

Institution: Robert Gordon University
Unit of Assessment: 13: Architecture, Built Environment and Planning
<p>1. Unit context and structure, research and impact strategy</p> <p>Achievement of strategic aims for research and impact</p> <p>Our research has a clear focus on the relationships between people, their environment and technology. Across our research, our emphasis has been on considering ways in which these aspects interact with one another, and on the ways in which emerging technologies and processes of participatory design can be developed and applied to improve the environmental, economic and social relationships which exist in our built environment.</p> <p>The staff cohort from which the submission is drawn has evolved considerably during the REF period, and work has been undertaken by teams which include both experienced academics and early career researchers. Of the nine submitted staff members, three were promoted or appointed to senior positions during the REF period (Bennadji, Dounas and Leon), two are at an early career stage (Hood and Victoria), and three are full Professors (Deveci, Gray and Laing). Among the cohort from REF 2014, two staff have since moved on to other institutions, two moved to careers in industry, and one staff member retired.</p> <p>We have placed a strong emphasis throughout the REF period on identifying and supporting routes through which outputs of the highest quality can emerge from studies and through activities undertaken in collaboration with external partners.</p> <p>We regard these characteristics of the submitting Unit as being critical to its success, and they will remain key to its long-term sustainability and vitality. It has also been particularly heartening during the submission period to witness externally funded research being secured by team members across the group. All members of staff submitted were active in proposal instigation and writing, and all secured external research grant income during the REF period. In almost all cases this has also been a result of deliberate and targeted collaboration, and often across disciplines.</p> <p>Our strategic research aims during the REF period concentrated on growing and undertaking applied research within our identified thematic areas (Digital Cities and Society; Sustainable Housing; Project Management) and ensured that such effort and activity were reflected through high-quality research outputs. Furthermore, the development of a strong cohort of researchers, including research students, has remained central to our recruitment policies and behaviour.</p> <p>The research themes strategically set out in REF2014 have been maintained to a significant degree, evolving to respond to changing societal drivers and needs.</p> <ul style="list-style-type: none"> • Visualisation has since evolved to encompass “Digital Cities and Society”, to incorporate aspects of the relationships between the built environment and digital technology, including the pervasive use of building information modelling, urban sustainability, mobility and the emergence of blockchain. • Sustainable Housing has continued to undertake work within both academic and practice-based contexts, and remains one of our strongest and most visible areas. • Project, Processes, Performance (now titled “Project Management”) has embraced the manner in which project management and participant behaviours have been affected by both technological and economic drivers. <p>In REF 2014, we included a thematic research area concerning pedagogy and theory. This work has continued, but has taken place within the context of academic enhancement and the application of innovative teaching methods and approaches. Therefore, the work of that</p>

group has become associated with the enhancement of teaching excellence, rather than within research.

We regard the integration of our research and teaching activity to be critical to the development of a strong intellectual culture within the host disciplines. Indeed, it has been possible to develop a thematic framework for the University's activities within architecture and the built environment where the topics, challenges and activities of our research are often common with those under consideration within our taught courses. We regard this relationship across our activities to be extremely important, and one which allows us to respond to external challenges in creative and agile ways. For example, our research work concerning innovations in mobility (Civitas PORTIS, Interreg PAV and Art-Forum) have had direct input to our Master of Architecture course at stages 3 and 5, as has our work with James Fisher and Sons, concerning visualisation and infrastructure management (at PG level, especially).

Since our submission to REF2014, we have maintained a trajectory of strengthening the outputs from our research in terms of both published academic outputs and through research-led practice (**Deveci**). We have also continued to work extensively and collaboratively with external partners, and often with municipal authorities from across the North Sea region (including the municipal authorities in Aalborg, Almere, Antwerp, Bremen, Hanover and Malmo). Our research during the current REF period has continued to receive funding through European Commission programmes, including H2020 and Interreg, and we have managed to extend our range of research collaborators and clients, working in particular with industry and local government partners. We have also been particularly successful in undertaking work funded by Innovate UK, including Knowledge Transfer Partnerships (in association with Abertay Housing Association; Highlands and Islands Transport Partnership; James Fisher & Sons; and, Kishorn Specialist Contractors) and funded research commissions (through Transforming Construction Network Plus).

At a strategic level within Scotland, we have been active in undertaking research through the Construction Scotland Innovation Centre, where representatives from the Unit were able to co-chair one of the four thematic strands (**Laing**), and to participate as innovation champions (**Deveci, Dounas, Laing**). The Innovation Centre was established to connect industry, academia and the public sector in order to derive the benefits which can emerge through cross-sector collaboration and creativity. The Centre is supported by the Scottish Funding Council, Scottish Enterprise and Highlands and Islands Enterprise, and RGU has been a partner since inception. In relation to this Unit, a series of projects were developed via the Centre which have extended our digitisation research into highly creative industry practice, including robotic fabrication of timber components and innovative affordable housing typologies. These resulted in the creation of a new university spin-off company (Roubo Ltd).

All of these activities have benefitted from us recognising the importance of stakeholder engagement within our research, which in turn resulted in the formation of research consortia and activity which respond to concerns of society, as well as seeking to advance academic knowledge.

We have had a long-standing strategic aim to increase the number of research students studying within the Unit. During the submission period, we have been successful in this aspiration, with the Unit's 2020 research student community numbering 25 candidates at the census date, an increase from 14 in 2014. It was also extremely important within the Unit to ensure that there was a close connection between the key strategic research themes within the Unit and studies undertaken by our postgraduate research community. This was especially true within Project Management, where we have been able to foster strong connections between research and our taught postgraduate courses (including graduates from our MSc courses in Construction Project Management and Advanced Architectural Design continuing to research degree study).

During the submission period the University established an Institution-wide Graduate School, which manages processes and formal training in relation to our research degree candidates. One clear and distinctive benefit of this University-wide initiative has been the establishment of a strong peer group of research degree candidates, which is cross-disciplinary in nature. The strength of that community is perhaps most clearly evidenced by its continuation throughout the pandemic of 2020, where students continued to meet in significant numbers, to present their work, and to engage in discussion and debate (albeit online).

In addition to training which has been made available to the postgraduate research student community, our Graduate School has been active in the running of staff development and training. Staff within the submitting Unit (**Laing, Salman**) have drawn on their extensive experience of research degree supervision and examination to provide instruction, advice and peer support to colleagues across the University, and all staff involved in the supervision of research degrees have been required to engage with a regular series of training events, designed to best support our students through the academic journey towards a PhD (including registration, research design, monitoring and preparation for the viva itself).

Future strategic aims and goals for research and impact

Our strategic goal over the next five years is to foster a vibrant and creative research environment, within which we can undertake work of the highest quality, explore our core research themes, and do so in a manner which has a demonstrably positive impact on our industry, society and environment. In so doing, we will enhance and nourish all areas of activity within the School, and make the strongest possible contribution to the wider community.

In order to ensure the ongoing vitality of the submitting Unit, we have in place a strategy to secure a reliable stream of external research funding. That strategy operates both at a unit-wide level and operationally within individual objectives and targets. This involves the establishment of collective unit-wide targets for external grant income on an annual basis, which translate to individual targets for volume of research applications.

The relationship between these is founded on a presumption of likely success rates (depending on funding stream and scale) and is coupled with a recognition that proposals will often involve numerous participants. This has helped to ensure that the efforts are regarded and treated as a team responsibility, and all submitted staff have extensive experience of proposal instigation and writing, and of undertaking funded work.

The Unit has a long track record of securing international research funding, extending over 20 years. This has included work supported by the European Frameworks 4 and 5, through a series of Interreg programmes, Framework 7 and ongoing research within Horizon 2020. A key aim for the Unit will be to strategically target national (UK and Scottish) funding streams, and to continue working within our relevant city and region deals (including those for Aberdeen and Aberdeenshire, and the Islands). Where rules permit, we will continue to collaborate with other European partners, and we continue to explore opportunities including through the British Council, and with key collaborators internationally (including Aarhus University and Politecnico di Milano).

The Unit includes staff from a range of academic and professional disciplines, and this supports us producing a diverse range of high quality outputs. Research themes within the Unit will continue to benefit from cross-discipline collaboration and knowledge sharing, including expertise from materials science (**Jafarifar**) and transport policy (**Gray**). Furthermore, the thematic areas targeted by the Unit will benefit through working as part of well-established quadruple helixes (including long-standing partnerships with government, industry and community groups).

These aspirations for research support and content are vital to the future sustainability and vitality of the Unit. They have enabled the Unit to apply and demonstrate the impact of

research activity within policy and practice (as noted within the associated impact case studies), and developing that aspect of the research is seen as key to its continued success.

Extending the reach and impact of our research is therefore a key strategic objective for the forthcoming period, and we have put in place structures to facilitate such activity.

Structure of the Unit and forward strategy

Our research activity can be conceptualised through three themes, where individual participation and involvement is encouraged across disciplines. These thematic areas will form our research direction and focus in the coming five years, with the drivers being both internal and external to the University.

Internally, we regard these themes as being essential to maintaining currency and vibrancy in the academic environment, and to ensure that we derive and encourage the greatest benefits from colleagues. Externally, the industry and the built environment are going through a period of significant change, driven by the need to respond to the climate emergency, and to apply emerging digital technology in ways which improve lives and the environment. We argue that all three of our thematic areas address these challenges, and have done so in a manner which is both applied and creative.

Staff in the Unit have been active in leading academic and industry groups relevant to each theme, and this has enabled the Unit to develop and undertake research which is intellectually challenging whilst being applicable across society and industry. Staff are indicated alongside their central area of research focus, although cross-theme working is supported and common. Each of the thematic areas contain core staff membership, with evidence of collaboration across themes (e.g. digital technology and housing). The staff submitted all have a demonstrable track record of publication, attraction of funding, and of engagement with external partners.

The themes identify key **challenges**, where the strategy to address these embraces **staff development**, engagement with our **PGR community**, pursuance of **funding** with objectives at unit and individual levels, and continued engagement with **stakeholders**.

Theme 1: Digital Cities and Society (Dounas, Gray, Hood, Laing)

Our Centre for Digital Cities and Society was formally established in 2020 and brings together interdisciplinary expertise from across the University. The Centre is founded on shared research interests in the impact which digital technologies have on people and their physical environments, including through design, fabrication and study of wellbeing.

This focus on people has become the predominant driver within the theme, and activities within the centre have been framed in relation to related challenges. The theme has a strong network of external stakeholders and partners (including from the digital technology sector, as well as partners in leading universities including Politecnico di Milano and within innovative Municipal Authorities, such as Bremen and Antwerp), which has enabled us to participate fully in the development and application of solutions. Recent work has concerned studying the impact of digital sensor technology and autonomous vehicles on urban and rural mobility (PORTIS, PAV, Art-Forum, G-PATRA) and the development of blockchain-enabled communication and project organisation (<https://archchain.cc>).

Through our activities in research and teaching, we will aim to work with external colleagues, from both the public and private sectors, and including academic partners internationally. In particular, much of our work is defined by engagement with the wider community, and the way in which we can assist, inform, advise and stimulate positive change with regards to urban design and management, mobility, productivity and the impact of emerging technology.

Our research has been supported by external funding bodies and clients including the European Commission (FP7 and Horizon 2020), Interreg North Sea Region and Northern Peripheries, UKRI, Aberdeen City Council, Aberdeenshire Council, the Construction Scotland Innovation Centre and Innovate UK.

Theme 2: Sustainable Housing (Bennadji, Deveci, Jafarifar)

This is a broad, interdisciplinary theme with a focus on the design, retrofitting and environment assessment of housing and domestic scale architecture. Continuing as a long-term theme within the Unit, the research concerns the technical design and monitoring of energy use in buildings, and has engaged with the study of human interactions and influences on sustainable housing. The theme has extended the application of assessment approaches and tools developed over a long time period, and recently funded work has considered the implications of the research within the contexts of new mass-market housing and policy and practice with regard to upgrading to mitigate fuel poverty.

A prominent aspect of work in the School of Architecture and Built Environment is that of practice-led research. This has led to a series of highly acclaimed built designs which, in developing sustainability principles, have won a number of awards pertaining to social inclusion, environmental performance and architectural design. These have included recognition for the work of Professor Deveci ('Integra House' shortlisted for the 2018 TRADA- JJ Design Innovation Awards; 'Heritage Way' awarded distinction in the 2019 Aberdeenshire Design Awards) and Dr Bennadji (2014 CIOB International Award in Research and Innovation; 2014 Saltire Award; 2018 Scottish Energy Efficiency Award).

Research in the theme takes place through funded research projects, PhDs, and student scholarships. Research interests from the theme have been published in leading journals (e.g. Energy in Buildings), and widely disseminated at international conferences (e.g. PLEA, ASCAAD). Engagement with CSIC and industry partners has also led to the development of products for the built environment via industrial research, such as a zero-fixings timber panel, and a robotically fabricated timber joint (**Dounas**). These products are now in the market development phase.

The importance of our research in terms of its implications for our occupants, society and the environment has been demonstrated through long-term collaboration between the contributing staff and external stakeholders including housing associations and the manufacturers of materials and components. The theme has a track record of securing external funding through UKRI, Interreg, Innovate UK (Knowledge Transfer Partnerships) and via research commissions from building owners and occupants themselves.

Theme 3: Project Management (Leon, Victoria)

Our Project Management theme has a strong track record of funded research, and team members also undertake related high-quality teaching, corporate training and other commercial activities within Management, Construction, Infrastructure and Oil and Gas. We also have established collaborations with key industry players and other institutions worldwide.

Drivers for work within the theme have included a need to respond directly where our industry sectors have faced organisational and strategic challenges. Within architecture and the built environment, and during the submission period, pervasive digitisation of the industry and development of the manner in which teams operate have been central to much of this activity.

Work from the theme is regularly presented in both local and international events, conferences (e.g. **Leon**, ARCOM) and public forums and we have robust links with both industry and professional bodies (including **Victoria** and **Laing** research with the RICS). We have a strong focus on applying Research and Development to support the local and wider industries, including among others Oil and Gas, Construction, Infrastructure and Business Development.

Members of the theme have collaborative links with other relevant disciplines, including the Computing, Business and Engineering Schools and the Energy Transition Institute within RGU, together with the Oil and Gas Innovation Centre, the Construction Scotland Innovation Centre, and through our Innovate UK KTPs. These provide a wider knowledge base for complex problem-solving, and support a greater reach in terms of research impact. Furthermore, we have access to high-end digital tools, from high-definition laser scanning, VR and AR equipment to simulation suites to complement our existing capabilities.

Activity of researchers in the theme can be evidenced through research commissions (including the application of digital data capture in the management of heritage assets) and knowledge transfer (including a current KTP with James Fisher and Sons regarding infrastructure management).

Priority developmental areas and initiatives

During the submission period, the Scott Sutherland School of Architecture and Built Environment moved to a new purpose-built building, which incorporates a dedicated research hub containing our on-campus postgraduate research students, academic research staff and Research Professors. A further benefit has been drawn from the physically connected Schools of Computing and Engineering, which has enabled more seamless and regular communication and collaboration to take place. In the next period, we will work towards extending the number of postgraduate research students within the Unit and will also aim strategically to align the associated projects with the core themes of the Unit, and with staff expertise.

Impact strategy

Within the submitting Unit and working across themes, specified staff (**Laing** and **Victoria**, in particular) will continue to direct support and encourage external engagement through numerous routes and methods. In keeping with the research themes of the Unit, we regard these activities as being central to the research, and we have adopted many approaches and mechanisms through which the research itself can develop in a manner which is genuinely collaborative and outward facing.

- Partnership working, through advisory committee work, innovation champions (CSIC) and professional bodies (RICS, CIAT, RIBA)
- Collaborative application for grant funding (e.g. with Aberdeen City Council)
- Extension of work with Innovate UK, including KTPs (e.g. James Fisher and Sons, Abertay Housing Association)
- Engagement with the RGU Innovation Hub and the wider innovation agenda at the University
- To extend the frequency and reach of public and externally-focussed research events and activities (including Professorial lectures and public events through funded research)

A strategic priority has been working with partners from outside of academia to address issues which are being experienced within practice and within society. As a result of this focus, the great majority of our most heavily funded research has been undertaken within consortia which have included external partners with whom we have an established track record of collaboration. This includes participation in public debate, informing of regional and local policy and operating as an independent group of experts.

Indeed, with regard to impact from our research outside of academia, the network of stakeholders with whom we habitually work (local and national government, industry and community groups) has meant that our work has been able to have an impact on economic performance, policy direction and the widespread application of innovative architectural and construction methods in industry. This has been particularly true in our work concerning housing and sustainable urban behaviours (within the thematic area of 'Digital Cities and Society'). This has helped to ensure that there is a seamless connection between the research

undertaken and its external impact, as opposed to the research being undertaken in an initially detached or isolated manner.

Ongoing and recent research activity includes work funded by the European Commission H2020 (Civitas PORTIS, URBANOME), UKRI, Interreg North Sea Region (Art-Forum, PAV, G-PATRA, Stronghouse) and Innovate UK (KTP). All of these projects have collaboration with known academic partners at their heart, and all include mechanisms and activities geared towards external impact as a core part of their methodology.

Wider impact from our research themes has been realised through a number of initiatives and platforms.

- Engagement with policy communities

Our research work, and especially that funded through various European funding streams, has enabled the research team within the Unit to disseminate, discuss and debate research findings with stakeholders across the continent. Our formal position within projects including PORTIS (Civitas H2020) and PAV (Interreg) has been to guide and undertake stakeholder engagement and evaluation work, in close collaboration with municipal authorities, private sector partners and members of the local community (including in Aberdeen, throughout the North of Scotland, and in Orkney).

Through our EU funded work, we are able to share and develop new areas of knowledge with partners from across Europe (e.g. with cities through the Civitas initiative).

Members of the research cohort have also been active in terms of providing evidence within the Scottish Government pertaining, in particular, to sustainable mobility (**Gray**). The University prides itself on having a strong connection with external stakeholder groups and the work undertaken within our research mirrors that approach and policy.

- Engagement with professional bodies and industry groups

Our researchers have been especially active in its collaboration with relevant professional bodies and policy organisations. With regards to the core academic disciplines represented within this research submission, work in collaboration with the RICS, RIBA and HiTRANS (Highlands and Islands Transport Partnership) is especially relevant.

Specifically, we undertook research supported by the RICS together with CHOBE (Council for the Heads of Built Environment) concerning the worldwide education of surveyors. Members of the cohort have continued to act as expert reviewers for the RICS Research Trust and have been active in terms of the RICS APS (Research Route), including taking on the role of chairperson in assessments (**Laing**). **Laing** and Kouider were chair and co-chair of the CIAT Research Group between 2016 and 2019, and continue as members of the Education group. With the RIBA, the Unit has engaged with research concerning issues of mental health and architecture students, with the work supported by an RIBA research grant. The Unit has also been very active in researching the connections between sustainable mobility on the design and management of our built environment. **Gray** has been an expert member of the board of the Highlands and Islands Transport Partnership (HiTRANS) since 2009, which has been especially beneficial in terms of formulating collaborative research projects and helped to ensure that the results of that research can then be applied through policy and practice. **Dounas** was invited to lead the technical committee of the Construction Blockchain Consortium in Oct 2020, and to lead the 2nd international research workshop for blockchain in construction during 2021.

- Strategic collaboration

The research staff cohort has formed numerous strategic partnerships with leading collaborators outside of the UK, including municipal authorities in Bremen, Antwerp, Almere and Varberg, and

has been able to forge connections with leading universities (including the appointment of visiting Professors from Aarhus and Curtin). We are also currently involved with numerous research activities funded through the Horizon 2020 and Interreg programmes, which have enabled close collaboration with key municipal authorities in the North of Europe in addition to leading universities and consultants. These projects extend across the next 3-4 years, and will enable strong collaborative bidding for Horizon Europe funding.

- Invited and arranged external lectures to industry groups

Submitted staff have been active in terms of delivering invited external lectures to industry groups. These have extended across all three of our research themes, and have included presentations to and invited attendance at the International Smart City Summit (**Laing**), TM Forum Yinchuan Smart City conference (**Laing**), Forum 8 urban modelling (**Bennadji**), presentation to the Chevening Alliance (**Laing**) and participation in the 2020 Royal Academy of Engineers “Frontiers of Development” symposium (**Jafarifar**), the Consortium for Blockchain in Construction and the Industrial Construction Chair in ETH Zurich (**Dounas**). **Deveci** has been a judge of the World Architectural Awards since 2012, and has been a design panel member for both Aberdeen City and the Highland Council, also since 2012.

The group has also been active in terms of instigating public debate, including in the organisation of conferences (including BuiltViz, IV, ASCAAD), seminars, public events and delivery of public lectures.

- Case studies

We present in our submission two **impact case studies**, which demonstrate how the research across our thematic areas applies robust and externally informed methodologies, to improve the built environment in tangible and verifiable ways. In the case of those studies presented, this relates specifically to the instigation and enacting of significant improvement to our housing stock, and to the impact which urban mobility can have on people and the environment. Each demonstrates a sustained commitment to external collaboration, knowledge generation and to making a positive impact on policy and practice.

Data management policy and practice

The University has recognised the importance of open research data position through its Research Data Management policy. Training has been provided for staff regarding open access to research data and research outputs, and staff are able to draw on expertise within the University regarding the writing and application of research data management plans. These are typically developed using funder guidance (e.g. EU, UKRI), and their development is included within research work plans. The University has used its digital research repository (Worktribe) to host research outputs (including written work and designs), including during embargo periods, and as a mechanism to facilitate wide access.

Research integrity

Research undertaken within the submitting Unit is all subject to ethics assessment prior to submission of proposals, and the University regards this as being an intrinsically valuable part of research development. The School of Architecture and Built Environment has a research committee, which takes an overview of ethical issues across our thematic areas. PGR studies are assessed by the supervisory team, and may be referred for consideration by the committee. This is to ensure that researchers can seek guidance, to aid adherence to best practice.

2. People

Staffing strategy and staff development

As a modern University with a strong focus on applied and impactful research, the REF period has seen the appointment of 6 new staff within the School of Architecture and the Built Environment who came with strong research records. Throughout the REF period, the University has had a research-oriented recruitment policy for new academic staff, which has given priority to the appointment of lecturers who hold a research degree.

Indeed, within the submitting Unit we have been extremely proactive in terms of utilising the policy to drive the recruitment of a cohort of post-doctoral lecturing staff. In turn, we have been able to foster a close connection between their own individual areas of research, research themes which exist across the Unit, and with their teaching at all levels. All of the category A submitted staff are on permanent contracts.

This strong thematic connection across all activities within the submitting Unit has greatly supported our aspirations to operate collaboratively and be able to demonstrate a clear nexus between teaching, research and scholarship.

The host school for the majority of Unit members (the Scott Sutherland School of Architecture and the Built Environment) applies an operational workload planning model, which ensures that early career researchers are given sufficient time to develop their own areas of research, and to do so within the broader context of developing as rounded academics. In practice, this has resulted in staff, wherever possible, being engaged with research, PhD supervision and teaching which is thematically connected. Staff are eligible to apply for 6-month research sabbaticals (awarded during the REF period to **Gray** and **Laing**).

The Unit has an established programme of research seminars, with involvement from academic staff as well as research degree candidates. Staff within the Unit are also active in public speaking, including through the University's own Professorial lecture series (**Deveci**, **Gray**, **Laing**). Such events are open to the wide community, and staff are encouraged to participate. Staff are also supported to disseminate research findings through the press, and the University communications team provide support and guidance.

Within the Unit, we make extensive use of regular staff planning and review structures (in the context of this Unit, where we have specifically used the 'Employee Performance Review', or EPR, for this purpose). Each staff member included within the submission, through discussion with their research coordinator and Head of School, participates in regular personal career review sessions, which within the context of research development have provided a useful mechanism in terms of time management, strategic application for external research funding, engagement with our postgraduate research community, and targets and direction setting with regards to research outputs. With regard to staff development, these discussions take place within the context of consideration for how a strong staff cohort can work together and across disciplines to achieve larger and more ambitious goals.

Therefore, the EPR is regarded by the University as a key mechanism through which we can encourage and support the development of individual research activity and achievement. Although the review process is undertaken at an individual level, staff are encouraged to work in a collaborative manner, and overall departmental targets with regard to research income and outputs are ultimately assessed at a collective level. As described in section 1 (Future Strategic Aims), for research active staff the EPR contains individual targets for volume of funding applications, which is then fostered, tracked (through regular reviews) and supported (through collaboration, peer review and through the University's Research Strategy and Policy department). We believe that this has helped to cultivate an atmosphere of collegiality within the Unit, which in itself has been demonstrated to hold the potential for greater collective success.

Staff within the Unit are supported to attend and present at high-level research conferences, especially where these relate directly to ongoing research activity. The Unit also makes strategic use of overheads recovered from funded research projects to support project investigators as they work to develop and strengthen their research networks and develop further research proposals. Specific and key examples are provided in section 4 of this document.

Staff with leadership and management roles are supported by RGU's Leadership Development team, offering a suite of both ILM accredited and non-accredited development programmes and activities which include:

- Pioneer: RGU Future Leaders' Programme
- Voyager: RGU Middle Managers' Programme (ILM Level 5 Certificate in Leadership and Management)
- Discoverer: RGU First Line and Aspiring Managers' Programme (ILM Level 3 Award in Leadership and Management)
- The RGU Manager: For those new to managing at RGU

All staff are also able to access the Skills4Success portfolio of staff development workshops to help with generic and interpersonal skills such as time management, communication and personal effectiveness.

The Unit also offers staff individual coaching sessions with experienced leadership coaches, team development, facilitation and other bespoke development interventions. Our Research Strategy and Policy department has during the REF period established a strong programme of researcher development training, which includes guidance and support for proposal writing and submission, peer review, research project management and research impact.

The staff cohort within the submitting Unit is comprised of a diverse group of staff, especially in terms of nationality and ethnicity, and the University as a whole has worked to establish routes through which the careers of research active staff can progress in line with their research achievements. Within the submitting group, two staff members (**Bennadji** and **Leon**) were promoted to Senior Lecturer level in direct recognition of the quality of their work, and for the contribution which this makes to the University community.

Postgraduate research students

The PGR cohort within Architecture and Built Environment are located in a dedicated space, within a new building constructed during the submission period. This has enabled the Unit to develop a stronger research ethos among the PGR community, and to provide PGR candidates with full access to specialist facilities.

In the period since REF 2014, and guided both by the outcomes from that process and from the recommendations arising from the external review of research degree provision in 2018, there have been profound changes in respect to the research organisation and administration within the University. Focussing on the research environment for postgraduate research (PGR) students, the three Research Institute-based Graduate Schools were amalgamated into one single pan-institution School in 2016. The intention behind the consolidation was the desire to ensure best practice was being followed consistently for all PGR students regardless of their individual discipline of study. An important aspect of this restructure was to ensure all PGR students would benefit from the changes. The evidence from 2016 is unequivocal in confirming that the overall research degree experience from the PGR community has improved, based on returns from Advance HE and equivalent internal Postgraduate Research Experience Surveys (PRES).

Taking the measure of Overall Satisfaction as a key performance indicator, in 2015 the rating was 71% and below sector and benchmark comparators. In 2017 this rose to 77% but remained marginally below the sector average. From 2018 to the present, the University has implemented a bespoke survey, covering similar aspects to those in PRES, but also recognising specific local issues and context. In November 2020 the survey was adjusted to account for the disruptions caused by the Covid-19 pandemic, that necessitated campus lockdown for several months.

Although the surveys are not directly comparable, the Overall Satisfaction level in the internal PRES (for students in Architecture and Built Environment) elicited a value of 91% (where the national Advance HE PRES value was 80% for Overall Satisfaction). A contributory factor to the considerable improvement was in part the result of the introduction of the **Researcher Development Programme** for all PGR students and Early Career Researchers (ECRs) within RGU <https://www.rgu.ac.uk/research/the-graduate-school/researcher-development-programme>. This programme was launched in September 2020 and was the first occasion when the University offered a comprehensive and structured training programme for researchers, focussed on PGR students and ECRs. This builds upon the **PgCert Researcher Development** course, a course that all PhD students must successfully complete, that was successfully revalidated in September 2019. Delivered by the Graduate School and taught by highly experienced researchers from the academic community this provides an excellent foundation in developing the broader skills necessary to become an independent researcher. By necessity, since March 2020 the course has been delivered online and the most recent feedback from the module taught in November 2020 provided a rating of 95% Excellent (this figure is for the cohort as a whole, to provide statistical validity).

In addition to the considerable progress in Overall Experience as observed in PRES, the other critical aspect to evidence the success of the new Graduate School relates to PGR student performance. Historically research degree graduate success has been high, with those passing being above 85% (when taking into account those who had failed the initial attempt but passed on resubmission). Working from this positive baseline, the University-wide Graduate School focussed on time taken for completion. Setting a target of 70% completion within registration period for the whole PGR student community, in 2019/20 completions across the University within registration period moved up from less than 40% overall around 70% currently, and rising.

Postgraduate research students in the submitting Unit were, and are, all registered as studying towards PhDs, and the Unit does not at present offer Professional Doctorates.

Submitting unit support and promotion of equality and diversity

As in the period of REF2014, all staff submitted under category 'A' are on long-term (permanent) contracts. Furthermore, all submitted staff are on full-time contracts. The Unit also has a healthy demographic profile, including in terms of sex, age and nationality, and this provides additional evidence of the Unit's sustainability in the long-term. Indeed, the submitted staff group is diverse, with 5 male, 4 female, and submitted staff having places of birth in the UK (2), the EU (2 from Greece) and further afield (5, including Algeria, Canada, Iran, Sri Lanka and Turkey). This has resulted in a genuine diversity and vitality, founded upon notions of collaboration, creativity and respect.

RGU operates an Equality and Diversity policy, where one of the submitting Unit's Academic Subject Leads (Bjeirmi) is the RGU Race Equality Champion. It has also implemented a Dignity at Work and Study policy, through which the University and School aim to support an inclusive culture in which differences are respected and any form of bullying, harassment or victimisation deemed unacceptable.

This informs our approach to the definition of staff recruitment, and to the ongoing operation of the organisation. Staff are formally supported by their HR colleagues during periods of ill health, as well as informally by peers and colleagues. Where staff suffer from conditions which require particular working conditions, it is normal for the organisation to be flexible in

terms of attendance on campus, and the environment when on site. Career promotion pathways are open to all staff, both part- and full-time, and revised policies were established during the REF period to support career advancement through research excellence. In this sense, especially, staff are able to map a career path based on a diversity of drivers.

The University has supported 76 women through AdvanceHE's Aurora Women in Leadership programme since its inception in 2013, which has allowed the University to tap into the hidden potential of a wide variety of women throughout the University, and to support them in moving forward with their career, be that at RGU or beyond. From the submitting Unit, **Leon** undertook the Aurora programme where it helped her to develop, identify, crystallise and communicate her aims within academia. She contends that it also assisted with managing work, leadership responsibilities, politics and relations.

It has enabled women across the organisation to continue a journey of personal development and has built their confidence, networks and continued career satisfaction. It has also allowed RGU to raise the profile of women and the important contributions they are making in the University.

As noted elsewhere the Unit operates an Employment Performance Review process, which involves co-design and agreement of annual objectives (including those for research income, outputs and impact) between staff and their line manager. In the case of research active staff, input is always sought from the Research Coordinator. Staff are encouraged to keep in regular informal communication with peers as well as line managers, to foster a supportive, creative and fulfilling work environment.

3. Income, infrastructure and facilities

Income, infrastructure and facilities pertaining to research and research impact

During the submission period, the Unit has undertaken research with a grant value in excess of £2.2Million. This equates to approximately £250K per submitted FTE, which compares favourably with sector-wide submissions to the previous REF. The grant value includes significant research commissions from the EU (£746K), Interreg (£272), UKRI (£150K), Innovate UK (£360K) and through collaboration with Scottish Local and Regional Authorities. The Unit continues to collaborate with partners from across Europe to work towards engagement in current and future international research challenges, and specifically in the areas of sustainable urban environments, energy efficiency in buildings and the use of robotics and digital technology in construction and architecture. As stated, establishment of the Construction Scotland Innovation Centre (CSIC) during the submission period introduced a significant and very positive mechanism to foster and support academic-industry collaboration through funded academic-industry partnering.

The Research Strategy and Policy department provides dedicated guidance and expertise with regard to the governance surrounding writing and submission of research proposals, and dedicated staff then offer experience and support to successful applicants. This is extremely important to the success of any research group, and enables academic members of the team to concentrate efforts on undertaking the research itself. The RS&P team is also proactive in terms of identifying forthcoming research calls, and their efforts have been invaluable, especially when dealing with complex or large research consortia.

During the submission period, RGU has been proactive in the development and introduction of a digital research management system (Worktribe), which enables the online sharing, recording and archiving of all project information. This extends from the instigation of a proposal through budgeting, award, completion, outputs and impact. This has positively contributed to team collaboration, and has ensured that there is a seamless and current connection between staff details, research activity and governance.

At a subject specific level, the submitting Unit has continued to develop and support access to state of the art technology, and during the submission period there has been further focus on the use of digital data capture technology (including HD laser scanning and drone equipment, with **Dounas** trained as a drone pilot). We have extensive and long-term experience of working with Leica Geosystems (Hexagon) technology, and submitted staff (**Laing, Leon**) have tutored at the annual digital data summer school organised by the world-leading 3D Survey Group (Politecnico di Milano). That activity has been aimed at exploring how such technology can be used within the study of heritage and community engagement, and represents a distinctive research approach by the Unit.

Staff members within the group (**Dounas, Deveci**) have been able to collaborate with CSIC to explore the use of robotic technology within construction and architectural technical design. Drawing on our experience of and access to state of the art 3D printing, CNC routing and laser cutting equipment.

This knowledge and infrastructure are central to our aspirations regarding the future of the digital city, and to the digitisation of our core industry. It enables us to explore innovative and creative research paths, which are likely to become pervasive in the next five years.

4. Collaboration and contribution to the research base, economy and society

Research collaborations

A strategic priority of the Unit has been to develop extensive and valuable networks of collaborators and research colleagues, across institutions and disciplines. This has resulted in us being able to build strong collaborative consortia for research bids, as well as enabling us to participate in larger scale research projects, where these are led by other Universities.

We recognise and value cross-discipline and external collaboration as being of central and invaluable importance to our research. We recognise that collaboration can foster higher quality research and generation of ideas, whilst offering a route towards applying and realising potential impact beyond academia. We also regard collaboration as being essential to the vitality of the Unit as a whole, where we have been able to witness very significant development within our own expertise as a direct result of such collaboration taking place. This includes within the University itself, and across Schools and discipline areas including computing (**Dounas, Laing and Leon** collaborating on digital heritage research), social studies (**Laing and Leon**, collaborating on studies concerning urban design) and creative and cultural business (where **Gray and Laing** have a long standing collaboration concerning sustainable mobility, and where this has recently extended to collaboration with data analytics in Computing).

This is certainly true in relation to our work concerning Digital Cities and Society (e.g. with Polytecnico di Milano, through tutoring at digital data capture summer school, and PhD examination), Sustainable Housing (e.g. with the Passivhaus Institute) and Project Management (including KTP collaboration with James Fisher and Sons PLC), where the research collaboration has often challenged us to address applied problems, and to do so in a manner which supports the collaborating team to develop, refine and benefit from the attainment of new skills.

Networks and partnerships

The Unit engages with an extensive network of external partners, and to contribute whatever possible to external forums and debate. Our growing reputation with regard to participation in European research led to us being invited to participate in numerous research commissions (e.g. **Bennadji, Gray, Laing, Leon** with Art-Forum, PAV and Stronghouse), and has enabled us to develop strong research consortia. This has been manifest through the Unit bringing together consortia to undertake cross-discipline and transnational research (e.g. **Gray and Laing** through G-PATRA), and through our participation in large scale EU research (e.g. **Gray, Hood, Laing,**

Leon through PORTIS, PAV), where staff in the Unit have been enabled to work with leading research institutions and consultancies (e.g. Rupprecht, POLIS).

Staff in the Unit were instrumental in establishing an international research network concerning blockchain in construction (**Dounas**), in collaboration with researchers from China and Cardiff (archchain.cc). They also conduct research on low-carbon seismic-resistant construction, in partnership with the University of Aberdeen, and Turkish Universities (Ozyegin University and Boğazici University), supported by GCRF (**Jafarifar**).

Our network has also developed to include Visiting Professorships from key external partner institutions (Jensen, Aarhus; Whyte, Curtin), and staff within the Unit are active as adjunct staff (Curtin) and as research degree examiners to an extensive range of institutions (including Dundee, Greenwich, Heriot-Watt, Naples Federico II, Salford, UWE).

It is important to note that many of our strongest research collaborations have also been with non-academic partners. This has included collaboration through Knowledge Transfer Partnerships (Abertay Housing and James Fisher & Sons Ltd) and has been central to our ability to realise impact from the research activity, most notably in collaboration with local authorities and regional transport partnerships.

Wider activities and contributions to the research base, economy and society

With regard to the organisation, chairing and academic leadership of conferences, **Bennadji** was a co-chair for ASCAAD (2021 online) and he and **Deveci** were co-chairs and theme leaders at PLEA (2017 Edinburgh). The Scott Sutherland School was an associate partner of “The 6th World Construction Symposium” (2017, Sri Lanka), organised and hosted by University of Moratuwa. **Victoria** was a rapporteur for the conference, and her research was recognised with a BEPAM Highly Commended paper award.

Urbanism at Borders has been a biannual research-led conference, initiated in 2017, with RGU (Zaman) taking a lead for all activities. Each conference (Aberdeen, Malaga) has engaged with Springer to publish edited books of selected and extended papers. The conference has links to more than 30 countries and aims to form a ‘Border Urbanism Research Centre’.

Hood is part of the Road Safety North East Scotland Lead Officer’s Group. This association led to further collaboration with Aberdeenshire Council and a funding award through the Transport Scotland Road Safety Evaluation Fund. **Hood** also sits on the Transport and Public Health Subgroup for the regions Health and Action Transport Plan.

We remain actively engaged with our Professional Bodies, and have been able to take a lead in the research, professional assessment and educational policy and practice activities of CIAT (**Laing** chaired the research group, and together with colleagues Kouider and Scott sits on the Education Group), the RIBA (including current research being undertaken by McClean, and membership of visiting boards) and the RICS (**Hood, Laing** and **Victoria** undertook a global scoping study during 2019-20, and **Laing** is a Chair for the Assessment of Professional Competence).