RIBA CPD Core Curriculum
Study Notes

06 Sustainable architecture

Understanding the legal and regulatory basis (including primary and secondary legislation), and principles, of climate change mitigation and adaptation. Having the knowledge and skills for low-carbon and low-energy design over the life cycle of a building (whole building overview and process), with effective client briefing and management.

Background and context: understanding of:

- Climate change and climate change science, and the impact of both mitigation and adaptation.
- The impact and magnitude that the built environment has on greenhouse gas emissions.
- Sustainable design from inception to completion and handover, including post-occupancy evaluation and feedback, and how this fits within a wider aim of resource efficiency.
- The links and differences between low-energy and low-carbon design.
- Design decisions on the whole life of our built environment, including how to design with total cost in mind (including maintenance, durability and end-of-life scenarios), and the role of data to assist with smarter buildings and cities.
- The link with digital construction as an enabler for creating more stable built environments.
- Sustainability checkpoints in the RIBA Plan of Work.

(See also 'Targeting Zero' by Simon Sturgis from RIBA Publishing *http://www.ribabookshops.com/item/targeting-zero-embodied-and-whole-life-carbon-explained/86504/*).

Legislation: understanding of:

- Primary legislation (acts or orders) such as:
  - Clean Air Act.
  - Clean Neighbourhoods and Environment Act.
  - Climate Change Act.
  - Energy Act.
  - Environmental Protection Act.
  - Flood and Water Management Act.
  - Natural Environment and Rural Communities Act.
  - Water Resources Act.
  - Wildlife and Countryside Act.
  - The key points laid out in NPPF regarding presumption in favour of sustainable design.
- Secondary legislation (regulations) and standards such as:
  - Relevant Building Regulations such as L1 and L2, and the devolved nations' equivalents.
  - Conservation of Habitats and Species Regulations.
  - Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations.
  - BS EN 15978:2011 'Sustainability of Construction Works. Assessment of environmental performance of buildings. Calculation method'.
  - BS EN 15804:2012 'Environmental product declarations. Core rules for the product category of construction products'.
  - RICS Professional Statement: Whole Life Carbon: Implementation in the built environment, 2017.
  - Environmental Permitting (England and Wales) Regulations.
  - Site Waste Management Plan Regulations.

- Town and Country Planning Regulations (environmental impact assessment) (England and Wales).
- SUDS legislation and the need to respond to predicted future flood conditions.
- Code for Sustainable Homes.
- The PassivHaus Standard.
- BREEAM standards.
- PAS 1192.
- ISO 20400: Sustainable Procurement Standard.
- Fire safety strategy and legislation

Client briefing and management

- Understanding and prioritising energy efficiency in low-carbon design over whole-life energy efficiency as underpinning the more general aim of low carbon emissions.
- Communicating the ethical and pragmatic importance of low-carbon design.
- Low energy and high comfort together resulting in good outcomes for client and planet.
- Communicating the importance of the selection of low-carbon materials and systems.
- The importance of life cycle analysis in aiding the understanding of a building's physical performance over its life.
- Understanding stakeholders, clients, planning and legislative authorities.
- Defining the brief whilst balancing sustainability targets.
- Importance of commissioning and building management – soft landings as a process from start to finish.
- Building performance metrics such as kWh/m^2a and $kgCO_2/m^2$.
- KPIs and which ones should be used, and comfort indices such as IAQ, CO_2 levels and temperature.

Knowledge of low-carbon skills and energy literacy

The thermal implications of building form and fabric, and how thermal performance can be improved:

- The effects of location, shelter and shading on thermal performance and allied issues such as moisture.
- The effects of building form on heat loss and solar aperture, and how these can be modelled using software or simple maths.
- The use of solar and internal heat gains, and their contribution to overheating if not managed.
- The use of building form to promote natural ventilation and cooling where appropriate.
- Understanding the difference between summer and winter ventilation.
- The importance of the continuity of insulation and airtightness within a ventilation strategy.
- The importance of minimizing thermal bridging and air leakage.
- Deploying constructions of high and low thermal mass appropriately.
- Understanding how light and heavy structures can influence performance, and how they may be appropriate (or less so) to certain building types.
- U value and Ψ value calculations.

Building services systems that contribute to low-carbon performance, and understanding the pros and cons of:

- Reducing cooling loads to avoid the need for cooling or air conditioning.
- Ventilation options, including natural cross-ventilation, passive stack ventilation, and mechanical supply and/ or extract ventilation.
- Ensuring efficient and responsive heating and cooling plant and heat emitters.
- Responsive systems and controls to improve efficiency and permit the use of solar and internal gains.
- Efficient internal and external lighting systems and controls, and understanding how to keep systems simple and not rely on BMS.

New and renewable energy systems, and the ability to compare and evaluate systems:

- Understanding how these systems work and what variables contribute to saving carbon.
- Heat pumps.
- Combined heat and power, including micro-CHP.
- Solar water heating.
- Biofuel heating systems.
- Photovoltaic arrays.
- Wind turbines.

Embodied and Whole Life Carbon assessments for new construction work:

- Embodied carbon assessments through RIBA work stages.
- Optimizing recycled content is compatible with low-carbon objectives.
- Life Cycle Analysis (LCA).
- LCA to establish durability of components, and flexibility of completed project.
- LCA to establish maintenance and replacement cycles.
- LCA to include 'end-of-life' assessment to ascertain resource-efficient demolition and capacity for reuse of components and materials.

Energy and environmental assessment for new and existing buildings:

- Domestic energy rating (SAP and NHER), including performance certification.
- Understanding of SAP as current compliance tool. Knowledge of other modelling tools such as IES and PHPP, and understanding which model to use for which job.
- Non-domestic energy rating systems (SBEM, etc.), including performance certification.
- Environmental assessment methodologies such as BREEAM and LEED.
- Code for Sustainable Homes.
- Domestic energy survey techniques and assessments.
- Housing stock assessment and stock profiling.
- Non-domestic energy surveys.

Airtightness and performance:

- Building physics.
- Condensation risk calculations, moisture management and avoidance of moisture.
- Movement of moisture in building fabric.
- Relative humidity, internal moisture control and moisture buffering.
- Closing the performance gap, and understanding the phenomena that create performance gaps in the first place, then understanding how to eliminate these issues.
- Heat loss parameters, and understanding the relationship between airtightness, insulation, glazing, heat loss and solar gain.
- Understanding and designing for thermal comfort, and the need for overheating risk mapping for future conditions.
- Health and wellbeing, including indoor air quality

Whole building overview and process

- Strategic definition: RIBA stage 0.
- Specification and tender.
- Procurement and cost management.
- Material selection, embodied energy, recycling and minimizing waste.
- Whole-life carbon foot printing.
- Life Cycle Analysis.
- Resource energy efficiency, materials, water, energy and behaviour.
- Thermal upgrade of historic and listed buildings.

- Using relevant insulation for listed buildings.
- Design for deconstruction, recycling and reuse (and reduction of waste).
- Construction processes to mitigate impact – use of offsite construction (see also design, construction and technology core topic).

Water efficiency and flood resilience

- Understanding and prioritising flood-resilient design in new-build and retrofit projects.
- Reducing demand: efficient systems and technologies.
- Rainwater harvesting, grey water recycling, and reuse.
- Reducing runoff: site water management.
- Green roofs.
- Permeable paving.
- Sustainable Urban Drainage (SUDS) legislation.

Energy efficiency and listed buildings: understanding of:

- Series of relevant published guidance by Historic England.
- Published guidance on responsible retrofit of Traditional Buildings by the STBA (sponsored by Historic England).
- SPAB Energy Efficiency reports.
- Understanding the special interest of the listed building, and how thermal upgrading may be effected without it being compromised.
- Understanding the requirement for listed building consent and the exemptions provided by Approved Document L (also in the case of buildings of traditional construction).
- Thermal upgrade of listed buildings, buildings in conservation areas, and of buildings of traditional construction.
- The use of the right insulation.
- The correct window upgrades.
- Understanding defects and behaviours of various materials.
- Approaches to repair and conservation techniques

Post-occupancy evaluation and building performance evaluation

https://www.architecture.com/knowledge-and-resources/resources-landing-page/post-occupancy-evaluation#available-resources

- Project delivery (client and project team experiences).
- Project outcomes (review strategic brief, business case and sustainability aspirations).
- Building use and occupant behaviour: analyse: building layout, building fabric and detailing, occupants' use of building and systems, occupation patterns.
- Occupant feedback (surveys and interviews).
- Energy use analysis (utility invoices and meter readings, metering strategy, equipment survey, embodied carbon, measurement and verification survey).
- System behaviour (facilities manager's experience): analysis of strategies: health and safety, ventilation, heating and cooling, lighting, control, maintenance).
- Environmental performance: measure: light levels, thermal comfort, indoor air quality, acoustics, airtightness, heat loss (thermal imaging).
- Comparison (intended building use and design performance predictions against actual, benchmark against public datasets).
- Reporting (clients, FM, users, project team, open dissemination to industry).

Links to other organisations and resources

Forest Stewardship Council *http://www.fsc-uk.org/en-uk*
WWF *https://www.wwf.org.uk/*
Green Register *https://www.greenregister.org.uk/*
BedZed *http://www.bioregional.com/bedzed/*
American Institute of Architects sustainable architecture *resources https://www.aia.org/topics/41-energy*
UK Green Building Council (UK-GBC*) http://www.ukgbc.org/*
Business Green *https://www.businessgreen.com/*
The Woodland Trust *https://www.woodlandtrust.org.uk/*
Bat Conservation Trust *http://www.bats.org.uk/*
LEEDS *https://new.usgbc.org/leed*
BREEAM *http://www.breeam.com/*
Carbon Buzz *http://www.carbonbuzz.org/*
Build Up: The European Portal for Energy in Buildings *http://www.buildup.eu/en*
Additional organizations listed here *http://www.sustainabilityexchange.ac.uk/organisations*