

IDCOP Research Focus

IDCOP Aim:

Core aim of the IDCOP programme is “to improve the performance of buildings” with special focus “on the role of the building ‘skin’ or envelope as a mediator between internal and external environments”.

IDCOP Research Focus:

In order to structure the consortium’s research and development strategies on improving the building envelope, the focus for the research will concentrate on the following:

***Multi-storey, multi-occupancy buildings:** this will cover sectors in: social housing, multi-storey housing, commercial offices, education, hotels and catering, health, and government etc.*

The IDCOP programme will focus on three basic architectural envelope types, their benefits and constraints as well as their applicability for refurbishment:

- Single Skin Envelopes.
- Double Skin Envelopes.
- Climatic Envelopes.

Examples of these are given in the Table 1 (separate document).

Rationale for this Focus:

1. These buildings have common characteristics weighted to their specific applications:
 - a low skin area to volume ratio (envelope surface to building volume),
 - occupant behaviour type / activity level,
 - demands for the thermal conditions inside the building,
 - the need for daylight,
 - the need for vision to the exterior,
 - the need for good acoustic performance of the envelope,
 - the need for privacy.
2. To ensure comparability, compatibility and relevance of data that will allow the consortium to develop coherent solutions for improving the building envelope and the objectives of the consortium. Specifically to work on building types with a high demand for application of new building envelope technologies and periodical demands for refurbishment [potential of new **products and processes**].
3. To study buildings which have high energy demands for lighting, heating, cooling and ventilation. Influence of the EU energy directive and Part L as drivers for heating demands - impacts on other energy demands especially cooling and lighting [potential of energy savings by new **products and processes**].
4. To concentrate on buildings that have a high potential for facility management (maintenance and refurbishment strategy / TLBM) [potential of new **processes**].
5. To explore and develop new avenues related to façades that will result in new types of facilities management regimes [potential for **service innovation**].
6. To study buildings which have the greatest potential to permit and facilitate personalised control of microenvironments [potential of new **products** increasing **people’s** comfort].

Specific IDCOP Research Focus for Façade Refurbishment:

The development of façade refurbishment solutions as well as building envelope analysis tools and energy performance rating methods are important aspects of the IDCOP programme for improving the existing UK building stock. In addition to the general IDCOP research focus the specific focus for this task is to concentrate on:

***Post-war** multi-storey, multi-occupancy buildings in the **commercial sector**, typically buildings designed according to the design logic known as **International Style**.*

Rationale for this Specific Focus:

1. These buildings have common characteristics in addition to the ones specified in the general focus (weighted to their specific applications):
 - a considerably large floorspace per building,
 - are purpose built and architecturally conceived for administration work,
 - mostly have concrete pillar–beam or pillar–plate constructions,
 - often possess modular, curtain-wall façades with no structural function,
 - the need for cost and time effective periodic refurbishment.
2. To study buildings which represent a large part of the UK building stock – the floorspace of office buildings built between about 1940 and 1990 represents more than 45 % of the entire office stock floorspace (Commercial and Industrial Floorspace and Rateable Value Statistics for England and Wales, ODPM 2005) [potential for **refurbishment**].¹
3. To study buildings which by their energy profile and size are strongly affected by upcoming new legislation set up according to the 2002 EU-directive on the energy performance of buildings – refurbishments of buildings with a usable floorspace larger than 1000 m² need to meet minimum energy performance requirements, in addition, an energy performance certificate will need to be displayed at a prominent place in the building [potential for new **products**].
4. To study buildings which allow modular refurbishment or retrofit approaches as well as the development of generic façade refurbishment solutions and related strategies for their implementation [potential for new **products and processes**].
5. To concentrate on buildings that are traditionally at the forefront of incorporating new façade technologies, designs and construction methods [potential for new **products and processes**].

¹ Pre 1940's office buildings are highly non-generic and often converted from other uses. Furthermore they are often listed buildings or possess planning restrictions.

Social Housing

Specific IDCOP Research Focus for Social Housing:

If improvements in the sustainability of existing social housing are to be realised then the balance between planned (20%) and responsive maintenance (80%) must be reversed. The focus of the social housing work will be on ways of achieving this change in thinking. In addressing the focus the team will concentrate on:

- The impact that all the stakeholders have on the decision making process (do they all have the same priorities for sustainability?)
 - o tenants;
 - o housing managers;
 - o development managers; and
 - o maintenance managers.
- What is achievable in terms of environmental and quality of life improvements (from the tenant's perspective) for the various levels of maintenance funding strategies available.
- The impact that the Decent Homes Standard and EcoHomes II have/are having on priority setting.
 - o Are they a minimum?
 - o Do they represent effective performance (environmental, social and economic) against which to judge sustainability?
 - o Are they a driver to move actions from the maintenance budget (revenue) to the refurbishment budget (capital).
- Do priorities set by political agendas reflect the true sustainable issues that face social housing providers?

Specific IDCOP Research Focus for Sustainable Maintenance:

The process of maintaining buildings consumes five times the resource required to build them. Optimising resource usage will significantly improve the sustainability of the maintenance process. The focus for the sustainable maintenance work will be to examine current practice, identify areas for improvement and re-design the maintenance process to reduce waste and achieve long term socio, economic and environmental benefits. In addressing the focus the research team will concentrate on:

- Quantifying levels of waste (inefficiency) currently associated with building maintenance;
 - o time, energy, money, etc;
- Developing a new maintenance process that reduces waste (inefficiency);
 - o subjective assessment of need;
 - o effective management controls of work.
- Measuring the success of the new process in both social housing and commercial buildings.

Specific IDCOP Research Focus for Development of a Through Life Environmental Business Model (TLEBM):

The research focus for the Development of a TLEBM work is to develop a multi-criteria decision-making model, which is based on a previously developed TLEBM by the University of Reading, and further endowed with quantitative capacities that can be used to facilitate an Intelligent Decision Support System (IDSS). In addressing the focus, the research will concentrate on:

- An Analytical Hierarchy Process (AHP) model for façade assessment.
- A façade rating system for rating building façade systems based on the AHP model.
- An IDSS for knowledge-driven decision-making in selecting the most appropriate façade solution for a specific building.

Specific IDCOP Research Focus for Embedded Sensor Technology and Occupant Behaviour:

The focus for the embedded sensor technology and occupant behaviour work is to optimise occupant's well-being as well as the energy consumption of buildings. In addressing the focus, the research team will concentrate on:

- Identifying the behaviour patterns associated with the use of the building fabric (e.g. ventilation, lighting levels, occupancy patterns, etc) and establishing a relationship between these variables and the consumption of energy.
- Development of prototype intelligent sensors which can monitor the variables and control circuits and which can mitigate their impact on energy consumption (e.g. control of ventilation).
- Development of a prototype computer based simulation model to present the performance data to occupiers in a way that identifies opportunities for improvements in energy conservation.
- Studying how to achieve the critical reverse communication between occupant and systems so that the building can be made to respond to evolving needs and perceptions.

Specific IDCOP Research Focus for Personalization of Intelligent Buildings:

An intelligent building continuously responds and adapts to changing conditions, allowing a more efficient use of resources and increasing the comfort of its occupants. It provides these benefits through sensing of the environment and occupant responses, in conjunction with automated control systems such as heating, ventilation and air-conditioning. The focus for the personalization work is to increase the representation and involvement of people in such systems, primarily the occupants, but considering also other stakeholders, such as the owner, the facilities manager, and wider society. In addressing the focus, the research team will concentrate on:

- Conceptual design of intelligent building that meets individual preferences and enhances personal satisfaction.
- A physical simulation model to verify the hypothesis of personalization.
- Design of a collaborative framework for requirements capture and collaborative design.
- A prototype computer environment for collaborative design.
- An agent-based prototype for personalized control of micro-environments.