as structures heat up. A composite bending stiffness, axial stiffness and resultant thermal forces are calculated for a generic cross-section. Material and geometric nonlinearity is considered. The properties of any number of materials (e.g. a steel beam, concrete slab and reinforcing steel) are represented by single beam properties. These calculated beam properties can be included in either commercially available, but simple, finite element software or advanced finite element modelling tools. The only assumption required is that Euler-Bernoulli behaviour, where plane sections remain plane, must hold. A methodology for including rebar tension stiffening at elevated temperatures has been included based on modifying an ambient temperature model.

A series of numerical case studies are presented, comparing the results of the proposed beam formulation against finite element models using shell elements. Results between these models (which includes deflections, stresses, strains and neutral axis positions) typically differ by 0-5% when Euler-Bernoulli assumptions hold. Furthermore, case studies and experimental results from real fire tests in the literature were also analysed by the proposed formulation coupled with relatively simple finite element software. The deflections of structures in fire predicted by the proposed model are well within acceptable tolerances for fire engineering systems, and typically comparable to more complex models in the literature. The model developed has been used to investigate eleven different beams consisting of steel beams, concrete slabs and composite steel-concrete beams, along with conducting a series of parametric studies. With further research and the inclusion of three-dimensional behaviour the method could become a valuable tool for the analysis of structures in fire.