# Building Stock Model

ACTIVE BUILDING CENTRE RESEARCH PROGRAMME

The 3DStock Model (developed by the Building Stock Lab, UCL Energy Institute) represents stocks of buildings and their use of energy in detail and over large areas. The model links numerous national-scale datasets to derive a clear understanding of the building stock and its relation to energy use. These snapshots facilitate detailed simulations of future energy performance and detailed scenario planning, such as pathways to net zero and local area energy plans.

## Developing the next generation Building Stock Modelling framework: anticipating larger-scale & automated deployments

### The context

- The original model evolved over a decade of iterative development.
- Extensive functionality incorporated over time: large & complex code-base.
- Facing increasing demand for national-scale and automated deployments.
- Growing availability of online data APIs vs. traditionally static sources of data supply.
- Ever-new datasets and ever-changing parameters: time-consuming to incorporate.

**Relationship Chart**

| table | created by | links | used by |
|---|---|---|---|
| table_a | script_a.py | VOA AURNs / OSAB UPRNs | script_c.py script_h.py script_i.py |
| table_b | script_b.py | TOIDs / F. Sites / HMLR) | script_c.py script_d.py script_j.py script_e.py |
| table_a | script_a.py<br>script_c.py | UARNs / UPRNs / Parent UPRNs | script_h.py script_i.py |
| table_c | script_c.py | Similar but by floor | script_d.py script_i.py script_e.py |
| table_d | script_c.py<br>script_d.py | UPRNs / UARNs / TOIDs | script_h.py script_i.py script_e.py |
| table_e | script_d.py | Staging table. | |
| table_f | script_d.py | Topo / UPRN / Floor # | script_e.py |
| table_f | script_e.py | SCU / UPRNs / TOIDs / pTOIDs / UARNs | script_k.py script_l.py script_j.py script_h.py script_i.py script_m.py |
| table_g | script_e.py | By floor. | script_j.py script_m.py |
| table_h | script_f.py | EPC / UPRN | script_h.py script_l.py |
| table_i | script_g.py | EPC / UPRN | script_l.py |

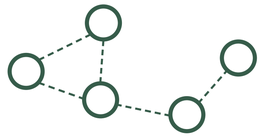
**Hierarchy**

| level | scripts | depends on |
|---|---|---|
| 0a | script_a.py | |
| 0b | script_f.py | |
| 0c | script_g.py | |
| 1 | script_b.py | |
| 2 | script_c.py | 0a, 1 |
| 3 | script_d.py | 1, 2 |
| 4 | script_e.py | 1, 2, 3 |
| 5a | script_j.py | 1, 4 |
| 5b | script_h.py | 0a, 0b, 2, 3, 4 |
| 5c | script_i.py | 0a, 2, 3, 4 |
| 5d | script_k.py | 4 |
| 5e | script_l.py | 0b, 0c, 4 |
| 5f | script_m.py | 4 |

The existing model interleaves numerous steps of processing across database tables and scripts. This is a non-trivial and complex endeavour as conveyed by the above (non-comprehensive) snapshot of the processing steps and their sequencing interdependencies.

### The goal

- Intuitive, flexible, scalable framework for modelling inter-connected data sources.
- Easily generalise workflows to new data sources and unique situations.
- Adopt new data-ingestion pipelines (online APIs) for on-demand deployments.
- Formalisation of code abstractions and modularisation of core methods.
- Adopt code development paradigms (automated testing, docs, deployment).



The next generation model streamlines processing and adopts a graph approach to data-modelling. The model consists of layers, nodes, and relationships.

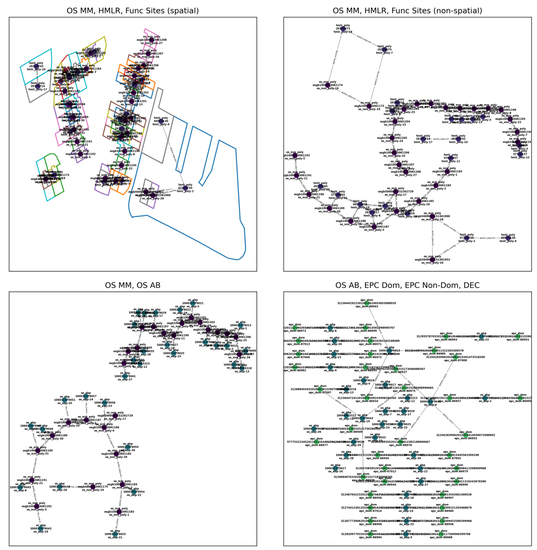
**Self contained Units** — **OS AddressBase** — **Geometry (MM, HMLR, etc.)** — **Adressable (DEC, EPC, etc.)**

Layers embody modular characteristics and related logic
e.g. address matching or geometrical processing.
Generalises more easily to new and as-yet unseen data sources.

**Spatial adjacent** — **Sibling** — **Adress match**

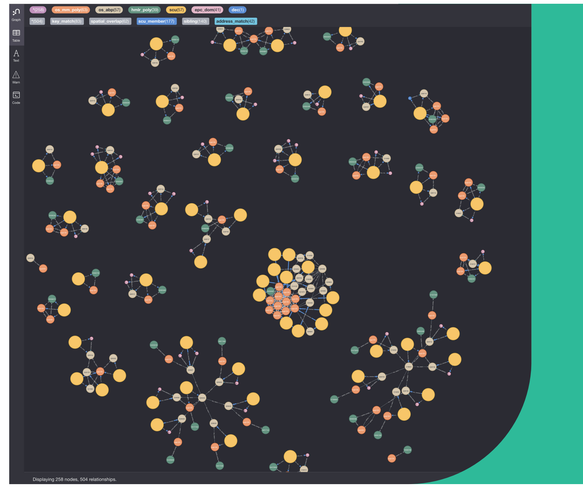
**Spatial overlap** — **Key match** — **SCU member**

Relationships describe potentially complex and variable dataset linkages in an intuitive and visualisable manner.




Phase 1 tests a new syntax of data-modelling abstractions based on graphs. Facilitates easier visualisation/exploration /refinement of data modelling workflow. Above shows an excerpt for the Meadows neighbourhood, Nottingham.

[Communicates intention of workflow - not intended to be legible.]



Phase 2 focuses on scalability & model persistence.
The above shows a snapshot for Nottingham as applied to HMLR inspire polys, OS Addressbase, OS MM buildings, OS MM functional sites, EPC domestic/non-domestic/DEC certificates, LiDAR rasters.

[Communicates intention of workflow - not intended to be legible.]

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