

1 Plausibility checks and correction of survey responses

A series of plausibility checks of the survey responses were made. As a result of these plausibility checks, some survey results were identified as unreliable and therefore removed, whereas other building typologies were identified as reliable but requiring a correction. Both the original survey responses and the corrected dataset are given in Zenodo. The following plausibility checks and corrections were made in the most impartial way possible.

1.1 Construction period and building materials

Construction materials that became only largely available during the industrial revolution are not expected to be commonly present in buildings constructed before the 19th century. Conversely, modern building typologies, such as HR buildings, may require such materials for structural purposes. The following verifications were carried out regarding the employed construction materials and the construction period:

- The presence of concrete, metal, and glass materials in buildings constructed prior to the 19th century was checked. After verification, one survey response describing a steeply sloped concrete roof was deemed implausible and deleted. Two survey responses for modern residential MR buildings constructed with concrete were judged to represent modern buildings. Therefore, the category "before 19th century" was removed, and the responses were kept in the corrected dataset.
- HR buildings, due to their structural requirements, are expected to be constructed with modern materials. The two survey responses describing HR buildings with non-modern materials were deleted.

1.2 Climate and thermal characteristics

It is assumed that buildings are insulated and equipped with HVAC systems suitable for the prevailing climate conditions. The World Map of Köppen-Geiger Climate zones (Peel, Finlayson, and McMahon, 2007) is used as a reference for climate zones. The 'BWk', 'Dfa', 'Dfb', 'Dfc', 'Dfd', 'Dsa', 'Dsb', 'Dsc', 'Dsd', 'Dwa', 'Dwb', 'Dwc', 'Dwd', 'EF', and 'ET' zones are assumed to represent cold climates, whereas the 'Af', 'Am', 'As', and 'Aw' are assumed to represent hot climates. The following verifications were made:

- Fifty-seven survey responses with cooling systems in countries with cold climates have been identified. The countries of these buildings were analyzed to consider the possibility of warmer temperatures in certain regions or times of the year. In such cases, both heating and cooling systems were kept. However, one Mongolian HR

residential building was reported with only a cooling system; this was corrected to include both heating and cooling systems.

- For fifteen survey responses, heating systems are reported in hot climate countries. After considering altitude and the possibility of local cold climates, in 6 cases this parameter remained unchanged. For three survey responses, where the HVAC system was described as both heating and cooling, it was modified to only cooling systems. Six survey responses describing buildings with only heating systems were corrected to indicate no heating system.
- The presence of building envelope insulation in hot climate countries was verified. This question appears to have been misinterpreted by respondents, particularly in countries where thermal insulation against cold is uncommon. Participants may have understood the question as simply asking about the presence of a wall or other form of separation/enclosure, rather than specifically about thermal insulation. This interpretation was confirmed by the fact that some reported insulation thickness ranges were similar to the expected thickness of the primary building envelope material itself, rather than the thickness of an insulation layer. After verification, two survey responses were deleted and 18 were corrected by removing the thermal insulation.

1.3 Coherence of building elements

Certain building element categories are expected to correlate with others. The following aspects were verified:

- Roof material and slope are analyzed together to correct several entries. If no roof slope is described, it is inferred from the roof material. Concrete and gravel roofs are considered flat (13 cases), while for other roof materials, the roof is categorized as moderately sloped (16 cases). Four buildings initially described as having flat clay tile roofs were corrected to have moderately sloped roofs. One building, described as having a flat wood roof, was removed due to other implausible variables.
- The combined description of glass buildings and wall thermal insulation is verified. If a building is listed as a glass building in both the wall material and window share categories, the classification is retained, and any associated wall insulation is removed (11 survey responses). For survey responses with glass mentioned in the wall material but not in the window share, the survey responses were analyzed individually. One office building was kept as a glass building, and the wall thermal insulation was removed. For two residential and commercial buildings, their wall material was changed to concrete, and their window share variable kept unchanged ("Bay/Large windows").
- Buildings with no windows, no glazing, or open-ended answers for glazing type were analyzed individually. One HR residential building, initially described as lacking windows, was corrected to "many windows" based on visual confirmation from *Google Street View* for that given country and building typology. One MR office building in the United States, originally described as having no glazing, was corrected to double glazing. For a LR residential building in Brazil, initially reported with no glazing, this variable remained unchanged; however the building environment was

changed from urban to rural since this corresponds to the local architectural practices.

- Open-ended answers for window types were categorized as "No glazing", "Single glazing", "Double glazing", "Triple glazing", or "no data". After reading each description, the number of cases redefined in each of these categories is 4, 7, 3, 0, and 5, respectively.

1.4 Comments integration for correcting the survey

The survey included an open field for general comments, which were thoroughly analyzed. Five comments resulted in modifications to the input data:

- The comment associated with the survey response id "ARBP3J3G" describing a MR commercial building revealed that it regards a specific theater in Argentina. As a result, the frequency category was changed to "Uncommon."
- The comment associated with the survey response id "T2C3YEO3" indicated that the LR residential building in Samoa had open air to facilitate breeze and airflow. Consequently, the air infiltration variable was corrected to "Strongly."
- The comment associated with the survey response id "COBPxA8" clarified that the building was used as an office, so the corresponding variable was corrected to "Offices."
- The comment associated with the survey response id "mo6F5XqX" indicated uncertainty about the roof material of an LR residential building in Greenland. After further research, the roof cover material was changed to asphalt shingles, as this is the most common roof type for LR residential in this country.
- The comment associated with the survey response id "eeCLI2aJ" provided details on two different MR residential building typologies in Canada, one from the late 19th century and the other from the 21st century. In this case, the original entry was deleted, and two new entries were created, with IDs "eeCLI2aJ1" and "eeCLI2aJ2."

2 Agreement of survey responses

For the typologies with more than one response, it is possible to assess the reliability of agreement between survey responses. The agreement is quantified for typologies with the same country, form, use, environment (urban or rural), and scale (national or regional). The variables wall and roof material and share of windows are investigated, since these are crucial for building energy modeling and should be easy to identify by the survey participants.

To assess the reliability of agreement between responses, Cohen's Kappa and Fleiss' Kappa are calculated. The first is calculated when there are two responses for a certain typology and the second in cases where there are more than two responses. Both measures quantify whether the degree of agreement between survey responses is in excess over that which would be expected by chance, according to the Equation 1 (Landis & Koch, 1977):

$$k = \frac{Po - Pe}{1 - Pe} \quad \text{eq.1}$$

Where Po represents the observed agreement and Pe represents the expected agreement if random judgment. In Cohen's kappa, the Pe and Po are calculated with the equations 2 and 3, for k categories, and N observations to categorize. Assuming n_{ii} denotes the number of cases where both raters assigned to category i

$$Po = \frac{\sum_{i=1}^k n_{ii}}{N} \quad \text{eq.2}$$

$$Pe = \sum_{i=1}^k (p_{i1} \times p_{i2}) \quad \text{eq.3}$$

With p_{i1} being the proportion of subjects Rater 1 assigned to category i and p_{i2} , the proportion of subjects Rater 2 assigned to category i .

In Fleiss' kappa, considering m is the number of raters per subject and n_{ij} is the number of raters who assigned subject i to category j , Pe and Po are calculated with the equations 4 and 5.

$$Po = \frac{1}{N} \sum_{i=1}^N \frac{\sum_{j=1}^k n_{ij}(n_{ij}-1)}{m(m-1)} \quad \text{eq.4}$$

$$Pe = \sum_{j=1}^k \left(\frac{\sum_{i=1}^N n_{ij}}{N \times m} \right)^2 \quad \text{eq.5}$$

Table 1 presents the results of these measures of agreement, where N is the number of typologies analyzed with more than one response and non-null values for the analyzed variable.

Table 1 - Cohen's and Fleiss' kappa measures of agreement among responses.

Variable	N	Po	Pe	k
Cohen's kappa				
Wall material	51	0.63	0.31	0.46
Roof material	53	0.73	0.30	0.62
Window share	51	0.71	0.40	0.51
Fleiss kappa				
Wall material	28	0.66	0.40	0.44
Roof material	27	0.63	0.30	0.47
Window share	25	0.62	0.51	0.22

The level of agreement is higher than could be expected for random responses, with most categories presenting a *moderate agreement*, according to the ranges of kappa provided by Landis and Koch (1977). The Fleiss' kappa value for the window share variable falls within the range of *slight agreement*. This outcome can be attributed to a higher probability of agreement occurring by chance, due to the concentration of responses within the category "Many windows" which covered 69% of the responses for this variable. Furthermore, although window share is an ordinal variable, only exact matches among responses were considered in the analysis. This approach disregards the consistency among neighboring categories, thus resulting in a more stringent and penalizing assessment of agreement.

These results provide evidence that the information of wall and roof materials as well as window share has not been entered randomly by the survey participants, thus increasing the confidence that the survey results yield meaningful information. This is even further emphasized by the fact that there might be an actual variety in architectural practices, even for the same building typology. Therefore, a perfect coherence of responses should not be expected.