

TrinityHaus

The Michael McNamara Research
Centre for Construction
Innovation and Sustainability



Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Annual Report 2021-22

March 2023



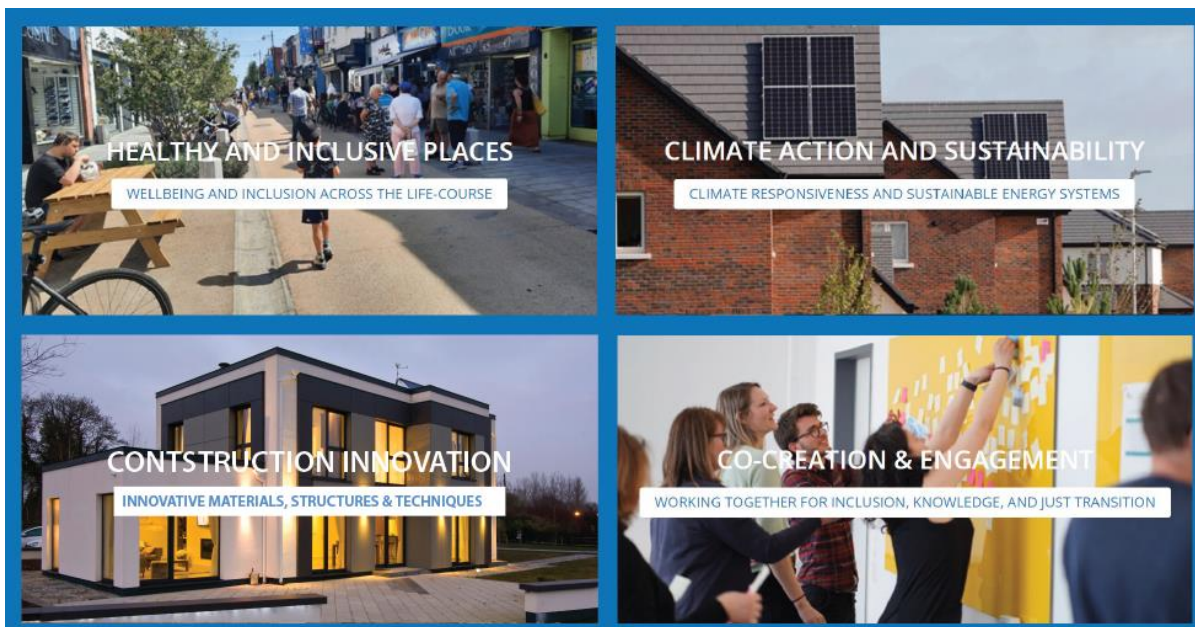
TrinityHaus
www.tcd.ie/trinityhaus

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TrinityHaus Research Centre – Annual Report 2021/2022

1. Introduction



TrinityHaus research pillars

TrinityHaus

The built environment greatly affects sustainability, climate change, well-being, health, and inclusion. These matters are deeply embedded and connected within our buildings, neighbourhoods, towns and cities, and they require integrated and people-centred research and design solutions.

TrinityHaus, established in 2008, responds to these challenges through transdisciplinary research and co-creation across multiple sectors and spatial scales. From housing to health care settings and from building material innovations to urban design, our projects focus on the role and impact of the built environment in creating low-carbon, resilient, healthy, and inclusive communities.

To achieve these objectives, the staff and students who work in TrinityHaus uniquely inculcate and embody the collaboration, interdisciplinary and supportive environment which the projects themselves espouse. The sharing of knowledge and skills in an open non-judgemental environment creates an ideas space from which all who participate benefit.

“I met elite doctoral students from different cultures from all over the world who are interested in both engineering and sustainability, each one of whom had received education with different methodologies.”

Dr Ahmed Alawais, former TrinityHaus postgraduate student

By way of background, TrinityHaus was originally set up through a very generous benefaction by Bernard McNamara which provided seed funding for the research centre, including the institution of the Michael McNamara Chair of Construction Innovation and Sustainability, named in honour of Bernard's father. The first incumbent of this Chair was Prof Mark Dyer who set up TrinityHaus, as its first Director, in its current location in 16 Westland Row, significantly altering the premises to accommodate open office space and an Ideas Lounge. Prof Dyer moved to New Zealand in 2017 to take up a new academic post, with his duties as Director of TrinityHaus coming to an end in 2019. An Acting Director, Prof Brian Broderick, took over the running of TrinityHaus until 2022 when he has seconded to the Research Office in Trinity. He was succeeded by Prof Roger P. West who is the current Director of TrinityHaus.

This is part of the legacy of Bernard McNamara's and Prof Mark Dyer's visions for a vibrant inclusive TrinityHaus Research Centre, founded on the Michael McNamara Chair.

The new Director, Dr Roger P. West, Professor of Structural Engineering in the Civil Engineering Department and a Fellow of the College, was appointed in September 2022. He is a very experienced academic whose principal research interests lie in innovations in construction, particularly in concrete technology, indoor building environments and building information modelling.

Some of the forthcoming research work which will be undertaken in TrinityHaus will be strongly associated with the recent launching of ConstructInnovate, the Construction Innovation Technology Centre (CITC) based in the University of Galway, of which Trinity College is a full and founding member.

"TrinityHaus played a very important role in my crucial formative years and in nurturing my ambition to successfully complete my research journey."

Niti Saini, graduating PhD candidate

Space

A mention should be made of a significant development in respect of the space which TrinityHaus occupies at present. In 2021, the Research Centre was informed that its neighbour, the School of Mathematics, was to be given the top two floors of 16 Westland Row. Subsequently, TrinityHaus lost four of its offices and 8 postgraduate desk spaces, which has restricted the ability to accommodate all those researchers who wish to be housed inside the Centre. There remains space for 12 postgraduates/postdoctoral researchers and office space for just three research staff. As will be seen from the level of activities in this report, this usurping of space is considered to be an unjustified and serious restriction on the research activity physically undertaken in the Centre where there exists a strong ethos of collegiality and peer-learning. Hence, much of what is reported on here is not undertaken in the Westland Row building, but all of the PIs are wholly committed to the Centre and all have given their consent for their many world-class research activities to be cited in this report.

“TrinityHaus brings together an eclectic mix of people of all ages, nationalities, cultures and research interests but with a common theme of wanting to make the infrastructure of the world more environmentally friendly.”

Dr. Christopher Shiell, former TrinityHaus postgraduate student

Now located in its own specially adapted space in the lower two floors of 16 Westland Row, TrinityHaus continues to house the Ideas Lounge in which dedicated multidisciplinary staff and postgraduates share their research ideas. The core collegiate working environment promotes creativity and inclusiveness, led by academics as Principal Investigators from three Schools in Trinity, supported by a strong core of Research Fellows and Assistants. As part of this ethos, regular talks are given by postgraduates to their peers over coffee so that an awareness of the breadth of the research undertaken in TrinityHaus can be shared and nurtured.

“The Friday coffee mornings provided an opportunity for everyone to leave their own personal research space for a brief moment and to share stories of past experiences.”

Dr Richard Hegarty, former TrinityHaus postgraduate student

Governance

With the arrival of the new Director, the governance panel of internal and external stakeholders is being reviewed and a new Board will be announced in the second quarter of 2023.

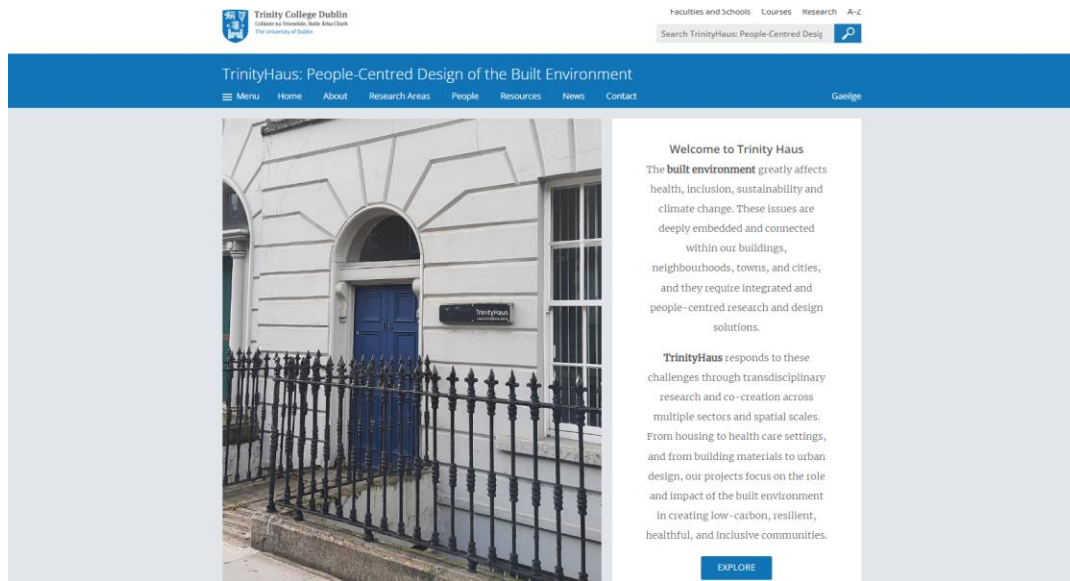
“I valued TrinityHaus's overarching sustainability agenda and its willingness to reach out beyond academia to engage in an urgent way with some of the challenges our government agencies and local authorities currently face.”

Dr. Rory Walsh, former TrinityHaus postgraduate student

Website

In early September 2022, the revamped TrinityHaus website went live (see [here](#)). The website allows the researchers in TrinityHaus to share their work and to connect with other research institutions and industry representatives. The website is updated regularly by TrinityHaus staff.

TrinityHaus Research Centre Annual Report 2021/2022



TrinityHaus Website

2. Key People

Principal Investigators, Research and Post-doctoral Staff

The research reported on within this document was led by the Principal Investigators, research staff from three Schools in College, as listed in Table 1.

Table 1: Principal Investigators, Research and Post-doctoral Staff 2021-2022

Role	Name and Specialisation
Director of TrinityHaus	Prof Roger West, Structural /Materials Engineer
PI and Deputy Director of TrinityHaus	Prof Liwen Xiao, Environmental Engineer
Principal Investigator	Prof Alan O'Connor, Bridge Engineer
Principal Investigator	Prof Brian Broderick, Structural Dynamics and Air Quality Engineer
Principal Investigator	Prof Sarah McCormack, Energy Engineer
Principal Investigator	Prof Sara Pavia, Sustainable, Materials Geologist
Principal Investigator	Prof Breiffni Fitzgerald, Structural Engineer
Principal Investigator	Prof Mary Lee Rhodes, Economist
Principal Investigator	Prof Desmond O'Neill, Medic in Aging
Principal Investigator	Adj. Prof Pat Shiel, Building Energy Engineer
Principal Investigator, Research Fellow	Tom Grey, Architecture and Urban Design
Visiting Professor	Dr Wen Zhang, Environmental Engineer
Research Fellow	Dimitra Xidou
Research Assistant	Jennifer O'Donoghue
Research Assistant	Emma Burke
Research Assistant	Mehak Puntambekar
Research Assistant	Conor McLoughlin
Post-Doctoral Staff	Dr Saviour Okeke
Post-Doctoral Staff	Dr. Alexandra Micu
Post-Doctoral Staff	Dr. Miguel Casero Florez
Post-Doctoral Researcher	Dr Christopher Shiel

Staff and Students Based Onsite in TrinityHaus

For reasons already outlined, due to limited space onsite, only some the staff and students involved with the many research activities are based on site in TrinityHaus over the 2021-22 period, as listed in Table 2. Other staff and students are spread across the campus.

Table 2: Staff and Students Onsite in TrinityHaus 2021-2022

Role	Name and Specialisation
PI and Deputy Director of TrinityHaus	Prof Liwen Xiao, Environmental Engineer
Adjunct Professor	Prof Patrick Sheil
Visiting Professor	Dr Wen Zhang
Principal Investigator, Research Fellow	Tom Grey, architecture and urban design
Research Fellow	Dimitra Xidou
Research Assistant	Jennifer O'Donoghue
Research Assistant	Mehak Puntambekar
Post-Doctoral Staff	Dr Saviour Okeke
PhD Doctoral Staff	Dr Wen Zhang
Post-Doctoral Researcher	Dr Christopher Shiell
PhD Student	Niti Saini (Supervised by Prof Roger West)
PhD Student	Dervilla Niall (Supervised by Prof Roger P. West)
PhD Student	Zihan Zhang (Supervised by Prof Liwen Xiao)
PhD Student	Peiyin Kang (Supervised by Prof Liwen Xiao)
PhD Student	Yanqi Shi (Supervised by Prof Liwen Xiao)
PhD Student	Manish Kanoija (Supervised by Prof Biswajit Basu)
PhD Student	Conor O'Reilly (Supervised b Prof Biswajit Basu)
Undergraduate Student (visiting)	Julien Guy (Supervised by Tom Grey)

3. Research Projects

Research Pillars



TrinityHaus research pillars

Research projects affiliated with TrinityHaus fall under one (or more) of the four research areas or pillars. The specific topics associated with these pillars are outlined below:

- 1. Healthy and Inclusive Environments:** Inclusive, healthy, age-attuned and people-centred built environment; soil, water, air (including external and internal air quality) and healthy materials.
 - For supporting Tallaght University Hospital’s Integrated Care for Older Persons
 - Impact of NO₂ on health with particular emphasis on vulnerable groups
 - Indoor air-quality in A-rated houses
- 2. Climate Action and Sustainability:** Low or zero carbon energy systems (including established research programmes in solar and wind energy), sustainable materials and buildings, and the circular economy.
 - PEDAL: Plasmonic enhancement and directionality of emission of advanced luminescent solar devices
 - Introducing low carbon cement alternatives in precast modular concrete buildings
- 3. Construction Innovation**

To enhance the sustainability of the construction industry through innovation

 - Low carbon concrete
 - Supplementary cementitious materials in the precast industry
 - Precast concrete sandwich panels for retrofitting
 - The immersion of Building Information Modelling into practice
- 4. Co-creation and Engagement:** To bring the voice, needs and preferences of the community to the heart of the process

- Key issues, challenges, and opportunities for engaging older persons in co-creation of standards and guidelines for the built environment
- Indoor air environment and energy demand in Ireland's cathedrals and churches

The research conducted by TrinityHaus and its focus on the built environment is inspired by and supports a range of key global, European, and Irish national frameworks and policies. Examples of these at a global level include the UN Sustainable Development Goals (SDGs), or HABITAT III – The New Urban Agenda. At a European level it includes the European Green Deal or the New European Bauhaus. At a national level the work aligns with, and responds to, key policies such as the Climate Action Plan 2021, Project Ireland 2040 - National Planning Framework, or Housing for All - a New Housing Plan for Ireland.

Funding and Sponsoring Agencies

A full list of the currently active and recently completed projects and the level of funding attributed to the TrinityHaus PIs is given in Appendix A. Recognising again that it is not possible for all these projects to be managed within TrinityHaus, the very high level of research engagement by the TrinityHaus PIs is well represented by this list which, omitting the CITC funding (the flow from which has just commenced) and Prof Rhodes' Connecting Nature project, amounts to approximately €7.6m in value to Trinity College. As may be observed, this funding is sourced from a diverse range of agencies in Europe and nationally.

4. Events

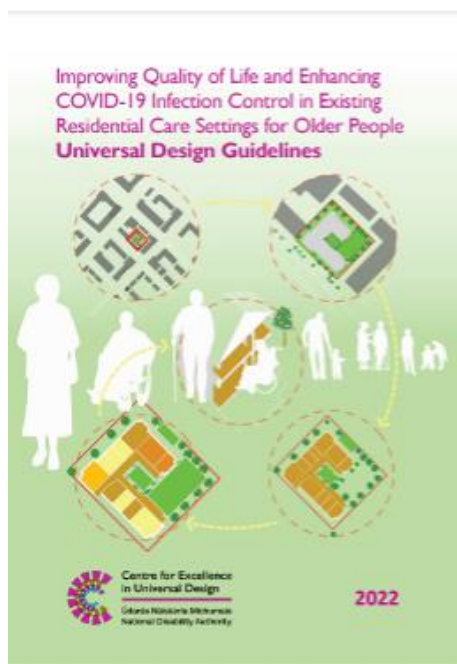
Despite the severe restrictions imposed by the Covid 19 pandemic, the following research events/seminars were organised and held by researchers at TrinityHaus. These activities help to disseminate research findings, publicise the centre's activities and provide networking opportunities in relation to future research and funding proposals.

TABLE 3. Events held 2021-2022

Date	Event	Award/Organiser
May 2022	Research Symposium: RLTC and the Built Environment: Quality of Life and Infection Control	SFI / organisers T. Grey, D. Xidou, J. O'Donoghue
March 2022	Launch of Research Report and Guidelines with CEUD: Universal Design for Improving Quality of Life and Enhancing COVID-19 Infection Control in Existing Residential Care Settings for Older People	Centre for Excellence in Universal Design / organisers T. Grey, D. Xidou, J. O'Donoghue
September 2022	2 nd International Workshop on Wind Farm Aerodynamics and Control, Dublin	Prof Breiffni Fitzgerald
July 2022	14 th International Conference on Applications of Statistics and Probability in Civil Engineering (ICASP14), TCD	Prof Breiffni Fitzgerald
August 2022	Civil Engineering Research in Ireland Conference 2022, Eds. N Holmes, C de Paor, RP West, TU Dublin and TCD	Prof Roger P. West

5. Publications

Throughout the wide array of research projects undertaken and completed by TrinityHaus affiliated research staff, there is a strong culture of information dissemination and publication. This includes both peer-reviewed journal publications and presentations at seminars or conferences as listed herein in **Appendices B and C** respectively. In total 85 journal papers and 56 seminar/conference citations are listed across 10 PIs and 4 research staff. Examples of other key publications are as follows:



Examples of TrinityHaus publications

6. Education and Learning

Postgraduate Students

TrinityHaus has affiliated postgraduate students completing PhD and both types of Masters (MAI and MSc.) degrees supervised across nine TrinityHaus PIs/Supervisors. Throughout the 2021-22 reporting period, over 100 postgraduate students (72 Masters and 35 PhDs) either began, continued or completed their research, all supervised by TrinityHaus-affiliated PIs. Their names, supervisors, degrees and completion dates are listed in **Appendix D**.

PhD Advisory Role

TrinityHaus research staff have also acted in an advisory role in the completion of PhD theses. For example, Research Fellows Tom Grey and Dimitra Xidou are currently acting as advisors to the PhD candidate Mark Ware who is student with the School of Engineering and informatics; University of Sussex). His research topic is titled 'Nature-based interior architecture – Taking nature to people' and involves an art-led approach to the research and creation of multisensory nature-based interior architecture and its design. This is a good example of the wide and multidisciplinary nature of some of the research projects run out of TrinityHaus.

Undergraduate internships

Undergraduate internships for visiting students are accommodated from time to time. Again, by way of example, in 2022 TrinityHaus hosted an undergraduate student from EPF Ecole d'ingénieurs, Troyes, France. The student, Julien Guy, was hosted by Professor Liwen Xiao and supervised by TrinityHaus Research Fellow Tom Grey. The project involved the 'Trinity East' site as a case study on how tactical urbanism could support the principles of the New European Bauhaus (sustainability, aesthetics, inclusion) and design for health.

7. Outreach and External Activities

Members of TrinityHaus are involved in many various non-project related activities based on their expertise and the research work conducted within the research centre. These activities help disseminate research outputs, develop networks and more importantly contribute research knowledge and experience towards solving important societal issues. They may be summarised, in brief, as follows:

Prof Roger West:

Chair of the **Irish Concrete Society**

Committee member of the **Concrete Consultative committee, NSAI**

Chair of the **Irish Concrete Durability committee**

Reviewer of papers for multiple journals

Prof Liwen Xiao:

Chair of the **Ireland Chinese Association of Environment, Resources & Energy**

General Secretary of the **Association of China-Ireland Academics**

Member of **CIRCULÉIRE's Circular Plastics** Thematic Working Group Panel

Guest Editor – of three journals: **Frontiers of Environmental Science & Engineering;**

Materials; Water

Associate Editor – of **Advances in Renewable Energy**

Reviewer of papers for multiple Journals

Prof Alan O'Connor:

Member Joint Committee on **Structural Safety**

Member/National Delegate **CEN/TC 250/SC10, CEN/TC 250/WG2** and **CEN/TC 250/WG6**

Board Member International Civil Engineering Risk and Reliability Association (**CERRA**)

Federation of European Highway Research Laboratories (**FEHRL**) – Research Coordinator for Republic of Ireland

IABSE TG1.10 (Chair) Utilisation of Traffic Data in Research, Design and Assessment of Bridges

IABSE TG6.1 (Vice Chair) Effects of Climate Change on Infrastructure

IABSE TG1.3 Calibration of Partial Safety Factors for the Assessment of Existing Bridges – Member

Transportation Research Board (USA) – Committee on Bridge and Structures Management (**AKT50**)

Chair of **14th International Conference on Applications of Statistics and Probability in Civil Engineering**, Dublin, 2023.

Joint Committee on Structural Safety (**JCSS**) Workshop on Assessment of Existing Structures, 2021.

Editor in Chief – **ICE Journal Infrastructure Asset Management**

Editorial Board Member – **Structural Safety**

Associate Editor Bridge Engineering – **Frontiers**

CEN-CENELEC Project Team Leader (**WG6.T2**) for the Eurocode Phase 3 project team tasked with incorporating Robustness Rules in the Material Related Eurocode Parts.

CEN-CENELEC Project Team member (**WG2.T2**) for developing a Eurocode (prEN1990-2) for the Assessment and Retrofitting of Existing Structures

Reviewer of papers for multiple journals

Prof Brian Broderick:

Eurocode 8: Design of Structures for Earthquake Resistance, **CEN Sub-Committee TC250/SC8**

Irish National Technical Contact for Eurocode 8: Design of Structures for Earthquake Resistance, **NSAI**

Member of Structures Journal Editorial Board, **IStructE**

Reviewer of papers for multiple journals

Prof Sarah McCormack:

School of Engineering **Athena Swan** Chair: 2019 – 2021

Guest Editor, Special Issue of **Renewable & Sustainable Reviews** on '*Integrating sustainable energy technologies in buildings*'.

CPD Course developer for **Engineers Ireland**

Panelist on **Solar Energy Industry** event, Croke Park

Panelist in **Humanlab**, Electric Picnic

Reviewer of papers for multiple journals

Prof Breiffni Fitzgerald:

Committee member of Structures and Construction Division, **Engineers Ireland**

Committee member of **Institution of Structural Engineers**, Ireland Branch

Chartered Engineer Panelist, **Engineers Ireland**

Invited Guest Editor, Special Issue of **Energies Journal** on '*Novel Design, Modelling and Analysis of Offshore Wind Turbines*'.

CPD Course developer for **Engineers Ireland**

Invited talks to the **Control Group of the Irish Systems and Signals** conference, Offshore Wind at the 2nd National Climate Stakeholder Forum, European Academy of Wind Energy (**EAWE**) on the wind energy research and education activities

Reviewer of papers for multiple journals

Tom Grey:

Chair of NSAI/TC 023/SC 01 "Accessibility in Built Environment" and Co-Chair of NSAI/TC 023/SC 06/WG 03 "Ageing Societies", **NSAI:**

- National mirror committee on the development of the new European Standard **EN 17210:2021**: Accessibility and usability of the built environment, and the update of **ISO 21542** - Building construction — Accessibility and usability of the built environment (2021)

- National mirror committee contributing to the development of **ISO/DIS 23623**
Ageing Societies- Framework for Dementia-inclusive communities
Housing conditions, housing adaptations, and new build housing, **Housing Agency Sub-
group on housing for our ageing population**
Co-convenor and committee member, **ISO/AWI 25553— Smart Multigenerational
Neighbourhoods- Guidance and Requirements**

Dimitra Xidou:

- **Network nature: task force no. 6 ; [Here.](#)**
- **Athena Swan: [Here.](#)**

Jennifer O'Donoghue:

Housing conditions, housing adaptations, and new build housing, **Housing Agency Sub-
group on housing for our ageing population**

8. Staff Development and Training

Ongoing development and upskilling of staff are essential in a research environment. In this context TrinityHaus research staff have completed a range of training during the Covid period, including:

Tom Grey:

- Data protection: *Trinity College Dublin Data Protection Office*
- REAMS: *Research Ethics Application Management System*

Dimitra Xidou:

- Data protection: *Trinity College Dublin Data Protection Office*
- Endnote: *Reference management software*

Jennifer O'Donoghue:

- NVivo: *Qualitative data analysis computer software*
- Adobe Dreamweaver: *Web development tool*
- Data protection: *Trinity College Dublin Data Protection Office*
- Endnote: *Reference management software*
- HSeLand: *Open Disclosure, Manual Handling and People Handling, High Risk Medicines, Early Identification and Management of Delirium in Adult Patients.*
- Data Protection and Health Research: *GDPR and Health Research*

9. Looking Forward

In conclusion, TrinityHaus is largely research-driven by sustainability issues in society at large, with many external stakeholders playing an active part in the research projects – in that way TrinityHaus is truly outward facing.

Coming out of the period of isolation which the Covid 19 pandemic imposed on both research students and staff, it is evident that the unique research experience that is the essence of being a researcher in TrinityHaus has been restored.

The academics who are the PIs in TrinityHaus have multiple demands on their time, for teaching, research supervision, administration, management and in leading their funded research projects. Concentrating on the research activities, TrinityHaus has a highly invigorated research community who give of their time to provide a very rewarding and unique research journey for all those involved.

Given the very significant successes in attracting funding in the recent past and the potential for future funding, especially that associated with the formation of the government sponsored CITC, finance is not seen as the central issue for TrinityHaus, though it is vital to ongoing success. Inevitably there are impediments to growth, such as the space restrictions imposed on us, or the ability of new researchers to join us due to national accommodation shortages. However, there is no risk that the ethos of the supportive, inclusive and diverse research environment which the research staff inculcate might be set aside in coping with the increasing demands which our fundamental roles as teachers, researchers and mentors impose.

TrinityHaus could not be better placed to provide the research environment to address the enormous sustainability challenges which humankind faces, as supported by our four research pillars: Healthy and inclusive places, climate action and sustainability, construction innovation and co-creation and engagement.

APPENDIX A - Research Projects by TrinityHaus PIs 2021-2023

Grant/Project Title	Granting Body	PI	Total Grant Value
Planning and design for Quality of Life and Resilience in RLTC settings for older people in Ireland: Research and Universal Design Guidelines for new-build, adaption and retrofit	Health Research Board	Prof. Des O'Neill (PI) and Tom Grey	€369,740
Supporting Tallaght University Hospital's (TUH) Integrated Care for Older Persons: Testing an approach to identify the common housing hazards in housing affecting older people in South Dublin	Meath Foundation	Prof. Des O'Neill (PI) and Tom Grey	€50,000
RLTC & COVID-19: Role of the Built Environment in Balancing Infection Control and Quality of Life	Science Foundation Ireland	Prof. Des O'Neill Co-PI Tom Grey	€161,455
Enhanced Prevention, Warning, Coordination and Emergency Management for Floods at Local Scales	AA Floods	Prof Alan O'Connor	€ 256,000
Universal Design for Improving Quality of Life and Enhancing COVID-19 Infection Control in Existing Residential Care Settings for Older People	Centre for Excellence in Universal Design	Tom Grey (PI) and Dimitra Xidou	€30,000
Dementia Inclusive Hospitals from a Universal Design Approach - free TCD MOOC with Futurelearn	EIT Health	Tom Grey	€50,000
Supporting Equity of Older People by Redefining and Refining Assessment of Dementia Inclusive Design of Hospital Spaces	HAPAI	Prof. Des O'Neill (PI) and Tom Grey	€161,455
Connecting Nature	European Commission/ Horizon 2020	Prof Mary-Lee Rhodes (PI) , Marcus Collier and Siobhan McQuaid	€11 million
Microplastic-free plastics.	SFI Plastic Challenge Award	Dr. Liwen Xiao	€650,000
National Standards Authority of Ireland (NSAI) and Accessibility of the Built Environment	NSAI	Tom Grey	N/A
National Construction Technology Centre ('Construct Innovate')	Enterprise Ireland	Prof Brian Broderick, Prof Alan O'Connor, Prof Roger West	€5,000,000 in consortium (estimated €1,000,000)

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Controlling the Wind-Induced Vibration Response of Modular High Rise Buildings	Irish Research Council	Prof Brian Broderick	€168,000
TORCH - Transforming Open Responsible Research and Innovation through CHARM	European Commission Horizon 2020	Prof Brian Broderick	€427,645
GOGREEN ROUTES: Resilient Optimal Urban natural, Technological and Environmental Solutions	European Commission Horizon 2020	Prof Brian Broderick	€445,000
Impact of NO2 on Health with Particular Emphasis on Vulnerable Groups	Environmental Protection Agency	Prof Brian Broderick	€130,000
STATION-AIR	Environmental Protection Agency	Prof Brian Broderick	€349,000
FOREST	Kinsella Award	Prof Sarah McCormack	€500,000 to consortium (€110,000)
Novogrid Opportunities	Enterprise Ireland – Innovation Voucher	Prof Sarah McCormack	€5,000
Luminescent light shelves for daylight enhancement in building for improved circadian rhythm	Velux Stiftung – Daylight research platform	Prof Sarah McCormack	€400,000 to consortium (€150,000)
IDEAS: Novel building integration designs for increased efficiencies in advanced climatically tunable renewable energy systems	European Commission – H2020-LC-SC3-2018-Two-Stage	Prof Sarah McCormack	€3,999,084 to consortium (€680,134)
Development of damping parameters for Irish Offshore Wind Farms	SEAI	Prof Breiffni Fitzgerald	€348,950 to consortium (€104,000)
A comprehensive decision support tool for end-of-life wind turbines of Ireland; Lifetime Extension, Decommissioning, Repowering, Repurposing [WindLEDeRR]	SEAI	Prof Breiffni Fitzgerald	€550,000 to consortium (€97,875)
Data Driven Digital Twin of Wind Farm (TwinFarm)	SEAI	Prof Breiffni Fitzgerald	€198,750 to consortium (€99,375)
Remote-Wind	SEAI	Prof Breiffni Fitzgerald	€650,000 to consortium (€164,284)
Machine Learning for Wind Farm Aerodynamics and Control	SFI Frontiers programme	Prof Breiffni Fitzgerald	€520,632
Enhanced Controllers to Improve Wind Farm Efficiency	SEAI	Prof Breiffni Fitzgerald	€324,788
Go Green Routes	European Commission	Prof Mary Lee Rhodes	€100,000

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NBS EduWorld	European Commission	G Donnelly-Cox (CSI) [TrinityHaus Dimitra]	€530,000
Microbial Fuel Cells based system for pollutants removal, resources recovery and disinfection	Enterprise Ireland	Prof Liwen Xiao	€520,000
Design and production of low-carbon, alkali-activated cement blends of low shrinkage and high frost resistance for high altitudes.	China Scholarship Council	Prof Sara Pavia	€30,000
Investigation of production and properties of hemp-based composites made with alkali-activated industrial wastes	Scientific and Technical Research Council, Turkey	Prof Sara Pavia	€25,000
JOIN-RISe. Joint development of innovative blended learning in STEM curricula based on SDGs for a resilient, inclusive, and sustainable education	EU Programme 2021	Prof Sara Pavia	€380,000
Design and evaluation of sustainable, alkali-activated construction materials made with waste.	China Scholarship Council	Prof Sara Pavia	€96,000
Development of alkali activated materials for sustainable construction.	Government of Saudi Arabia	Prof Sara Pavia	€181,000
SUSKIDS Enabling professionals and families to transfer sustainable knowledge and skills to down syndrome individuals.	EU Programme 2022	Prof Sara Pavia	€395,830

APPENDIX B - Relevant Journal Peer-reviewed Publications 2021-22

Prof. Roger P. West

Kinnane, O., West, R.P. and O’Hegarty, R., 2022. ‘Failure Modes of Load-Bearing Sandwich Panels in Shear’. In *Stability and Failure of High Performance Composite Structures* (pp. 39-66). Singapore: Springer Nature Singapore.

Holmes, N., Tyrer, M., West, R., Lowe, A. and Kelliher, D., 2022. ‘Using PHREEQC to model cement hydration’. *Construction and Building Materials*, 319, pp. 126-129.

Jani, R., Holmes, N., West, R.P., Gaughan, K., Liu, X., Orisakwe, E., Qu, M., Kokanoff, J., Stella, L., Yin, H. and Wojciechowski, B. (2022) ‘Characterisation and performance enhancement of cement-based thermoelectric materials’, *Polymers*, 14(2311), pp. 19.

West, R.P. and Kinnane, O. (2021). ‘Composite behaviours of thin precast concrete sandwich panels’, edited by Shamsher Singh, in *Emerging Trends in Advanced Composite Materials in Structural Applications*, Springer Nature, Singapore, pp. 1 – 28.

O’Hegarty, R., Kinnane, O., Newell, J., and West, R.P. (2021). ‘High performance, low carbon concrete for building cladding applications’. *Journal of Building Engineering*, 43, pp. 13.

Lipczynska, J., West, R.P., Grimes, M., Niall, D., Kinnane, O. and O’Hegarty, R.P. (2021). ‘Composite behaviour of wide sandwich panels with thin high performance recycled aggregate concrete wythes with fibre reinforced polymer shear connectors’. *Journal of Structural Integrity and Maintenance*, 6(3), pp. 187-195.

Bhagat, D., Bhalla, S. and West, R.P. (2021). ‘Fabrication and structural evaluation of fibre reinforced bamboo composite beams as green structural elements’. *Composites Part C: Open Access*, 5, p.100150.

Korde, C., Cruickshank, M. and West, R.P. (2021). ‘Activation of slag: a comparative study of cement, lime, calcium sulfate, GGBS fineness and temperature’. *Magazine of Concrete Research*, 73(1), pp. 15-31.

Prof. Liwen Xiao

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APPENDIX C - Seminars and Conferences 2021-2022

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Prof. Sarah McCormack

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Prof Sara Pavia

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Prof Breiffni Fitzgerald

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Prof. Des O'Neill

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Tom Grey

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Dimitra Xidous

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Jennifer O'Donoghue

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Mehak Puntambekar

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APPENDIX D - Postgraduate Students

Student	Award Dates	Supervisor (s)
Doctoral Students in Engineering		
Ahmed Alawais - PhD	2021	Prof Roger P. West
Niti Saini - PhD	2022	Prof Roger P. West
Jingran Gao - PhD	2022	Prof Roger P. West
Dervilla Niall - PhD	2023	Prof Roger P. West
Ferguson Tobins - PhD	2025	Prof Roger P. West, co-supervisor
Luming Yang - PhD	2023	Prof Liwen Xiao
Yanqi Shi - PhD	2023	Prof Liwen Xiao
Peiyin Kang - PhD	2024	Prof Liwen Xiao
Yifan Sun - PhD	2024	Prof Liwen Xiao
Zeena Wang - PhD	2025	Prof Liwen Xiao
Zihan Zhang , PhD	2026	Prof Liwen Xiao
Mohammad Al-Mhawadi - PhD	2024	Prof Alan O'Connor
Kristopher Campbell - PhD	2024	Prof Alan O'Connor, co-supervisor QUB
Aonghus O'Domhnaill - PhD	2021	Prof Brian Broderick and Prof Margaret O'Mahony
Unnikrishnan Madhavan - PhD	2023	Prof Brian Broderick and Prof Biswajit Basu
Terry Ryan - PhD	2023	Prof Brian Broderick
Hollie Moore - PhD	2024	Prof Brian Broderick and Prof Breiffni Fitzgerald
Kiran Aspunde - PhD	2025	Prof Brian Broderick and Prof John Gallagher
Shanmuga Priyan - PhD	2025	Prof Brian Broderick and Prof John Gallagher
Sudipta Lal Basu - PhD	2022	Prof Breiffni Fitzgerald
Shubham Baisthakur - PhD	2024	Prof Breiffni Fitzgerald
James McAuliffe - PhD	2025	Prof Breiffni Fitzgerald and Prof Brian Broderick
Adbulbaset Alazhare - PhD	2025	Prof Breiffni Fitzgerald
David Flanagan - PhD	2026	Prof Breiffni Fitzgerald
Atiq Rehman - PhD	2021	Prof. Sarah McCormack
Anita Ortega - PhD	2023	Prof. Sarah McCormack
Bill Cass - PhD	2023	Prof. Sarah McCormack
Aaron Glenn - PhD	2025	Prof. Sarah McCormack
Kenny McGoldrick - PhD	2025	Prof. Sarah McCormack (TU Dublin)
Wai Qian Tham - PhD	2026	Prof. Sarah McCormack
Tianren Chen - PhD	2026	Prof. Sarah McCormack (UCC)
Roisin Gowen - PhD	2026	Prof. Sarah McCormack
Omar Aleweet – PhD	2023	Prof Sara Pavia
Murat Sahim – PhD	2023	Prof Sara Pavia
Zehao Lei – PhD	2024	Prof Sara Pavia

Masters students in Engineering:		
Julia Deladiennee - MAI	2021	Prof Roger West
James Lawson - MAI	2021	Prof Roger West
Eoin Kelly - MAI	2021	Prof Roger West
Terry Sweeney – MSc	2022	Prof Roger West
Orlaith Murphy MAI	2022	Prof Roger West
Maebh Childs - MAI	2022	Prof Roger West
Sudhakar Bhagat - MSc	2022	Prof Roger West
Erica Markey - MAI	2022	Prof Roger West
Sudhakar Bhagat - MSc	2022	Prof Roger West
Shiyao Zhuang – MPhil	2023	Prof Roger West
Ryan Champion - MAI	2023	Prof Roger West
Ruchita Jani - MPhil	2023	Prof Roger West
Mark Theunissen - MAI	2023	Prof Roger West
Vasadhu Bhagat - MSc	2023	Prof Roger West
Donal Cotter - MAI	2023	Prof Roger West
Ryan Champion - MAI	2023	Prof Roger West
Shiyao Zhuang – MPhil	2023	Prof Roger West
Georgia Giannakpoulou - MSc	2021	Prof Liwen Xiao
Olivia Skwerski - MSc	2022	Prof Liwen Xiao
Kenneth Hyland - MSc	2023	Prof Liwen Xiao
Mike Joyce - MAI	2021	Prof Alan O'Connor
Leontina Schelling - MAI	2022	Prof Alan O'Connor
Alex Casey - MAI	2022	Prof Alan O'Connor
Matthew Conway - MAI	2022	Prof Alan O'Connor
Eanna O Foighill - MSc	2022	Prof Alan O'Connor
Oisín Dougan - MAI	2023	Prof Alan O'Connor
Gavin Taylor - MAI	2023	Prof Alan O'Connor
Shauna Kelly - MAI	2021	Prof Brian Broderick
Michael Jester - MAI	2021	Prof Brian Broderick
Cesar Henriquez - MSc	2021	Prof Brian Broderick
Duoonan Elangovan - MSc	2021	Prof Brian Broderick
Ben Broderick - MAI	2022	Prof Brian Broderick
Orla Kearney - MAI	2022	Prof Brian Broderick
Tom Sheehy - MAI	2022	Prof Brian Broderick
Prateek Glover - MAI	2023	Prof Brian Broderick
Stephen Foley - MAI	2023	Prof Brian Broderick
Adam Lunnollery – Masters	2021	Prof Sarah McCormack
Maria Ayala Baragan – Masters	2021	Prof Sarah McCormack
Sander Saer – Masters	2021	Prof Sarah McCormack
Yazan Ahmed – Masters	2021	Prof Sarah McCormack
Liam Halloran – MSc	2021	Prof Sarah McCormack
Polyxeni Martzeli – MSc	2022	Prof Sarah McCormack
Adrian Bacaoanu – MSc	2022	Prof Sarah McCormack
Una O'Neill – MAI	2022	Prof Sarah McCormack
Finan Levingston – Masters	2022	Prof Sarah McCormack
Richard Wadsworth – Masters	2022	Prof Sarah McCormack
Bethany King – Masters	2022	Prof Sarah McCormack
Shaakirah Madhi – Masters	2022	Prof Sarah McCormack

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Thomas Flynn – Masters	2022	Prof Sarah McCormack
James Sutton – MAI	2022	Prof Sarah McCormack
Lizzie Collins - MAI	2023	Prof Sarah McCormack
Conor Gallagher - MAI	2023	Prof Sarah McCormack
Rory Cafferky - MSc	2023	Prof Sarah McCormack
Nontyatyambo Manyisame - MSc	2023	Prof Sarah McCormack
Martin Eeson - MSc	2023	Prof.Sarah McCormack
Pui Fan - MSc	2023	Prof Sarah McCormack
Natalie Shannon - MAI	2021	Prof Sara Pavia
Ross Reilly - MAI	2021	Prof Sara Pavia
Robert Lynch - MAI	2022	Prof Sara Pavia
Mark Donegan - MAI	2023	Prof Sara Pavia
Qiyi Xie - MSc	2023	Prof Sara Pavia
William Lee - MAI	2021	Prof Breiffni Fitzgerald
James McAuliffe - MAI	2021	Prof Breiffni Fitzgerald
Adhiraj Jain - MSc	2021	Prof Breiffni Fitzgerald
Laura Murphy - MAI	2022	Prof Breiffni Fitzgerald
Conor Bryce - MAI	2022	Prof Breiffni Fitzgerald
Philip McDowell - MAI	2022	Prof Breiffni Fitzgerald
Rory Coffferky - MAI	2022	Prof Breiffni Fitzgerald
Thomas Shanahan - MAI	2023	Prof Breiffni Fitzgerald
Daniel McCann - MAI	2023	Prof Breiffni Fitzgerald
Emily Cullen - MAI	2023	Prof Breiffni Fitzgerald
Maghnus Shaw - MAI	2023	Prof Breiffni Fitzgerald

