This data article relates to a multi-criteria process applied to slab-on-ground floor for buildings in warm climate. The input data of the analysis are the building materials with their thermal properties, sustainability characteristics and supply and installation costs.

The multi-criteria analysis has been performed with the software modeFRONTIER. The computational procedures in accordance with the UNI 13786 (Thermal performance of building components, Dynamic Thermal Characteristics, Calculation Methods) has been carried out in Matlab language. The methodology is presented in the articles “High performance precast external walls for cold climate by a multi-criteria methodology” (Baglivo and Congedo, 2016) [1], “Design method of high performance precast external walls for warm climate by multi-objective optimization analysis” (Baglivo and Congedo, 2015) [2], “Multi-Objective Optimization Analysis For High Efficiency External Walls Of Zero Energy Buildings (Zeb) In The Mediterranean Climate” (Baglivo et al., 2014) [3] and “Multi-criteria optimization analysis of external walls according to ITACA protocol for zero energy buildings in the Mediterranean climate” (Baglivo et al., 2014) [4], for the identification of high efficiency external walls.

The set of possible optimal configurations identified by the source of Pareto have been collected into different categories of slab-on-ground floor, focusing on slab-on-ground floor with concrete, slab-
on-ground floor with gravel and slab-on-ground floor with crawl space. The dataset provides a set of high efficiency solutions through the combination of commercial and eco-friendly building materials. © 2018 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Specifications Table

| Subject area                  | Civil engineering. |
|-------------------------------|--------------------|
| More specific subject area    | Thermal, economic and eco-friendly performances of a set of slab-on-ground floor. |
| Type of data                  | Tables             |
| How data was acquired         | Pricelist, technical data sheet, analysed and processed output data. |
| Data format                   | The building material properties have been provided by commercial data sheets. Each building material has been processed in the multi criteria analysis. |
| Experimental factors          | The data have been produced through a multi objective analysis performed with modeFRONTIER optimization tool. The values are presented in terms of energy performances, costs and eco-sustainability score. The UNI EN ISO 13786 for the assessment of the thermal performances has been processed in MatLab environment. The costs are assessed through a market survey and regional price list. The eco-sustainability score comes from the guidelines and instructions of the Itaca Protocol. |
| Data source location          | The evaluations consider the city of Lecce classified, by the Italian Regulation, as climatic zone C with 1153°-days |
| Data accessibility            | Data is within this article. |

Value of the data

- The detailed information about different topologies of slab-on-ground floor offer designers a wide set of possible design choices.
- The data list several high efficiency solutions for warm climates.
- The collection of data permits the comparison with other climate conditions and other traditional or innovative suggestion.

1. Data

The “File 1 – Input data” contains the properties of each building material considered the input values of the multi criteria analysis. All these building materials have been used within the optimization process. The constraints and objective of the simulation are set up considering the design of slab-on-ground floor for warm climate. The Table 1 shows the constraints and objectives, in terms of thermal properties, cost and sustainability score imposed at the multi-criteria analysis.

The model configuration established is a slab-on-ground floor with maximum five layers. The presence of the same adjacent materials involves the replacement of the two layers in a single layer, reducing the overall number of layers.
Several combinations of slab-on-ground floor, simulated in modeFRONTIER environment are provided in the Supplementary materials from File 2 to File 5.

In particular, the “File 2 – General configurations” contains several configurations applied on a generic model of slab-on-ground floor, in which no constraints have been set on the placement of the building materials on a given layer, each material may assume an arbitrary position within the stratigraphy. The prototype of slab-on-ground floor with no constraints imposed on the layer is shown in Fig. 1.

The subsequent Files contain stratigraphy obtained by constraints on certain layers, in particular the “File 3 – Slab-on-floor with concrete” provides the results of the multi-criteria analysis characterized by the application of concrete at the first and last layer. The concrete at the first layer works as a spacer between the ground and the insulating material, while the concrete at the last layer is useful for the installation of the underfloor technological system. The prototype of slab-on-ground floor with concrete is shown in Fig. 2.

### Table 1

| Output | Units of measures | Objectives | Constraints |
|--------|------------------|------------|-------------|
| $f_d$  | $h$              | $\div$     | $< 20 h$    |
| $\Delta t$ | $W/m^2 K$    | $\div$     | $< 0.18 W/m^2 K$ |
| $Y_{12}$ | $kJ/m^2 K$     | $\div$     | $< 0.38 W/m^2 K$ |
| $U$   | $m$              | $-$        | $< 0.70 m$  |
| $Y_{11}$ | $W/m^2 K$       | $\div$     | $-$         |
| $Y_{22}$ | $W/m^2 K$       | $\div$     | $-$         |
| % Itaca | $-$             | $\div$     | $-$         |
| Cost  | Euro/m$^2$      | $\div$     | $-$         |

Fig. 1. Prototype of slab-on-ground floor with no constraints imposed on the layer.
The “File 4 – Slab-on-floor with crawl” shows the model with ventilated crawl space. The crawl space is used to prevent the infiltration of moisture. Fig. 3 reports the disposition of the building materials in each layer.
The “File 5 – Slab-on-floor with gravel” reports the results of the simulation characterized by the presence of gravel on the first layer in direct contact with the ground, while in the second and fifth layer presence of concrete have been imposed. The gravel guarantees a natural drainage of the capillary water. The Fig. 4 shows the disposition of the layer on a prototype of slab-on-floor.

2. Experimental design, materials and methods

The simulation has been conducted for slab-on-ground floor adapted for buildings located in warm area, considering the city of Lecce with 1153°-days (Climatic zone C) in accordance with the Italian climatic classification. The characteristics of the zone has permits to assess the objectives and constraints of the problem, in order to optimize the performances of the building component. The city of Lecce presents non-extreme winters and high aridity summer with average temperature equal to 30.3 °C. Rainfall is concentrated in autumn with seasonal average value equal to 40 mm and 190 mm in winter. As regards the spring and summer, the average seasonal rainfall are approximately 105 mm and 60 mm, respectively.

The software modeFRONTIER has been used for the multi-objective analysis. The input data of the problem are the building materials listed in a database with their physical characteristics, eco-sustainability score in accordance with the Itaca Protocol and cost from the regional price list. The methodology is presented in [1–4].

The statistical method to develop the analysis is DOE (Design of Experiment) and the set of initial combinations are processed according to Moga II (generic multi-objective algorithm). The set of possible optimal configurations have been identified by the source of Pareto, representing the best compromise between constraints and objectives of the problem.

The goal of multi-objective analysis is to provide a valid tool for the design of slab-on-ground floor which will subsequently be contextualized to a specific ground and building geometry.

The analysis presented is strictly based on the construction characteristics of the floor. This analysis provides the use of the simplified method as required by the UNI 12831 [5].
An example of how the result of simulation can be used is performed on a floor prototype obtained from the multi-criteria analysis (considering the case characterized by concrete at the lowest and upper layer) (Tables 2–6):

The UNI 12831 considers the ground thermal conductivity equal to 2.0 W/m K and the effects of perimeter isolation are not considered.
The example of analysis is carried out considering a floor area equal to 100 m² and exposed perimeter of 40 m.

In accordance with the UNI 12831, the characteristic parameter $B'$ is given by:

$$B' = \frac{A_g}{0.5 \times P} = \frac{100}{0.5 \times 40} = 5 \text{ m}$$

From the following tables, it is possible to identify the $U_{eq,br.}$ for burial depth equal to 0 and 3 m. The heat loss through the floors directly or indirectly in contact with the ground, depends on several factors, which include the exposed area and perimeter of the slab on the ground floor (depending on the construction of the floor), the burial depth and the thermal properties of the ground.

**Table 5**

Ground thermal conductivity [6].

| Category | Description               | Thermal conductivity ? (W/m K) |
|----------|---------------------------|-------------------------------|
| 1        | Clay or silt              | 1.5                           |
| 2        | Sand or gravel            | 2.0                           |
| 3        | Homogeneous rock          | 3.5                           |

**Table 6**

Results of the analysis in accordance with [6].

| $\lambda_{ground}$ W/m K | $U_{eq, Z 0}$ W/m²K | $U_{eq, Z 3}$ W/m²K |
|---------------------------|----------------------|----------------------|
| 1.5                       | 0.159                | 0.18                 |
| 2                         | 0.170                | 0.194                |
| 3.5                       | 0.189                | 0.214                |

Fig. 5. Example of external wall.
The thermal dispersion towards the ground can be calculated according to EN ISO 13370[6] in a
detail or in a simplified way. In the second case, thermal losses due to thermal bridges are not taken
into account.

An example of the calculation in accordance with the UNI EN ISO 13370 is reported. The example is
carried out considering the previously case of slab on ground floor.

The thermal properties of the ground used are chosen in accordance with the UNI EN ISO 13370:
The case has been studied for the three types of ground and for 2 typologies of slab on ground
floor: floor placed on the ground (burial depth \( Z = 0 \)) and floor underground (burial depth equal to 3
m) with perimetral horizontal isolation.
The depth of the groundwater greater than 1 m.
The external wall is characterized by a \( U \) equal to 0.33 W/m\(^2\) K (Fig. 5).
The results of the analysis are presented below.

As it is possible to note, the designer can use the several typologies of slab on ground floor and
apply them to their case study, characterized by a particular type of soil, a specific geometry of the
building and with certain climatic features.

Transparency document. Supplementary material

Transparency data associated with this article can be found in the online version at http://dx.doi.
org/10.1016/j.dib.2018.08.004.

Appendix A. Supplementary material

Supplementary data associated with this article can be found in the online version at http://dx.doi.
org/10.1016/j.dib.2018.08.004.

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