

<b>Institution: Robert Gordon University</b>
<b>Unit of Assessment: 16: Architecture, Built Environment and Planning</b>
<b>a. Overview</b>

Our research within Architecture and the Built Environment has for many years considered the design, provision and assessment of built environments with specific reference to the user, occupant and client. Our multidisciplinary group is innovative in that the research is often underpinned by and demonstrated through the practice-based design, production and rigorous assessment of innovative, groundbreaking buildings, and also through the publication of high quality written work. Our research is grouped under four ‘themes’, each of which represents priority developmental areas for the research activity. Together these reflect our interest in ensuring a sound methodological basis for built environment design (**Visualisation**), which offer better living environments for people (**Sustainable Housing**), through improving the act of production (**Projects Process Performance**). More recently, we have established a line of research which explores issues driving teaching and practice (**Theory and Pedagogy**). The research is undertaken through the completion of research commissions, through undertaking applied and deeply exploratory practice based research, and through engagement with our research student community.

<b>b. Research Strategy</b>
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Since RAE2008, our research within Architecture and Built Environment has continued to develop its core themes, and has widened to embrace elements of energy policy, the energy sector and related pedagogy. Furthermore, research activity now pervades all aspects of activity within the Scott Sutherland School of Architecture and Built Environment to a far greater extent than at any point in its history, with staff actively engaged in both theoretical and applied research. There has been a successful strategy to widen participation in research, with a core aim to disseminate our applied research through high quality and prestigious channels, including both written and practice based outputs. This has increased both the visibility and impact of our work, and has fostered an ethos whereby widespread dissemination becomes part of established and expected research processes.

Our submission includes staff (*Gray, Kishk and Strachan*) from Aberdeen Business School, demonstrating a real commitment to cross-discipline working, particularly in the fields of urban transport, life cycle costing and energy policy. Research previously housed in the ‘Environments for People Research Centre’ have continued to develop in terms of both quality and scope, and remain at the core of our research ethos, with an emphasis on the relationships between the designed built environment and the people who will ultimately use or be affected by those designs. This evolution of our research has also seen an emphasis on more of our research being led from the core disciplines within the unit. A benefit of this has been a stronger integration of research and teaching activity within architecture and built environment, with a consequence being a stronger academic and intellectual culture developing across the unit.

Following RAE 2008, which recognised a step change improvement in RGU’s research performance, the university invested strategically through the increased Research Excellence Grant. This has been implemented primarily through the creation in 2009 of three faculty-based Research Institutes to focus and manage research. These institutes have developed their own thematic multidisciplinary areas aligned to the needs and challenges faced by the economy and society. The research in this submission is housed mainly within IDEAS (*Innovation, **DE**sign And **S**ustainability Research Institute*), with 3 of the submitted staff being members of IMAGES (*The Institute of **M**anagement, **G**overnance and **S**ociety*).

**Main objectives and activities:** Over the course of the next five years, we aim to further strengthen each of our research themes through academic publication, study through research based practice, undertaking of funded research commissions, growing of our research student

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community and by continuing to engage with both academic and non-academic external parties and organisations.

**Strategy and drivers:** Our strategy is founded on the dual desire to secure higher levels of funding in all research themes, and maintaining our commitment to the delivery of high quality outputs. Funding in the unit has increased considerably since 2010, with particular success relating to EU, ERDF (Interreg) and Scottish Government research. Our key thematic areas are supported through staff mentoring, with all themes benefitting from the inclusion of a range of, experienced to developing, multidisciplinary staff members. Multidisciplinary working within our research has opened significant opportunities for the unit during the REF period (including in urban design/transport; building/environmental monitoring; and, pedagogical/architectural research). An aspiration to continue support for this method of working will remain a key driver in the coming years.

All themes within the submitted unit have a track record of successful completion of research commissions, with this leading to publication in high-level journals (including Design Studies, Environment and Planning B, Computers in Industry, JEBE and Journal of Environmental Planning and Management). Staff, working in research theme (as opposed to professional discipline) groups will continue to be encouraged and mentored to engage with both academically and industrially driven research. This strategy to target high quality publications and other research outputs is monitored through the employment performance review, which enshrines publication, PhD supervision and funding targets for all research active staff members.

### **Theme 1: Visualisation** (Bennadji, Laing, Scott, Zaman)

We have an established inter-disciplinary track record of research into the field of design visualisation in the built environment. Emerging from what was termed 'new approaches to design evaluation' in RAE 2008, the group has a focus on improving design processes, often from the perspective of the end user. Methods from visualisation, environmental economics, environmental design and urban design have enabled the work to understand the manner in which complex sets of attributes influence choice and value. The use of rapidly developing IT applications (*Bennadji, Laing, Scott*) within the evaluation of environments has been central to the innovative aspects of much of the research. The application and usability of new methods in building information modelling is important within this theme (*Laing*), including investigation of the potential future role of such techniques in the education and practice of design professions. The Theme has been well funded, with research exploring sustainable urban transport (CARE North+), architectural heritage auditing and high definition laser scanning (Scott- Aberdeen City Heritage Trust, *Scott 1 and 2*) and urban design (*Zaman*).

### **Theme 2: Sustainable Housing** (Brown, Bennadji, Deveci, Moore, Strachan, Vila Domini)

A major theme of our research for many years has been the social, economic and environmental impact of sustainable housing. A prominent aspect of this work is our practice-led research. This has led to a series of very highly acclaimed built designs which, in developing sustainability principles, have won a number of awards pertaining to social inclusion, environmental performance and aesthetic design (*Brown, Deveci, Vila Domini*). This is related to our work concerning energy policy, and its implications within planning (*Strachan*). This is a broad, interdisciplinary area of our research with a focus on the design and assessment of sustainability in domestic scale built environments. The theme includes studies of energy and the physical performance of whole buildings and their elements (*Bennadji, Deveci*), to studies and designs which address drivers, attitudes, perceptions and social aspects of sustainable housing (*Moore*). It includes the development of assessment methods for aspects of sustainability (*Bennadji*), many of which have been applied in funded partnership with industrial and public authority partners.

### **Theme 3: Projects, Processes, Performance** (Gray, Kishk, Moore, Scott, Wilson)

This theme concentrates on process rather than product in the development of built environments, with a view to investigating and improving the performance of both the design and construction processes and the end product. There are strong connections with other themes, with an emphasis on methods of assessment and the aim of achieving sustainability in the end product. This theme

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concerns performance of the management process in projects and ensuring the optimum operation of the professional team (*moor02*). It is also concerned with managing the process to ensure the optimum performance of the built asset (*kish02, kish04*), including work applied within the Health sector (*Wilson*). Finally, the theme has developed a strand of work concentrating on the organisation of urban settlement (*moor04*) and its links with policy development (*gray02, gray03*). Examples of recent research projects include the consultancy and research components of CIC Start (an ERDF academic-industry collaborative network, CARE North (Interreg IVB study of low carbon urban transport, including 6 North Sea Region Municipal Authorities) and work related to asset management (Healthcare Buildings and Oil and Gas Industry). The theme has recently embarked on the Scottish Government funded 'Mainstreaming Innovation' project, which aims to develop academic-industry links to further reduce carbon emissions in the built environment.

**Theme 4: Theory and Pedagogy** (Basanese, Lewis, McClean)

This theme explores those aspects of theory (*Lewis*), pedagogy (*McClean*) and higher education (*McClean*), which directly influence the future direction of education in architecture and the built environment, in terms of both content and process. The work has been undertaken through funded collaboration with leading organisations and professional bodies in the field, including CEBE, and takes a prominent position in UK national debate on the subject. The theme has also included studies of sustainable humanitarian architecture, undertaken through applied educationally based research, and which have been exhibited and debated internationally (*Bassanese*). The theme has attracted funding from CEBE, the RICS and the Carnegie Trust for the Universities of Scotland.

**Priority developmental areas and initiatives**

Our research themes represent the focal areas for research efforts in terms of writing, publication, design based research, research student cohorts and aspirations for funding. The School has recently been successful in securing EU FP7 funding (theme 1 – 'COncEPT' project), ERDF (theme 1 – 'CARE North+'), KTP funding (theme 3 - sustainable housing), and senior staff are active in European R&D efforts including expert membership of the Smart Cities Stakeholder Platform. We actively target multi-disciplinary funding (often across all Research Institutes at RGU, and with external partners), and continue to engage with industry-focussed research and consultancy. We are core partners in a proposed 'Construction Scotland Innovation Centre', and in 'Mainstreaming Innovation' (Scottish Government) both of which aim to further strengthen links between academia and industry.

Our number of research students has increased steadily over the course of the REF period, and has enabled us to support exploratory work within all of our main research themes. This remains a priority area for development within the unit, including development of the students themselves and further and wider involvement of academic staff within their supervision. Within the next two years, the estate master plan of the University will see the construction of a new state-of-the-art building for the Scott Sutherland School of Architecture and Built Environment, to include a dedicated research hub containing all of our research students and Research Professors. This development will see the school located nearby the main research hub for computing and engineering, and represents a clear opportunity to develop our multidisciplinary research activity in the areas of sustainable and low-energy design, visualisation, and digital design.

**c. People, including:****i. Staffing strategy and staff development**

All new academic appointments within the University take consideration of the potential for staff to make a personal contribution to research activities within their school. Indeed, all new academic appointees are encouraged to consider how they may work towards membership of the appropriate Research Institute. All of those staff submitted under category 'A' are on long-term (permanent) contracts, and there is an appropriate mix between full-time and part-time contracts. The demographic profile of the cohort submitted reflects an appropriate range of gender and age, and represents a staff cohort which will continue to develop well beyond the REF period. We also include early-career staff members (*Brown, Wilson*), who have been supported to develop their

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research interests, and to have demonstrated a willingness and ability to produce high quality published and practice-based research outputs.

The profile of staff contained in the submission demonstrates a healthy approach to both career development and collegiate mentoring and support for new researchers. Senior staff included in RAE 2008 have been able to develop significant research portfolios (Deveci, Laing, McClean, Moore), whilst supporting the emergence of new researchers (Bassanese, Brown, Wilson). Across the staff cohort, there has been an emphasis on enshrining focussed time and resource for research activity through the employment performance review system. This has been facilitated through the Research Institutes, and thematic alignment between research and teaching. Staff research performance is evaluated annually by the Institute Director in terms of specific metrics such as publications and related citations, income generation and research student supervision.

Research within the unit benefits from interaction with a range of external colleagues, whose main engagement with the University is through undertaking the role of visiting professor to our architecture studios. This brings an opportunity for staff to interact with leading practitioners and to develop research which is informed by, and has the potential to influence, design practice outside of academia. This also supports our aspiration to support staff wishing to pursue practice-based research within the field of architectural design. In addition to specified staff development activities, the school regularly runs and hosts research seminars, conferences (including the AHRA Doctoral conference), and engages fully with national initiatives, including CIC Start and the proposed Scottish Construction Innovation Centre. Engagement in such activity is the lifeblood of a vibrant and intellectually driven School, and this will continue to form the backdrop and foundation to our research endeavour.

RGU is actively committed to the Concordat to Support the Career Development of Researchers. In engaging in this important initiative the University has initiated and promoted a number of activities for training research staff across all different levels from research students through to professorial-level staff. Research staff development has, since 2006, been one of the University's strategic staff development priorities. The University has also developed specific bespoke events to support research staff in a number of areas including an *Angel's Nest to Dragon's Den* workshop – a regular 3-day workshop on research applications; *Research Project management* workshop; and, *Public Engagement in Science* workshop, organised in collaboration with the Satrosphere Science Centre in Aberdeen

Since 2004, a *Supervisor Training Programme* for all research degree supervisors, regardless of experience, has been operated by the University. There is initial training which has witnessed an uptake of over 90% of the University's supervisory base. In addition CPD/refresher sessions, introduced in January 2010, have already attracted 44% of the University's supervisory base. Regular evaluations of these events provide the University with positive feedback as well as useful suggestions for future course content. In PRES 2013, under *Supervision*, the University outperformed its national benchmarks in terms of the supervisory skills offered to students including subject expertise, mentoring and availability.

As evidenced in the outputs submitted, the unit has a strong culture of collaboration and co-authorship. This has helped to ensure that staff are given appropriate credit for their research effort, and has helped to ensure that the benefits of publication in terms of visibility are available to those engaged in the research process. Staff are supported through the RGU research ethics processes, including where appropriate review and advice via the research ethics sub-committee.

RGU is an Equal Opportunities employer and this is embedded in all our HR policies and processes. We have a number of family friendly policies which include generous maternity pay and leave above the statutory provision. RGU has a flexible working policy which allows staff once they have enough service to apply for flexible working regardless of their personal circumstances.

### c. II. Research students

Each Research Institute in the University has a Graduate School providing all postgraduate research students within the institution a supportive environment, evidenced by our maintaining

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PhD completion rates well in excess of 85% since 2008. The Scott Sutherland School of Architecture and Built Environment, through its associated Graduate Schools within IDEAS and IMAGES, as of the census date hosts 11 full time and 7 part time research students, with studies extending across all our research themes. It is worth noting that this is an increase on RAE 2008 of almost three times. In fact, the research student community contained in this submission contains the highest number of research degree candidates in the history of the School. During the REF period, we have seen a steady growth in research student numbers (from 5.60FTE to 14.50FTE), and a corresponding number of successful completions (9 in the REF period). This has included a steady increase in self and industry funded students, indicating a wide recognition of our reputation for undertaking high quality research, in a supportive environment.

A wider benefit of the graduate School within IDEAS has been the development of a strong research culture which extends across schools and across disciplines, with joint supervision across disciplines, as appropriate. We have also benefitted from a strong cohort of self-funded research degree candidates, some of whom graduated from our taught Masters programme. The group runs a regular series of research seminars, and all research students are encouraged to participate and present at such events, along with staff from the unit and external guests. Our Research Institutes also support students to present and publish their work through international conferences, which we regard as a key mechanism to develop their academic presentation skills and an opportunity to interact with academic and industry leaders.

All doctoral students undertake the *Postgraduate Certificate (PgCert) Research Methods* course which was first validated in 2002. It presently operates as two modules, each of 30 Scottish Credit and Qualifications Framework (SCQF level 11) credits, and delivered intensively in one week blocks regardless of study mode. Induction elements previously offered in the first module are now offered as part of a *Graduate School Induction Programme*, which was implemented in October 2011. A number of seminars and training sessions are also arranged for doctoral students on specific issues including workshops on developing research proposals for funding applications; preparation for the viva; and, teaching and demonstrating for ad hoc tutors.

The IDEAS Research Institute has awarded a series of prestigious research scholarships to excellent candidates in the submitted unit. These have supported our research efforts in the fields of visualisation, sustainable building maintenance, low-energy design, participatory design and sustainable housing (under the supervision of Laing, Deveci, Kishk, Moore and Zaman). Staff from across the unit (9 of the submitted cohort) are widely involved in PhD student supervision, and this will be of growing importance in the coming years, as the community continues to grow. The Institute has also awarded a series of summer studentships, aimed at promised undergraduates, which have enabled the unit to widen its capacity in areas including architectural theory, interactive IT and in the development of published design material.

### **d. Income, infrastructure and facilities**

The submitted unit has been successful during the assessment period in attracting a range of significant major research grants. This has included notable research funded through Scottish Enterprise, EU FP7 (COncEPT), ERDF Interreg IVB (CARE North, CARE North+ and E-harbours) and the ESRC (Understanding future environments), often working in partnership with Local and National Government. Our research income has increased steadily since 2010, with a clear emphasis on the funding streams noted. We have enjoyed particular success undertaking work funded by Government (Scottish national and local) and Europe (Interreg, ERDF, FP7) for many years, and our successful presentation of that work through leading journals and award winning practice based research ensures a strong foundation for further work. This work has typically been undertaken in collaborative multidisciplinary partnerships, and with partners outside of academia. The unit is strategically working towards full engagement with opportunities afforded by Horizon 2020, including calls in Energy Efficient Buildings, Smart Cities, ICT (for design and creativity) and Transport. Indeed, leadership of a major proposal within the latter forms a keystone of CARE North+, and will engage with a range of local authority, industry and academic partners from across Europe. The RGU Research Institutes facilitate applications and income for external research funding, and this will continue to operate as a powerful mechanism through which we can

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take a strategic approach to encouraging and securing successful development of our main research areas.

The unit has important technical capability, through the use of high level energy monitoring technology (associated with CIC Start, working with SMEs including Kishorn Developments; Anderson Bell and Christie), visualisation equipment (HD scanning and Microsoft surface table) and advanced CAD/CAM equipment (3D printing). The value of this activity has been evidenced through related published work, and has provided a basis for engagement with both further research and applied consultancy work. Through the University and Research Institutes, particularly IDEAS, there is an established process to support annual investment in significant equipment, and to seek suitable staff technical training.

RGU has invested significantly in its research institutes since 2009. For IDEAS this has amounted to almost £7.5 million. IDEAS has core funding from the REG income awarded to its four RAE 2008 submissions (~£1.2 million pa), the Knowledge Transfer Grant that recognises joint work with industry (~£120k pa), a University contribution for each IDEAS member (~£550k pa), plus overheads from its research and knowledge exchange grants. Dedicated space for research activity has been an established part of architecture and the built environment within the University for many years. Recently, it has been possible to co-locate some of our research staff and students with those from Gray's School of Art, providing both formal and informal opportunities for discussion and debate. All students are provided with a dedicated research space, and are encouraged to participate in School and Research Institute activities (e.g. seminars, workshops, research training events). The University has been undertaking a significant expansion of a single campus, and this will include a new building for the Scott Sutherland School (planned for 2015), including a research hub for all research students, thus ensuring our existing provision during the next 5 year period.

Research and Enterprise Services department (RES) supports the Research Institutes and Academic Schools for research and knowledge exchange services, including support for knowledge transfer and commercialisation activity. The University has recently (2013) completed construction of a new state of the art library facility, which is underpinned by extensive access to 1000s of academic journals online. The University has also established an open-source repository for research outputs, including articles, design outputs and PhD theses (<https://openair.rgu.ac.uk>).

**e. Collaboration and contribution to the discipline or research base****Interdisciplinary research**

The great majority of research within the submitted unit has taken place within external multidisciplinary groups, and this reflects a commitment to addressing complex issues facing both society and our constituent industrial areas. Externally to RGU, we have extensive experience of working also with groups from outside of academia, including industrial partners, private clients (particularly with regards to practice based work) and municipal authorities from across Northern Europe. Within RGU itself, this has involved collaboration with colleagues in RGU from Business, Management, Transport, Health and Art and Design. Our Research Institutes are all intrinsically cross-discipline, and the University longer-term initiatives are in the main thematically, as opposed to discipline, driven. The benefits of this engagement with multi-discipline working have included the ability to publish in a wide range of high-quality journals, the opportunity to work with a similarly stimulating range of external partners, and to address research problems within architecture and built environment whilst drawing on expertise and methodologies from across the academic base.

**Networks and clusters**

Working externally to RGU, staff from the unit are involved regularly in wider debate at both National and European levels. Much of this activity has come about through the recognition of our research track record, as in the case of our participation in the European Construction Technology Platform ([www.ectp.org](http://www.ectp.org), where our involvement was invited to research and professional work with the RICS), the EU Smart Cities Stakeholder Platform ([www.eu-smartcities.eu](http://www.eu-smartcities.eu), our membership following successful application based on work in the visualisation theme) and the World Energy

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Cities Partnership Academic Programme (WECAP - [www.energycities.org/academic-programs](http://www.energycities.org/academic-programs), with participation from both Moore and Laing, leading in turn to collaborative proposals to the Norwegian Research Council). International research collaboration has been established with leading international organisations including University of Stavanger (through WECAP), Aalborg University and the Wuppertal Institute (through Information Visualisation research), Hong Kong Polytechnic University (Carnegie Trust) and KEA Copenhagen (KEA funded PhD and Research Development programme, ERASMUS and through co-organisation of the International Conference on Architectural Technology). In addition, we are members of the BIM Academic Forum, and have been active in the development of modelling and visualisation research in the built environment (Information visualisation, ASCAAD, BuiltVIZ). In all cases, research undertaken within our themes has ensured that our participation in these networks has been sought out and valued.

### Academic and industrial collaboration

The unit was a core partner in CIC Start online ([www.cicstart.org](http://www.cicstart.org)), a collaborative partnership of 7 Scottish HE partners, which interacted between 2009 and 2013 with over 2000 participants, and undertook significant and innovative work with industrial partners (including reports on feasibility studies and academic consultancies, webinars, online conferences and articles published in the quarterly online magazine Innovation Review). This was an important initiative which demonstrated the strong connections between industry need and academic expertise, in an applied setting. We are partners in the 'Mainstreaming Innovation' ([www.mainstreaminginnovation.org](http://www.mainstreaminginnovation.org)) and are academic lead for the 'Design' stream within the proposed (Scottish Funding Council) Construction Scotland Innovation Centre. During the REF period, we have also actively sought to work with industrial partners through Knowledge Transfer Partnerships (Sylvan Stuart and Grampian Housing). We aim wherever possible to match the skills and knowledge evidenced by our research track record with the needs of external partners. This can be witnessed through our work concerning environmental design (undertaken through KTP partnership, and with private clients), design evaluation (working with national and local authorities), and at a local level with a large primary and secondary school). Recently, we have worked with Aberdeenshire Council to develop a funding stream and strategic proposals for the implementation of affordable low-energy housing. In terms of policy development, we have been active working with national and regional transport authorities, as evidenced through our advisory work with ICLEI and North Sea Region partners.

### Leadership in external debate

Staff are also editorial board and organising committee members for journals and conferences, including *Zaman* (AHRA 'Emerging Boundaries' Research Student conference 2012), *Bennadji* (ASCAAD), *Laing* (IV, BuiltVis, Cloudcom 2013), *Deveci* (Passivhaus), *Journal of Building Survey, Appraisal and Valuation* (edited by Simon McLean), and have delivered invited and keynote presentations (particularly *Bennadji*, *McClean*, *Deveci*). Staff have also been instrumental in establishing seminar series concerning building conservation (*Laing*), Architecture and Education (*Lewis* and *Penn*, via the AE Foundation) and Humanitarian Architecture (*Bassanese* via Build our Nation). The AE Foundation has provided a notable forum through which participants can debate key issues in architectural education, and publish from that activity (*Lewis*). Build our Nation has been an excellent example of how cross-discipline and transnational working can lead to transformative educational experiences, and which have been exhibited at prestigious international platforms (*Bassanese*). Staff have made significant contributions to the work of associated professional bodies including the RICS (Academic Route to Chartered Professional Membership, EU ECTP representation), CIOB (Scottish chairmanship) and the RIBA (Education Board).