CURRICULUM VITAE

Name	**Richard Shaun Walls**
Nationality	South African
Date of Birth	28 December 1985
Current Occupation	Lecturer / Academic – Stellenbosch University
E-mail address	rwalls@sun.ac.za
Languages	English (Excellent), Afrikaans (Conversational), Biblical Greek (Read)
Marital status	Married to Merryn Walls
Religion	Christian
YouTube Channel	https://www.youtube.com/channel/UCUZH8qYZwKToJa6n2T9FhyA

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

Lead researcher in fire safety engineering at Stellenbosch University, especially in terms of 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, and informal settlement fire behaviour. Full-scale fire tests on shacks have been conducted in conjunction with the Western Cape Local Government Disaster Management, Fire & Rescue Services and the Breede Valley Fire Training Centre. 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, and ascertaining the fire resistance of products. Served as a reviewer of the fire design annex of the soon to be released SANS 10162-1 steel design code.

Previous research has focussed on structural optimisation, demolition engineering and steelwork design. During research project at Wits University a method of optimising structures was developed, called the Virtual Work Optimisation (VWO) method. This was extensively researched during an MSc degree under Prof Alex Elvin. Methods for automated design, optimisation, member grouping, and optimal bracing were developed.

Extensive skills have been obtained in computational analysis, programming, design, international design codes, optimisation, computer modelling and practical design. Software systems used include C++, Matlab, Octave, Prokon, advanced Excel, various fire design software packages and more.

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 Dr 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:

1. Elvin, A. Walls, R.S. & Cromberge, D., 2009. Optimising structures using the principle of virtual work. *Journal of the SA Inst of Civil Eng,* October, 51(2), pp. 11-19.
2. Walls, R.S. & Elvin, A., 2010. An algorithm for grouping members in a structure. *Engineering Structures,* June, 32(6), p. 1760–8.
3. Walls, R.S. & Elvin, A., 2010. Automated structural design and optimisation. *The Structural Engineer,* August, 88(15/16), pp. 30-34.
4. Walls, R.S. & Elvin, A., 2010. Mass and Stiffness Distributions in Optimized Ungrouped Frames. *Int. Journal of Steel Structures,* September, 10(3), pp. 233-242.
5. Walls, R.S. & Elvin, A., 2010. Optimizing Structures Subject to Multiple Deflection Constraints and Load Cases Using the Principle of Virtual Work. *J. Struct. Eng,* 136(11), pp. 1444-1452.
6. Walls, R.S. & Viljoen, C., 2016. A comparison of technical and practical aspects of Eurocode 3-1-1 and SANS 10162-1 hot-rolled steelwork design codes.*Civ Engr S Afr*, 58(1), pp.16–25.
7. Walls, R.S., Viljoen, C, de Clercq, & H, Clifton, GC. 2017. Reliability analysis of the Slab Panel Method (SPM) for the design of composite steel floors in severe fires. *Journal Structural Fire Engineering,* March**.**
8. Van Jaarsveldt, W.J., Walls, R.S., & van der Klashorst, E., 2017. Experimental testing and finite element modelling of steel columns weakened to facilitate demolition of structures. Under review.
9. Walls, R.S., Viljoen, C, de Clercq, H, 2017. Analysis of structures in fire as simplified skeletal frames using a customised beam finite element. In progress.
10. Walls, R.S., Viljoen, C, de Clercq, H, 2017. A nonlinear, beam finite element with variable, eccentric neutral axis. In progress.
11. Walls, R.S., Olivier, G.H., Eksteen, R., 2017. Informal settlement fires in South Africa: Fire engineering overview and full-scale tests on "shacks". Provisionally accepted for publication.

Conference Papers:

12. Walls, RS. & Elvin, A., 2010. *A search algorithm for optimizing the grouping of members.* Cape Town: SEMC Conference Proceedings, pp. 1121-4.
13. Walls, RS. & Elvin, A., 2010. *The virtual work optimization method applied to structures: An investigation into cellular beams versus trusses.* Cape Town: SEMC Conference Proceedings, pp. 1113-6.
14. Walls, RS. & Ekolu, S., 2012. *An investigation into failures and problems of industrial floors on the ground - with an emphasis on case studies.* Cape Town: Concrete Repair, Rehabilitation and Retrofitting III, pp. 573-9.
15. Walls, RS, Viljoen, C, de Clercq, H, & Retief, J. 2014. *A critical review on current and proposed structural fire engineering codes for steelwork in South Africa.* Johannesburg: ICCMATS, pp. 1134-1140.
16. van Jaarsveldt, W.J. & Walls, R.S., 2016. Predicting the failure load of steel columns weakened to facilitate demolition of a structure. In A. Zingoni, ed. *Insights and Innovations in Structural Engineering, Mechanics and Computation*. Cape Town: Taylor & Francis, pp. 1190–5.
17. Walls, R.S., 2016. Demolition of steel structures: structural engineering solutions for a more sustainable construction industry. In J. Kacprzyk, ed. *Lecture Notes in Networks & Systems*. Cairo: Springer.
18. Walls, R.S., 2016. Teaching structural analysis and design: Evaluation and student feedback on various techniques and interventions. In A. Zingoni, ed. *Insights and Innovations in Structural Engineering, Mechanics*

and Computation. Cape Town: Taylor & Francis, pp. 2169–74.

19. Walls, R.S. & Botha, M., 2016. Towards a Structural Fire Loading Code for Buildings in South Africa. In A. Zingoni, ed. *Insights and Innovations in Structural Engineering, Mechanics and Computation*. Cape Town: Taylor & Francis, pp. 1761–5.
20. Walls, R.S. & Zweig, P., 2017. Towards sustainable slums: understanding fire engineering in informal settlements. In Y. Bahei-El-Din & M. Hassan, eds. *Advanced Technologies for Sustainable Systems*. Cairo: Springer, pp. 93–98. Available at: http://link.springer.com/10.1007/978-3-319-48725-0.

General articles and publications:

21. Walls, RS, & Elvin, A., 2009. Automating structural design: Getting computers to design. *Steel Construction,* May, 33(3), pp. 32-34.
22. Walls, RS, 2011. Consol Nigel: A state-of-the-art factory takes shape. *Civil Engineering,* July, 19(6), pp. 51-53.
23. Geldenhuys, C. & Walls, R., 2015. Saving Money on Passive Fire Protection - Designing Composite Floors in Fire: the Slab Panel Method. *Steel Construction*, 39(2), pp.30–32.
24. de Clercq, H. & Walls, R., 2015. Student to engineer - easing the transition by wau of the final-year design project. *Civil Engineering*, (May), pp.43–48.

Student Supervision:

PhD: Zimba, N – “Design of industrial buildings in fire” – 2017-

MEng: Van Jaarzveldt, 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-

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

Cicione, A – “Behaviour of shacks in fire” – 2017-

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

Approximately 4 final year (honours) research projects are also supervised each year.

Lecturing

- MT13 – Post-graduate course: Advanced Concrete Design
- GO446 – Under-graduate course: Advanced Design Project
- SD424 – Design of structural steelwork
- Advanced design of steel structures in fire – series of lectures – April 2014
- YouTube Channel with engineering videos covering topics such as structural design, building draughting, rebar and fire. https://www.youtube.com/channel/UCUZH8qYZwKToJa6n2T9FhyA.

Research Grants and Funding Received

1. NRF-DAAD Scholarship – R90,000 for PhD studies
2. NRF Thuthuka Grant – R280,000 per year for 3 years
3. International charitable engineering organisation – R120,000 per year for 2 years
4. Currently various larger grant applications are under review in collaboration with the University of Edinburgh.
5. SU Institute of Structural Engineering – Start-up funding provided for research group.
6. Various smaller Stellenbosch University travel and research grants.
7. Under-graduate studies - three Academic Excellence and University Council Merit Scholarships from Wits.

8. Post-graduate – Post-graduate scholarship from Wits University

University accolades

Stellenbosch University Awards: Best post-graduate thesis in Civil Engineering 2016. Best runner-up paper and presentation at the Scholarship of Teaching & Learning Conference 2015.

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

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 – Present: 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.
	Made it to the finals of the 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

Aug 2014 – Present	Full-time 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.